

Indian Military Technical Airworthiness Regulations - 21 (IMTAR-21)

Version 0.0

**CERTIFICATION OF MILITARY AIR SYSTEMS & AIRBORNE
STORES AND APPROVAL OF ORGANISATIONS**

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INTRODUCTION

Introduction

Airworthiness of a system and airborne store encapsulates technical airworthiness and operational airworthiness. Technical airworthiness implies that the system/airborne store is designed to be airworthy and manufactured to the approved design, while operational airworthiness implies that the manufactured system/airborne store is maintained to be airworthy during operations by following stipulated maintenance practices. Together, the airworthiness of the system/airborne store is ensured all through its life cycle.

The life cycle of a system/airborne store, begins with project initiation, its design & development, prototype realisation, production, induction to services, in service operations, mid-life upgrades, modifications and life extensions, before finally culminating in its gradual phasing out after having served its intended purpose for the stipulated life.

Airworthiness throughout the life cycle is ensured by following specific systematic procedures and pertinent technical requirements in all phases of system/airborne store life cycle. These procedures and technical requirements facilitate the applicants or the stakeholders to unambiguously process and procure Approvals, Clearances and Airworthiness Certificates from the Technical Airworthiness Authorities for their products. These technical requirements are called the Indian Military Technical Airworthiness Regulations (IMTAR).

Applicability

IMTAR is primarily intended for airworthiness certification of system and airborne stores in the Indian Military Technical Airworthiness Regulatory Framework.

These requirements represent the minimum applicable requirements to meet the safety objectives of the system /airborne store. These may be augmented with specific and special requirements while applying to unconventional, novel, complex and futuristic system/airborne store.

Military System /Airborne stores, designed prior to the approval and release of this IMTAR, need not comply to this document.

Organisation of IMTAR

The IMTAR is divided into SUBPARTS. These Subparts contain the technical requirements to be followed for Airworthiness Certification for specific phase in the development life cycle of an system /airborne store in the Indian Military Aviation scenario.

The subparts and their corresponding titles are as follows,

SUBPART	TITLE
SUBPART A	General Procedure for Indian Military Airworthiness
SUBPART B	Ab-initio Development of Air System Leading to RMTC/MTC and Production
	B1: Ab-Initio Development of Aircraft
	B2: Ab Initio Development of Unmanned Air Systems (UAS)
	B3: Ab-Initio Development of Air Launched Missiles (ALMs)
	B4: Ab-Initio Development of Aero Engines and Sub Systems
SUBPART C	Ab-initio Development of Airborne Stores Leading to IMTSA / L o A / TA
	C1: Ab-Initio Design & Development of Airborne Stores Leading to Issue of Type Approval
	C2: Ab-Initio Design & Development of Air Armament Stores and Air Launched Weapons Leading to Issue of Type Approval
	C3: Airborne Stores which are Materials and Standard/AGS Parts of Metallic and Non-metallic, in Accordance with Officially Recognised Standards/Approved CEMILAC Test Plan not Specific to any Platform Leading to LoA
	C4: Ab-initio Development of Airborne Stores leading to LoA
	C5: Airborne Stores, for which IMTSA Exists, Leading to IMTSA Approval (IMTSA)
	C6: Airborne / Ground System Software And Complex Electronic Hardware (CEH)
SUBPART D	Modifications of Air Systems Leading to AMTC/SMTC
SUBPART E	Modifications of Airborne Stores
SUBPART F	Production of Air Systems and Airborne Stores
SUBPART G	Organisation Approvals:
	G1: Design Approved Organisation Scheme
	G2: Production Approved Organisation Scheme
	G3: Maintenance Approved Organisation Scheme
SUBPART H	Certificates of Airworthiness (CoA) for Air Systems and Airborne Stores
SUBPART I	Research Aircraft
SUBPART K	Indigenous Substitutions of Airborne Stores
SUBPART L	Continued & Continuing Airworthiness
SUBPART M	Repairs
SUBPART N	Bought Out Air Systems and Airborne stores
SUBPART P	Flight Testing of Air Systems and Airborne Stores
SUBPART Q	Identification Of Air Systems and Airborne stores
SUBPART R	Civil Certified Military Aircraft
SUBPART S	Customer Furnished Equipment and Customer Specified Equipment
SUBPART T	T1: Test Rigs
	T2: Tools, Testers & Ground Equipment (TTGE)
SUBPART U	Mutual Recognition

Organisation of Subpart

Each Subpart contains all the applicable regulations within the scope of the subpart title, that represents a facet in the Indian Military Technical Airworthiness Regulatory Framework. The regulations cover the technical airworthiness requirements for the aircsystem/airborne store at various development phase within the scope of the subpart title.

The Subpart is organised as Rationale, Contents, Regulation, Acceptable Means of Compliance and Guidance Materials. These are discussed herein.

Rationale : Each Subpart identifies a Rationale as a basis for the regulations.

Contents : Rationale is followed by the contents of the Subparts, that captures the numbered topics/titles of the regulations.

Regulation :The Regulation is described and is uniquely numbered with the Regulatory Clause.

Acceptable Means of Compliance (AMC): Each Regulation is supported with Acceptable Means of Compliance (AMC), which are nonexclusive means of demonstration of compliance with the regulation and the Technical Airworthiness Authorities. Alternate and equivalent means may also be listed wherever applicable.

Guidance Material : The Regulation also lists certain guidance material that may be used by the applicant to facilitate in meeting the AMC, thereby complying to the Regulation. This is to be strictly used only as guidelines and shall not be viewed as an equivalent to AMC.

Definitions

Acceptable Means of Compliance

Acceptable Means of Compliance (AMC) represents the preferred means by which the TAA expect the intent a regulation / criteria to be met.

Airsystem

Airsystems include fixed or rotary wing Aircraft, Unmanned Airsystems, Aero Engines, and Air launched Missiles.

Airborne Stores

Airborne stores include all Parts & Appliances, Airborne General Stores, Aero Materials, Air Armaments, Crew Personal Protection Equipment, Fuel Oil Lubricants (FOL), Parachutes etc, used in an Airsystem.

Air Launched Missiles (ALMs)

Air launched missiles are defined as those missiles which are required to be carried, released and jettisoned (CR&J) from a military airborne platform. This definition covers both live and inert variants of the ALMs. Air Launched Missiles are characterized by own propulsion system and guidance system. ALM is an Airsystem unlike Air armament which is an airborne store.

Air Armament

Air Armament is a type of airborne stores. Air Armament includes air-dropped bombs (including smart bombs), rockets and similar air dropped weapons. This definition covers both live and inert variants of the Air Armament. Counter measure dispensing systems, Air-dropped Torpedoes, depth charges, sonobouys, rescue boats and similar items which are deployed from Air-vehicles are included as Air armament.

Airworthiness

Airworthiness is the continued capability of the military Airsystems and airborne stores to perform satisfactorily and fulfill mission requirements, throughout the specified life in the prevailing environments with acceptable levels of safety and reliability. The acceptable levels to be mutually agreed between users, designers and the certification authority.

Airworthiness Certification Plan (ACP)

ACP is a document that brings out the details towards compliance to the agreed Type Certification Basis of the Airsystem along with the involvement of TAA and other stakeholders at various stages of the development.

Airworthiness Certification Criteria

It is a foundational and a guidance document that contains the relevant standards/tailored standards/Codes to be used by the main contractors to define their airsystem's airworthiness certification basis.

Amended Military Type Certificate (AMTC)

AMTC is an approval of a major change to a Type design/Military Type Certificate, carried out by the Type Certificate Holder/Original Equipment Manufacturer (OEM).

Airsystem Design Organisation (ASDO)

ASDOs are Organizations involved in Design & Development and Modification of an Airsystem. ASDO shall be responsible for the overall design or through-life configuration management of the design of the Airsystem, and for co-coordinating the design and integration of the airborne stores designed by other Design Organizations.

Airsystem Maintenance Organisation (ASMO)

ASMOs are Organizations involved in the Maintenance of an Airsystem. ASMO shall be responsible for the overall Maintenance of the Airsystem, and for co-ordinating the overhauling & maintenance of the airborne stores maintained by other Organizations.

Airsystem Production Organisation (ASPO)

ASPOs are Organizations involved in Manufacturing and Repair of an Airsystem. ASPO shall be responsible for the overall Manufacturing of the Airsystem, and for integration of the airborne stores manufactured by other Organizations.

ASR/NSQR/GSQR/ISQR/JSQR

The ASR/NSQR/GSQR/ISQR/JSQR is a document released by the Indian Airforce, Indian Navy, Indian Army and Inter Services respectively, which describes in qualitative and quantitative terms, the requirements for an airsystem or airborne store.

Applicant

An individual or organization seeking approval from TAA for a specific Airsystem or airborne store.

Authority Holding Sealed Particulars

AHSP is the authority responsible for collecting, collating, developing, amending, updating, holding and supplying sealed particulars of the defence items in accordance with the laid down procedure. DGAQA is the AHSP for aviation stores of all the Services and the Coast Guard.

Continuing Airworthiness Maintenance Organisation (CAMO)

Maintenance Organisation within the Services to ensure Continuing Airworthiness.

Certificate of Airworthiness (CoA)

The Certificate of Airworthiness (CoA) is the formal document issued by DGAQA or competent authority to certify that an airsystem is airworthy. Every individual airsystem has to gain its own Certificate of Airworthiness which is achieved when it can be shown to conform to the Type Design and is in a condition for safe operation.

Certificate of Design

The Certificate of Design is the declaration by the authorized personnel of the Main Contractor that the system/subsystem/airborne store complies with all the requirements laid down in the technical specification with the exceptions quoted therein.

Configuration Control

Configuration control is an important function of configuration management discipline. Its purpose is to insure that all changes are performed through a well-defined process with concurrence of all the stake holders.

Configuration Management

Configuration management is a systems engineering process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design and operations throughout its life.

Configuration Management Plan

Configuration management plan is developed to define, document, control, implement, account for, and audit changes to the various components of the project.

Continued Airworthiness

All tasks to be carried-out to verify that the conditions under which a type-certificate or a supplemental type-certificate has been granted, continue to be fulfilled at any time during its period of validity.

Clearance for Service Use (CSU)

Clearance for Service Use (CSU) is an approval by CEMILAC for use of an airborne store by the User Services.

Continuing Airworthiness

All of the processes ensuring that, at any time in its operating life, an Airsystem and the airborne stores complies with the airworthiness requirements in force and is in a condition for safe operation.

Concurrent Certification

Concurrent Certification is an approach where TAA are associated with a project, from the beginning of the project through all stages of development i.e., from the requirement stage, the design, development, test and evaluation process, so that, the Certification activities are progressed concurrent with the design and development.

Concept of Operation (CONOPS)

Concept of operation is a document describing the characteristics of a proposed system from the view point of user services who will use that system.

Design Organisation (DO)

DOs are Organizations involved in the Design & Development, Repair and Modification of airborne stores used in an Airsystem. DO shall be responsible for the through-life configuration management of the designed airborne stores.

Design Organisation Approval (DOA)

An approval given to an organization as competent to carry out Design, Development and Modification and Repair of airsystems or airborne stores.

Design Approved Organisation Scheme (DAOS)

The Design Approved Organization Scheme (DAOS) is a mechanism by which the design competence of an Organization is assessed.

Design Organization Exposition (DOE)

DOE is a set of document to be presented to the CEMILAC by design organisation seeking DOA. It describes directly or by cross-reference, the organization, the relevant procedures and Air systems & airborne stores to be designed, changed or repaired.

Development Flight Clearance (DFC)

An approval given to an airborne store for integration on to an aircsystem to carry out development flight trials.

Engineering Change Notice (ECN)

An engineering change notice is a document authorizing and recording design changes throughout the prototyping and life-cycle phases of a product.

Flight Clearance Note (FCN)

FCN is an approval given to an aircsystem and is an authorization for the flight test department to carry out development flight trials within the listed system/operating limitations and cleared envelopes.

Failure Reporting, Analysis and Corrective Action System (FRACAS)

Failure Reporting, Analysis and Corrective Action System (FRACAS) is a system which is carried out using software tool, that provides a process for reporting, classifying, analyzing failures, and planning corrective actions in response to those failures. A FRACAS system may attempt to manage multiple failure reports and produces a history of failure and corrective actions.

Ground Vibration test (GVT)

GVT is done to assure the aeroelastic and aeroservoelastic stability of a new or modified air system.

Impact Kinetic Energy

Kinetic Energy of the UAV upon impact, taking into account the maximum All Up Weight (AUW) for the UAV mass and a factor of the Stall speed or maximum operating speed for the UAV velocity, for an unpremeditated descent scenario or a loss of control descent scenario respectively.

Final Operational Clearance (FOC)

Clearance issued to an airsystem for regular operations by the services, when a type design has complied with and demonstrated all the requirements of Design and Safety.

Flight Clearance Note

FCN is issued by the CEMILAC as an airworthiness clearance for an air system to carry out the development flight trials within the flight envelop and limitations specified therein.

Flight Plan Co-ordination Memo (FPCM)

A Flight Plan Co-ordination Memo (FPCM) defines the current configuration and flight limits shall be issued by CEMILAC for undertaking day-to-day trial flights subsequent to issue of FCN. It also cover minor configuration updates in the baseline configuration defined in FCN.

Indian Military Technical Standard Order (IMTSO)

An Indian Military Technical Standard Order (IMTSO) is a minimum performance standard/Specification issued by CEMILAC for specified airborne stores to be used on Military airsystem. Airborne stores with IMTSO approval are eligible for use on any airsystem, provided the IMTSO standard meets the airsystem requirements.

Indian Military Technical Standard Order Approval (IMTSOA)

An approval given to an airborne store that meets the relevant IMTSO standard/specification. However an IMTSOA, by itself, is not an authorization for installation on any airsystem.

Indian Military Technical Airworthiness Regulation (IMTAR)

IMTAR is a procedural document that mandates the processes to be followed by organizations/stakeholders involved, under which necessary Clearances, Approvals and Certificates related to Airworthiness and Certification of Indian Military Airsystem for various scenarios and aspects of Aircraft Life cycle, will be issued by the Technical Airworthiness Authorities of India.

Initial Operational Clearance (IOC)

Clearance issued to an airsystem with restrictions of intended use for operations by the services, when a type design has complied and demonstrated most of the requirements of design and safety, wherein it has been assessed that the non-complied requirements have no impact on Air safety.

Initial Airworthiness Approval

The approval issued by CEMILAC for the Initial Type Design. Initial Airworthiness Approval includes, MTC, RMTC, RSD, Type Approval, IMTSOA, LoA.

Inspection Note

Each and every produced and released aeronautical equipment or airborne stores is accompanied with an Inspection Note issued by DGAQA, stating satisfactory inspection of the equipment or airborne stores.

Instructions for Sustaining Type Airworthiness (ISTA)

ISTA comprises of descriptive data and accomplishment instructions that ensures the type certification airworthiness standard is maintained throughout the operational life of an air system. Typically, the instructions are in the form of manuals.

Letter of Approval (LoA)

LoA is an approval given to a class of airborne stores like Materials, Standard Parts and other items that are not covered under Type Approval or IMTSOA.

Local Concession Committee (LCC)

LCC is a technical committee for discussions on the non-compliance of modifications and Service Instructions. LCC is chaired by CEMILAC and shall have members from DGAQA, Design and Quality department of the contractor firm and User Representatives.

Local Modification Committee (LMC)

LMC is a forum for technical discussions and associated aspects of introduction and applicability of modifications. It is constituted by the Government. LMC shall be chaired by CEMILAC, with members from maintenance organization of the respective user services, Service Headquarters, DGAQA, Contractors representatives in Design, Production Engineering, Methods Engineering and Quality Control.

Local Technical Committee (LTC)

LTC is a sub-committee constituted by the chairman of the LMC, to technically evaluate the modifications in the absence of detailed information and documentation from the licensor or the OEM. LTC shall give its recommendations to the LMC.

Local Type Certification Committee (LTCC)

LTCC is a committee to technically discuss the indigenisation aspects of airborne stores to be indigenised. It is chaired by CEMILAC with members from, Head of indigenization, the Main Contractor's Head, Design & Quality representatives, DGAQA and User representative.

Loss of Control

A failure (or a combination of failures) which results in loss of control of an UAS and may lead to impacting the ground at high velocity.

Main contractor

Main contractor is the development and or production agency who is entrusted with the total responsibility for development and/or production of the airsystem/airborne store.

Maintenance Organisation (MO)

MOs are Organization is involved in Maintenance of airborne stores used in an Airsystem. MO shall be responsible for the through-life configuration management of the Maintenance of airborne stores installed in an Airsystem.

Maintenance Organisation Approval (MOA)

An approval given to an organization as competent to carry out Maintenance of airsystems or airborne stores.

Maintenance Approved Organisation Scheme (MAOS)

Maintenance Approved Organization Scheme (MAOS) is a mechanism by which the competence of an Organization to undertake Maintenance of airsystem and airborne stores can be assessed.

MAINTENANCE ORGANIZATION EXPOSITION (MOE)

MOE is a set of document used to identify the procedures, means and methods for approval of Mil CAMO by DGAQA.

Make –I

Military Airsystem/airborne store projects funded by the Government

Make –II

Military Airsystem/airborne store projects funded by the Private Firms

Make-III

Military Airsystem/airborne store projects that are indigenously manufactured for import substitution.

Master Minimum Equipment List (MMEL)

MMEL is a categorized list of on-board systems, instruments and equipment that may be inoperative for flight in a specified air system.

Military-run Maintenance Organization (MMO)

A military-run maintenance organization (MMO) is an organization run by user services which is authorized to maintain any aircraft and/or component for which it has been established to do so by the relevant Front-Line Command.

Military Continuing Airworthiness Management Organization (Mil CAMO)

Military Continuing Airworthiness Management Organization (Mil CAMO) is an organization approved by TAA to insure that all necessary Air System corrective and preventive Maintenance is carried out before flight as per Aircraft Maintenance Programme (AMP).

Military Aircraft

Military aircraft includes Army, Navy, Air Force and Coast Guard aircraft, and every aircraft commanded by personnel of the Armed Services. These include Fixed or rotary wing Aircraft, piloted or unmanned aircraft during development or during operations for military use, registered or intended to be registered with Ministry of Defence.

Military Permit To Fly (MPTF)

Military permits to fly is a clearance in the form of FCN, to an airsystem that do not meet, or have not been shown to meet, applicable airworthiness requirements but are capable of safe flight under defined conditions.

Military Type Certificate (MTC)/FOC

MTC/FOC is a certificate that the aircsystem of a particular type design complies with all the agreed Design, Safety and Airworthiness requirements.

Provisional Clearance

A provisional clearance is issued to an airborne store for a limited period, pending issue of Type approval by CEMILAC. A provisional clearance is issued to the effect that the airborne store under development meets all the laid down specifications and test requirements with the exceptions stated there in.

Production Organisation (PO)

POs are Organization is involved in Manufacturing and Repair of airborne stores used in an Aircsystem. PO shall be responsible for the through-life configuration management of the airborne stores produced and installed in an Aircsystem.

Production Organisation Approval (POA)

An approval given to an organization as competent to carry out Manufacture and repair of of aircsystems or airborne stores

Production Approved Organisation Scheme (PAOS)

PAOS is a mechanism by which the competence of an Organization to undertake Manufacture and Repair of aircsystem and airborne stores can be assessed.

Quality Assurance Plan

A document that details the involvement of DGAQA for the quality assurance related activities throughout the design & development and production of the Aircsystem and airborne stores.

Regional Centre for Military Airworthiness (RCMA)

Regional Centre for Military Airworthiness is a field unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the aircsystems/airborne stores during design and development, production and In-service phase. In such places where no establishment of RCMA exists, such authority may be delegated to Visiting Technical Officers (VTOs) of CEMILAC.

Office of Regional Director-AQA (ORDAQA)

The Office of Regional Director-AQA is a field unit of Directorate General of Aeronautical Quality Assurance (DGAQA) to ensure Quality Assurance of the aircsystems/airborne stores during Design, Development and production phases.

Original Equipment Manufacturer (OEM)

The original equipment manufacturer which is the only firm manufacturing the specified Airsystem/Airborne Store of a specific make, as distinguished from the stockists/distributors or suppliers of such items/equipment and no other manufacturer exists for that item.

Recognition

Recognition is a structured process by which Indian TAA can evaluate a foreign National Airworthiness Authorities and assess the potential to use their certification approvals for Indian Military. Recognition can be undertaken on a reciprocal basis, known as 'Mutual', or on a unilateral/multilateral basis.

Release to Service Document (RSD)

Document issued to the services during IOC or FOC of an airsystem, that authorizes regular flying by the service within the stipulated limitations and cleared envelopes.

Restricted Military Type Certificate (RMTC)/IOC

When an Air System has not completely demonstrated compliance to the design and safety requirements, wherein it has been assessed that the non-complied requirements have no impact on Air safety, a RMTC/IOC can be issued for a provisional period until the Type Design can be demonstrated to be accurate and complete.

Special Conditions

Special conditions are included in the type certification basis of the airsystem or airborne stores when the design features of a particular product or the experience in operation render any of the airworthiness certification criteria provisions inadequate or inappropriate to insure conformity with essential requirements.

Standard Part

A part manufactured in complete compliance with an established industry or Indian Government specification which includes design, manufacturing, test and acceptance criteria, and uniform identification requirements; the specification must include all information necessary to produce and conform to the part and be published so that any party may manufacture the part.

Safety of Flight Tests (SOFT)

An abridged version of the Qualification tests for a non safety critical system, sufficient enough to establish confidence in the safety of a few development flights, for the purpose of data gathering to facilitate further development activities. Development Flight Clearance based on SOFT will be decided by CEMILAC on a case to case basis.

Special Technical Instructions (STI)

STIs are issued by the Service Headquarters based on the draft forwarded by main contractor firm duly coordinated by CEMILAC to ensure the maintenance of the airworthiness standard of aircraft.

Service Bulletins (SB)

The SBs are issued either by the licensor in the case of bought out equipment used on the aircraft or the contractor firm to ensure the maintenance of the airworthiness standard of aircraft.

Servicing Instructions (SI)

SIs are issued by the Service Headquarters based on the draft forwarded by main contractor firm duly coordinated by CEMILAC to ensure the maintenance of the airworthiness standard of aircraft.

Standard of preparation (SOP)

The frozen build standard of the aircsystem/airborne store including its approved drawings, list of approved equipments/items.

Structural Coupling Test (SCT)

SCT is done to ensure that the airframe frequencies have been sufficiently neutralized or not.

Supplier

An agency/person in the supply chain who provides a product, article, or service that is used or consumed in the design or manufacture of, or installed on, a product or article.

Supplemental Military Type Certificate (SMTC)

SMTC is an approval of a change to a Type design/Military Type Certificate, carried out by any party other than the Type Certificate Holder.

Technical Airworthiness Authorities (TAA)

CEMILAC and DGAQA, the organizations dealing with Technical Airworthiness of the aircsystems/airborne stores are called TAA.

Test and Evaluation Master Plan (TEMP)

The test and evaluation master plan documents the overall structure and objectives of the test and evaluation for a program. It covers activities over a program's life-cycle and identifies evaluation criteria for the testers.

Test Adequacy Review Board (TARB)

Test adequacy review board is constituted by the main contractor with concerned stake holders as members to review the adequacy of the test cases being finalized for during ATP, QTP, Aircsystem integration etc.

Tools, Testers and Ground Equipment (TTGE)

TTGE includes the following

Tools: All mechanical/special tools required to maintain the aircsystem.

Testers: All testers and Test Equipments which are used to test/verify functions/parameters of the parts/equipments/LRUs/aircsystem.

Ground Equipment: Ground handling and Ground support equipment required to operate / maintain the aircsystem.

Type Approval

Type Approval is a certificate issued by CEMILAC to the effect that the airborne store under reference meets all design specifications and test requirements laid down by CEMILAC. The type approval is issued after the Design Authority/Main Contractor submits a full type record with all relevant documents, to the satisfaction of CEMILAC.

Type Approval Basis (TAB)

The Type Approval Basis (TAB) is an agreed set of airworthiness requirements that an airborne store must be compliant with, in order to be issued a Type Approval.

Type Certification Basis (TCB)

The Type Certification Basis (TCB) is an agreed set of airworthiness requirements that an aircsystem must be compliant with, in order to be issued a Military Type Certificate.

Type Certificate Data Sheet (TCDS)

TCDS, is a document that contains information of the aircsystem type design, operating limitations, applicable regulations/standards of compliance, and any other conditions or limitations prescribed for the Type design. The MTC is issued to the type design based on the TCDS submitted by the main contractor.

Type Certification Exposition (TCE)

Type certification exposition is document of documents containing the type design, operating limitations and a draft MTC data sheet.

Type Record

Type Record is a document giving a description of the airborne store, its functional and performance characteristics, summary of strength and other calculations along with reserve factors, environmental envelope of operation and storage of the store, results of all tests including environmental, functional and performance tests, weight data, list of applicable drawings, lifing details and includes the Certificate of Design. It includes all documents and specifications approved by CEMILAC, information on dimensions, materials and processes necessary to define the structural strength of the aeronautical product. It should also indicate instructions for continued airworthiness of the product, operating limitations and other information for the safe operation of the product.

Unmanned Aircraft System (UAS)

An unmanned aircsystem and associated elements (including communication links and the components that control the unmanned aircraft) that are required for the crew in command to operate safely and efficiently.

Unmanned Aerial Vehicle(UAV)

A UAV is a powered aerial vehicle that does not carry an onboard human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable and can carry lethal or nonlethal payload.

Unpremeditated Descent

A Failure (or a combination of failures) occurs which results in inability of the aircsystem to maintain a safe altitude above the surface.

Urgent Operating Note (UON)

UONs are normally issued by the contractor firm duly co-ordinated by CEMILAC and flight test department of the contractor firm. These are to be promulgated immediately by Service Hqrs. Such instructions are issued to ensure the maintenance of the airworthiness standard of aircraft.

User Services

User Services refers to Indian Army, Indian Navy, Indian Airforce, Indian Coast Guard and such Services under the Ministry of Defence, that engage with CEMILAC in respect of Airworthiness and Certification of their products.

DRAFT

SUBPART A- GENERAL PROCEDURE

1.0 Introduction

Airworthiness is ensured by following procedures and meeting clearly defined technical requirements. This subpart introduces the General procedure followed in the Indian Military regulatory framework for Project Initiation, Ab-initio Development process, Production, Continued & Continuing Airworthiness, Indigenous Substitution and Organisation Approvals. The procedures followed during various phases in the life cycle of antisystem/airborne store is discussed. This subpart also brings out the roles and responsibilities of the Technical Airworthiness Authorities i.e CEMILAC the Airworthiness Assurance Authority and DGAQA the Quality Assurance Authority.

2.0 Procedures

The General Procedures followed for Airworthiness and Certification of an aircsystem/airborne store at various stages in its life cycle are discussed.

2.1 Project Initiation and Process of Development

User services or in a few instances, the design agency, initiate the Draft specific requirements for an aircsystem or airborne stores. The service requirements in the form of Draft qualitative staff requirements are scrutinised by the Department of Defence Production (DDP). DDP initiates a feasibility study through the Development Agencies/ Contractors/ DRDO.

Based on the feasibility study, precise staff requirements are made by the Services and the project definition report for the development contract is prepared by the development agency and put up to MoD. The report is examined by the MoD, DRDO, DDP and the User. MoD after consultation with the all stakeholders approves the development contract for the new aircsystem and its weapon system or any other aeronautical stores.

The design and development phase begins once the contract is accepted by the development agency/main contractor. A team comprising of representatives of Development Agency, Technical Airworthiness Authorities (CEMILAC, DGAQA), User Services, Maintenance Organisation of the services, Flight Testing Agency, oversee the activities of development. On completion of the development, the Type documentation /record is submitted by the main contractor. CEMILAC issues Certificate/Approval for the aircsystem/airborne stores after ensuring compliance to the airworthiness requirements.

After the issuance of Certificate/approval, the programme enters into the production phase. The airworthiness is to be ensured right through production and in-service phase. Figure A.1 illustrates the generic procedure during the process of project initiation.

2.2 Ab-initio Development Phase

Once the project is sanctioned, the main contractor selects one of the two options for the airworthiness certification: Concurrent design and certification or Certification commencing after completion of all design activities. In the second case, CEMILAC has the liberty to seek for any repetition of test or analysis to accord clearance/certification.

Based on the Precise Qualitative Staff Requirements, the main contractor prepares the Aircraft Requirement Specifications which captures the requirements at the aircraft level and addresses all the system/subsystem interface issues. System Technical Specifications are derived from the Aircraft Requirement Specification.

The Type Certification Basis (TCB) along with the acceptable means of Compliance and the Airworthiness Certification Plan (ACP) is prepared by the main Contractor.

Airworthiness certification during Design Development involves two phases viz., the Design Evaluation phase and the Testing phase, both Ground and Flight testing. Design Evaluation involves evaluating the adequacy of the design to meet the design and safety requirements, while testing validates the design.

The design proceeds as project definition phase, preliminary design and detailed design phase. The project definition identifies major systems/equipment, Weight, Sizing & Configuration. This is a prelude to the preliminary design. In preliminary design, the trade-off in design and design parameters for safety, functionality, performance are established based on preliminary testing and analysis. Mock up studies for ergonomics and finalisation of specifications of various systems/subsystems is also completed. In detail design phase the detail design of components, subsystems and systems based on, FMECA, FTA, Hazard Analysis, CG analysis, safety and risk analysis are carried out.

During the development two technical reviews i.e, preliminary (PDR) and critical design review (CDR) are conducted. PDR, to review the basic design approach of each of the configuration item. CDR, to ensure that for each configuration item, the detailed design solution and the engineering drawings satisfy the technical requirements and specification, before freezing the design.

Main contractor establishes working rigs as per the rig specification for all systems/subsystems to functionally test and demonstrate compliance to design requirements. Testing is carried out as per the ACP to validate the design or in some instances to refine the design, after it is baselined. Testing may reveal the need for design changes. This is an iterative process until the design is proven satisfactory.

After successful integration testing, the design Standard of Preparation which accurately defines the product, the drawing standard, various LRUs and equipment used, is baselined. The Certificate of design for each subsystem, system and the whole aircraft are prepared by the main contractor.

The prototype is realised based on the baselined SOP and flight testing is progressed. During development each prototype Air System and Airborne Stores fitted on an Air System must be individually identified to comply with configuration control and flight testing requirements. The detailed requirements for Identification are given in **SUBPART Q**.

The Flight testing follows the Flight test plan and the individual Flight Plan Coordination Memo (FPCM). The Flight Clearance Note (FCN) approved by CEMILAC, bringing out the system limitation, operating limitations and cleared envelopes, authorises flight testing by the Flight test agency. Form 1090 or the Certificate of Safety is issued by DGAQA. The main contractor prepares the prototype notes for operating and maintaining the aircraft in airworthy condition during development flight trials. Testing may reveal the need for design changes. This is an iterative process until the design is proven to be satisfactory. The detailed technical requirements for flight testing are given in **SUBPART P**. A strict Configuration Control Management/Process needs to be in place, all through the design and development phase.

After meeting all the requirements and compliance to TCB, the main contractor prepares and submits the Type Certificate Data Sheet (TCDS) for the Airsystem or the Type Record for the Airborne store to CEMILAC. CEMILAC, on satisfactory compliance to all design, safety and documentation requirements, issues the Military Type Certificate (MTC) or Type Approval to the Main Contractor and Release to Service Document (RSD) to the User Services for regular operations. It is imperative that all Publications and Tools, Testers and the Ground Equipment (TTGE) required for ensuring the Continuing Airworthiness of the Airsystem in Service are also delivered to the user Services along with the RSD. The detailed requirements of the TTGEs are brought in **SUBPART T**.

There may be situation wherein most of the requirements are complied with, and it has been assessed that the non-complied requirements have no safety implication on the aircsystem. In such cases, CEMILAC issues a Restricted Military Type Certificate (RMTC) with restrictions on the intended use for a provisional period until the Type Design can be demonstrated to be accurate and complete. The detailed technical requirements for Ab-initio development of Air System/ airborne store are given in **SUBPART B & SUBPART C** respectively. Figure A.2 illustrates the procedure during the ab-initio design and development phase.

Technology demonstrators that are developed to demonstrate contemporary technologies for military aviation, that may be produced in limited numbers, not for regular operations also follow the procedures of this section. However, considering their limited use and life, the technical requirements are tailored and specifically brought out in **SUBPART I**.

2.3 Production Phase

Production begins after the issuance of MTC or RMTC. The finalised approved drawings are sealed and cover sheet signed by a senior member of the design agency and CEMILAC.

The Department of Defence Production and supplies, in consultation with CEMILAC, DGAQA and the development agency, decides on the initiation of the production phase. The production agency is selected by the DDP in consultation with MoD, and thereafter, the design and the production agency may be closely associated to ensure smooth transition from design to production.

A letter of intent by the user service headquarter is a starting point for the preproduction/production phase. Based on this the manufacturer submits the production plan, time schedules and the budgetary quote for all the deliverables. Based on the budgetary quote, the Service headquarter converts the Letter of Intent into a firm order by placing a formal indent.

The production phase is monitored by DDP through meetings with all stakeholders. The detailed technical requirements for production are given in **SUBPART F**.

During Production phase, there can be Modifications, Deviations in the products from approved drawings and concessions on non-implementation of modifications/ service instructions. These need to be appropriately addressed by the Production Organisation.

Any design change that does not affect safety, operational use, reliability, interchangeability, cost, delivery schedule and does not change production drastically, such as minor dimensional correction, deletion of redundant dimensioning, minor corrections and material schedule may be covered under Alteration/Amendments. Changes outside the scope of alteration/amendments are called Modification. CEMILAC shall be consulted, if to which category the changes belong, if undecided.

All modifications are discussed in Local Modification Committee (LMC), constituted by the Government, Chaired by CEMILAC, with members from CEMILAC, respective users, maintenance organisation of respective users, DGAQA, representatives from Design, Production and Quality. Details regarding Technical feasibility & Safety, Production, Document changes, Applicability and cost are discussed in LMC. If the cost is beyond the financial powers of LMC, then the main contractor needs to obtain financial sanction from the Services.

Prior to LMC, an Advance Modification Information and details of proposed modification is submitted by the main contractor and technically cleared by CEMILAC, DGAQA, and maintenance organisation of the user services. Mod leaflets for modifications introduced by the contractor or the services, which gives the details of the work done, cost, time and effect on aircraft /equipment operation, handling, maintenance and publication, is prepared by the contractor and is coordinated by CEMILAC.

Modifications for licence or bought out aircraft/store by the licensor, is evaluated by a Local Technical Committee (LTC), chaired by CEMILAC, with members from DGAQA, design, production and the quality department. The recommendations of the LTC is placed before LMC for consideration.

Definitions

Acceptable Means of Compliance

Acceptable Means of Compliance (AMC) represents the preferred means by which the TAA expect the intent a regulation / criteria to be met.

Airsystem

Airsystems include fixed or rotary wing Aircraft, Unmanned Airsystems, Aero Engines, and Air launched Missiles.

Airborne Stores

Airborne stores include all Parts & Appliances, Airborne General Stores, Aero Materials, Air Armaments, Crew Personal Protection Equipment, Fuel Oil Lubricants (FOL), Parachutes etc, used in an Airsystem.

Air Launched Missiles (ALMs)

Air launched missiles are defined as those missiles which are required to be carried, released and jettisoned (CR&J) from a military airborne platform. This definition covers both live and inert variants of the ALMs. Air Launched Missiles are characterized by own propulsion system and guidance system. ALM is an Airsystem unlike Air armament which is an airborne store.

Air Armament

Air Armament is a type of airborne stores. Air Armament includes air-dropped bombs (including smart bombs), rockets and similar air dropped weapons. This definition covers both live and inert variants of the Air Armament. Counter measure dispensing systems, Air-dropped Torpedoes, depth charges, sonobouys, rescue boats and similar items which are deployed from Air-vehicles are included as Air armament.

Airworthiness

Airworthiness is the continued capability of the military Airsystems and airborne stores to perform satisfactorily and fulfill mission requirements, throughout the specified life in the prevailing environments with acceptable levels of safety and reliability. The acceptable levels to be mutually agreed between users, designers and the certification authority.

Airworthiness Certification Plan (ACP)

ACP is a document that brings out the details towards compliance to the agreed Type Certification Basis of the Airsystem along with the involvement of TAA and other stakeholders at various stages of the development.

Airworthiness Certification Criteria

It is a foundational and a guidance document that contains the relevant standards/tailored standards/Codes to be used by the main contractors to define their airsystem's airworthiness certification basis.

Amended Military Type Certificate (AMTC)

AMTC is an approval of a major change to a Type design/Military Type Certificate, carried out by the Type Certificate Holder/Original Equipment Manufacturer (OEM).

Airsystem Design Organisation (ASDO)

ASDOs are Organizations involved in Design & Development and Modification of an Airsystem. ASDO shall be responsible for the overall design or through-life configuration management of the design of the Airsystem, and for co-coordinating the design and integration of the airborne stores designed by other Design Organizations.

Airsystem Maintenance Organisation (ASMO)

ASMOs are Organizations involved in the Maintenance of an Airsystem. ASMO shall be responsible for the overall Maintenance of the Airsystem, and for co-ordinating the overhauling & maintenance of the airborne stores maintained by other Organizations.

Airsystem Production Organisation (ASPO)

ASPOs are Organizations involved in Manufacturing and Repair of an Airsystem. ASPO shall be responsible for the overall Manufacturing of the Airsystem, and for integration of the airborne stores manufactured by other Organizations.

ASR/NSQR/GSQR/ISQR/JSQR

The ASR/NSQR/GSQR/ISQR/JSQR is a document released by the Indian Airforce, Indian Navy, Indian Army and Inter Services respectively, which describes in qualitative and quantitative terms, the requirements for an airsystem or airborne store.

Applicant

An individual or organization seeking approval from TAA for a specific Airsystem or airborne store.

Authority Holding Sealed Particulars

AHSP is the authority responsible for collecting, collating, developing, amending, updating, holding and supplying sealed particulars of the defence items in accordance with the laid down procedure. DGAQA is the AHSP for aviation stores of all the Services and the Coast Guard.

Continuing Airworthiness Maintenance Organisation (CAMO)

Maintenance Organisation within the Services to ensure Continuing Airworthiness.

Certificate of Airworthiness (CoA)

The Certificate of Airworthiness (CoA) is the formal document issued by DGAQA or competent authority to certify that an airsystem is airworthy. Every individual airsystem has to gain its own Certificate of Airworthiness which is achieved when it can be shown to conform to the Type Design and is in a condition for safe operation.

Certificate of Design

The Certificate of Design is the declaration by the authorized personnel of the Main Contractor that the system/subsystem/airborne store complies with all the requirements laid down in the technical specification with the exceptions quoted therein.

Configuration Control

Configuration control is an important function of configuration management discipline. Its purpose is to insure that all changes are performed through a well-defined process with concurrence of all the stake holders.

Configuration Management

Configuration management is a systems engineering process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design and operations throughout its life.

Configuration Management Plan

Configuration management plan is developed to define, document, control, implement, account for, and audit changes to the various components of the project.

Continued Airworthiness

All tasks to be carried-out to verify that the conditions under which a type-certificate or a supplemental type-certificate has been granted, continue to be fulfilled at any time during its period of validity.

Clearance for Service Use (CSU)

Clearance for Service Use (CSU) is an approval by CEMILAC for use of an airborne store by the User Services.

Continuing Airworthiness

All of the processes ensuring that, at any time in its operating life, an Airsystem and the airborne stores complies with the airworthiness requirements in force and is in a condition for safe operation.

Concurrent Certification

Concurrent Certification is an approach where TAA are associated with a project, from the beginning of the project through all stages of development i.e., from the requirement stage, the design, development, test and evaluation process, so that, the Certification activities are progressed concurrent with the design and development.

Concept of Operation (CONOPS)

Concept of operation is a document describing the characteristics of a proposed system from the view point of user services who will use that system.

Design Organisation (DO)

DOs are Organizations involved in the Design & Development, Repair and Modification of airborne stores used in an Airsystem. DO shall be responsible for the through-life configuration management of the designed airborne stores.

Design Organisation Approval (DOA)

An approval given to an organization as competent to carry out Design, Development and Modification and Repair of airsystems or airborne stores.

Design Approved Organisation Scheme (DAOS)

The Design Approved Organization Scheme (DAOS) is a mechanism by which the design competence of an Organization is assessed.

Design Organization Exposition (DOE)

DOE is a set of document to be presented to the CEMILAC by design organisation seeking DOA. It describes directly or by cross-reference, the organization, the relevant procedures and Air systems & airborne stores to be designed, changed or repaired.

Development Flight Clearance (DFC)

An approval given to an airborne store for integration on to an aircsystem to carry out development flight trials.

Engineering Change Notice (ECN)

An engineering change notice is a document authorizing and recording design changes throughout the prototyping and life-cycle phases of a product.

Flight Clearance Note (FCN)

FCN is an approval given to an aircsystem and is an authorization for the flight test department to carry out development flight trials within the listed system/operating limitations and cleared envelopes.

Failure Reporting, Analysis and Corrective Action System (FRACAS)

Failure Reporting, Analysis and Corrective Action System (FRACAS) is a system which is carried out using software tool, that provides a process for reporting, classifying, analyzing failures, and planning corrective actions in response to those failures. A FRACAS system may attempt to manage multiple failure reports and produces a history of failure and corrective actions.

Ground Vibration test (GVT)

GVT is done to assure the aeroelastic and aeroservoelastic stability of a new or modified air system.

Impact Kinetic Energy

Kinetic Energy of the UAV upon impact, taking into account the maximum All Up Weight (AUW) for the UAV mass and a factor of the Stall speed or maximum operating speed for the UAV velocity, for an unpremeditated descent scenario or a loss of control descent scenario respectively.

Final Operational Clearance (FOC)

Clearance issued to an airsystem for regular operations by the services, when a type design has complied with and demonstrated all the requirements of Design and Safety.

Flight Clearance Note

FCN is issued by the CEMILAC as an airworthiness clearance for an air system to carry out the development flight trials within the flight envelop and limitations specified therein.

Flight Plan Co-ordination Memo (FPCM)

A Flight Plan Co-ordination Memo (FPCM) defines the current configuration and flight limits shall be issued by CEMILAC for undertaking day-to-day trial flights subsequent to issue of FCN. It also cover minor configuration updates in the baseline configuration defined in FCN.

Indian Military Technical Standard Order (IMTSO)

An Indian Military Technical Standard Order (IMTSO) is a minimum performance standard/Specification issued by CEMILAC for specified airborne stores to be used on Military airsystem. Airborne stores with IMTSO approval are eligible for use on any airsystem, provided the IMTSO standard meets the airsystem requirements.

Indian Military Technical Standard Order Approval (IMTSOA)

An approval given to an airborne store that meets the relevant IMTSO standard/specification. However an IMTSOA, by itself, is not an authorization for installation on any airsystem.

Indian Military Technical Airworthiness Regulation (IMTAR)

IMTAR is a procedural document that mandates the processes to be followed by organizations/stakeholders involved, under which necessary Clearances, Approvals and Certificates related to Airworthiness and Certification of Indian Military Airsystem for various scenarios and aspects of Aircraft Life cycle, will be issued by the Technical Airworthiness Authorities of India.

Initial Operational Clearance (IOC)

Clearance issued to an airsystem with restrictions of intended use for operations by the services, when a type design has complied and demonstrated most of the requirements of design and safety, wherein it has been assessed that the non-complied requirements have no impact on Air safety.

Initial Airworthiness Approval

The approval issued by CEMILAC for the Initial Type Design. Initial Airworthiness Approval includes, MTC, RMTC, RSD, Type Approval, IMTSOA, LoA.

Inspection Note

Each and every produced and released aeronautical equipment or airborne stores is accompanied with an Inspection Note issued by DGAQA, stating satisfactory inspection of the equipment or airborne stores.

Instructions for Sustaining Type Airworthiness (ISTA)

ISTA comprises of descriptive data and accomplishment instructions that ensures the type certification airworthiness standard is maintained throughout the operational life of an air system. Typically, the instructions are in the form of manuals.

Letter of Approval (LoA)

LoA is an approval given to a class of airborne stores like Materials, Standard Parts and other items that are not covered under Type Approval or IMTSOA.

Local Concession Committee (LCC)

LCC is a technical committee for discussions on the non-compliance of modifications and Service Instructions. LCC is chaired by CEMILAC and shall have members from DGAQA, Design and Quality department of the contractor firm and User Representatives.

Local Modification Committee (LMC)

LMC is a forum for technical discussions and associated aspects of introduction and applicability of modifications. It is constituted by the Government. LMC shall be chaired by CEMILAC, with members from maintenance organization of the respective user services, Service Headquarters, DGAQA, Contractors representatives in Design, Production Engineering, Methods Engineering and Quality Control.

Local Technical Committee (LTC)

LTC is a sub-committee constituted by the chairman of the LMC, to technically evaluate the modifications in the absence of detailed information and documentation from the licensor or the OEM. LTC shall give its recommendations to the LMC.

Local Type Certification Committee (LTCC)

LTCC is a committee to technically discuss the indigenisation aspects of airborne stores to be indigenised. It is chaired by CEMILAC with members from, Head of indigenization, the Main Contractor's Head, Design & Quality representatives, DGAQA and User representative.

Loss of Control

A failure (or a combination of failures) which results in loss of control of an UAS and may lead to impacting the ground at high velocity.

Main contractor

Main contractor is the development and or production agency who is entrusted with the total responsibility for development and/or production of the airsystem/airborne store.

Maintenance Organisation (MO)

MOs are Organization is involved in Maintenance of airborne stores used in an Airsystem. MO shall be responsible for the through-life configuration management of the Maintenance of airborne stores installed in an Airsystem.

Maintenance Organisation Approval (MOA)

An approval given to an organization as competent to carry out Maintenance of airsystems or airborne stores.

Maintenance Approved Organisation Scheme (MAOS)

Maintenance Approved Organization Scheme (MAOS) is a mechanism by which the competence of an Organization to undertake Maintenance of airsystem and airborne stores can be assessed.

MAINTENANCE ORGANIZATION EXPOSITION (MOE)

MOE is a set of document used to identify the procedures, means and methods for approval of Mil CAMO by DGAQA.

Make –I

Military Airsystem/airborne store projects funded by the Government

Make –II

Military Airsystem/airborne store projects funded by the Private Firms

Make-III

Military Airsystem/airborne store projects that are indigenously manufactured for import substitution.

Master Minimum Equipment List (MMEL)

MMEL is a categorized list of on-board systems, instruments and equipment that may be inoperative for flight in a specified air system.

Military-run Maintenance Organization (MMO)

A military-run maintenance organization (MMO) is an organization run by user services which is authorized to maintain any aircraft and/or component for which it has been established to do so by the relevant Front-Line Command.

Military Continuing Airworthiness Management Organization (Mil CAMO)

Military Continuing Airworthiness Management Organization (Mil CAMO) is an organization approved by TAA to insure that all necessary Air System corrective and preventive Maintenance is carried out before flight as per Aircraft Maintenance Programme (AMP).

Military Aircraft

Military aircraft includes Army, Navy, Air Force and Coast Guard aircraft, and every aircraft commanded by personnel of the Armed Services. These include Fixed or rotary wing Aircraft, piloted or unmanned aircraft during development or during operations for military use, registered or intended to be registered with Ministry of Defence.

Military Permit To Fly (MPTF)

Military permits to fly is a clearance in the form of FCN, to an airsystem that do not meet, or have not been shown to meet, applicable airworthiness requirements but are capable of safe flight under defined conditions.

Military Type Certificate (MTC)/FOC

MTC/FOC is a certificate that the airsystem of a particular type design complies with all the agreed Design, Safety and Airworthiness requirements.

Provisional Clearance

A provisional clearance is issued to an airborne store for a limited period, pending issue of Type approval by CEMILAC. A provisional clearance is issued to the effect that the airborne store under development meets all the laid down specifications and test requirements with the exceptions stated there in.

Production Organisation (PO)

POs are Organization is involved in Manufacturing and Repair of airborne stores used in an Airsystem. PO shall be responsible for the through-life configuration management of the airborne stores produced and installed in an Airsystem.

Production Organisation Approval (POA)

An approval given to an organization as competent to carry out Manufacture and repair of ofairsystems or airborne stores

Production Approved Organisation Scheme (PAOS)

PAOS is a mechanism by which the competence of an Organization to undertake Manufacture and Repair of airsystem and airborne stores can be assessed.

Quality Assurance Plan

A document that details the involvement of DGAQA for the quality assurance related activities throughout the design & development and production of the Airsystem and airborne stores.

Regional Centre for Military Airworthiness (RCMA)

Regional Centre for Military Airworthiness is a field unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the airsystems/airborne stores during design and development, production and In-service phase. In such places where no establishment of RCMA exists, such authority may be delegated to Visiting Technical Officers (VTOs) of CEMILAC.

Office of Regional Director-AQA (ORDAQA)

The Office of Regional Director-AQA is a field unit of Directorate General of Aeronautical Quality Assurance (DGAQA) to ensure Quality Assurance of the airsystems/airborne stores during Design, Development and production phases.

Original Equipment Manufacturer (OEM)

The original equipment manufacturer which is the only firm manufacturing the specified Airsystem/Airborne Store of a specific make, as distinguished from the stockists/distributors or suppliers of such items/equipment and no other manufacturer exists for that item.

Recognition

Recognition is a structured process by which Indian TAA can evaluate a foreign National Airworthiness Authorities and assess the potential to use their certification approvals for Indian Military. Recognition can be undertaken on a reciprocal basis, known as 'Mutual', or on a unilateral/multilateral basis.

Release to Service Document (RSD)

Document issued to the services during IOC or FOC of an airsystem, that authorizes regular flying by the service within the stipulated limitations and cleared envelopes.

Restricted Military Type Certificate (RMTC)/IOC

When an Air System has not completely demonstrated compliance to the design and safety requirements, wherein it has been assessed that the non-complied requirements have no impact on Air safety, a RMTC/IOC can be issued for a provisional period until the Type Design can be demonstrated to be accurate and complete.

Special Conditions

Special conditions are included in the type certification basis of the airsystem or airborne stores when the design features of a particular product or the experience in operation render any of the airworthiness certification criteria provisions inadequate or inappropriate to insure conformity with essential requirements.

Standard Part

A part manufactured in complete compliance with an established industry or Indian Government specification which includes design, manufacturing, test and acceptance criteria, and uniform identification requirements; the specification must include all information necessary to produce and conform to the part and be published so that any party may manufacture the part.

Safety of Flight Tests (SOFT)

An abridged version of the Qualification tests for a non safety critical system, sufficient enough to establish confidence in the safety of a few development flights, for the purpose of data gathering to facilitate further development activities. Development Flight Clearance based on SOFT will be decided by CEMILAC on a case to case basis.

Special Technical Instructions (STI)

STIs are issued by the Service Headquarters based on the draft forwarded by main contractor firm duly coordinated by CEMILAC to ensure the maintenance of the airworthiness standard of aircraft.

Service Bulletins (SB)

The SBs are issued either by the licensor in the case of bought out equipment used on the aircraft or the contractor firm to ensure the maintenance of the airworthiness standard of aircraft.

Servicing Instructions (SI)

SIs are issued by the Service Headquarters based on the draft forwarded by main contractor firm duly coordinated by CEMILAC to ensure the maintenance of the airworthiness standard of aircraft.

Standard of preparation (SOP)

The frozen build standard of the aircsystem/airborne store including its approved drawings, list of approved equipments/items.

Structural Coupling Test (SCT)

SCT is done to ensure that the airframe frequencies have been sufficiently neutralized or not.

Supplier

An agency/person in the supply chain who provides a product, article, or service that is used or consumed in the design or manufacture of, or installed on, a product or article.

Supplemental Military Type Certificate (SMTC)

SMTC is an approval of a change to a Type design/Military Type Certificate, carried out by any party other than the Type Certificate Holder.

Technical Airworthiness Authorities (TAA)

CEMILAC and DGAQA, the organizations dealing with Technical Airworthiness of the aircsystems/airborne stores are called TAA.

Test and Evaluation Master Plan (TEMP)

The test and evaluation master plan documents the overall structure and objectives of the test and evaluation for a program. It covers activities over a program's life-cycle and identifies evaluation criteria for the testers.

Test Adequacy Review Board (TARB)

Test adequacy review board is constituted by the main contractor with concerned stake holders as members to review the adequacy of the test cases being finalized for during ATP, QTP, Aircsystem integration etc.

Tools, Testers and Ground Equipment (TTGE)

TTGE includes the following

Tools: All mechanical/special tools required to maintain the aircsystem.

Testers: All testers and Test Equipments which are used to test/verify functions/parameters of the parts/equipments/LRUs/aircsystem.

Ground Equipment: Ground handling and Ground support equipment required to operate / maintain the aircsystem.

Type Approval

Type Approval is a certificate issued by CEMILAC to the effect that the airborne store under reference meets all design specifications and test requirements laid down by CEMILAC. The type approval is issued after the Design Authority/Main Contractor submits a full type record with all relevant documents, to the satisfaction of CEMILAC.

Type Approval Basis (TAB)

The Type Approval Basis (TAB) is an agreed set of airworthiness requirements that an airborne store must be compliant with, in order to be issued a Type Approval.

Type Certification Basis (TCB)

The Type Certification Basis (TCB) is an agreed set of airworthiness requirements that an aircsystem must be compliant with, in order to be issued a Military Type Certificate.

Type Certificate Data Sheet (TCDS)

TCDS, is a document that contains information of the aircsystem type design, operating limitations, applicable regulations/standards of compliance, and any other conditions or limitations prescribed for the Type design. The MTC is issued to the type design based on the TCDS submitted by the main contractor.

Type Certification Exposition (TCE)

Type certification exposition is document of documents containing the type design, operating limitations and a draft MTC data sheet.

Type Record

Type Record is a document giving a description of the airborne store, its functional and performance characteristics, summary of strength and other calculations along with reserve factors, environmental envelope of operation and storage of the store, results of all tests including environmental, functional and performance tests, weight data, list of applicable drawings, lifing details and includes the Certificate of Design. It includes all documents and specifications approved by CEMILAC, information on dimensions, materials and processes necessary to define the structural strength of the aeronautical product. It should also indicate instructions for continued airworthiness of the product, operating limitations and other information for the safe operation of the product.

Unmanned Aircraft System (UAS)

An unmanned aircsystem and associated elements (including communication links and the components that control the unmanned aircraft) that are required for the crew in command to operate safely and efficiently.

Unmanned Aerial Vehicle(UAV)

A UAV is a powered aerial vehicle that does not carry an onboard human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable and can carry lethal or nonlethal payload.

Unpremeditated Descent

A Failure (or a combination of failures) occurs which results in inability of the aircsystem to maintain a safe altitude above the surface.

Urgent Operating Note (UON)

UONs are normally issued by the contractor firm duly co-ordinated by CEMILAC and flight test department of the contractor firm. These are to be promulgated immediately by Service Hqrs. Such instructions are issued to ensure the maintenance of the airworthiness standard of aircraft.

User Services

User Services refers to Indian Army, Indian Navy, Indian Airforce, Indian Coast Guard and such Services under the Ministry of Defence, that engage with CEMILAC in respect of Airworthiness and Certification of their products.

DRAFT

Depending on the modification, the design standard of production of airsystem/airborne stores will be updated. The main contractor shall also submit all the publications related to the modification. The detailed technical requirements for Modifications of Air System/airborne store are given at **SUBPART D & SUBPART E** respectively.

Components with minor deviations that are non-serially numbered may be salvaged with the approval of DGAQA. Production permits of deviations of components that are serially numbered may be accepted by DGAQA, if found not to affect safety, inter-changeability, maintenance, Strength, Function and Life. DGAQA may refer to CEMILAC if required, wherein the decision of CEMILAC shall be treated as final. Salvaging of major deviations of complex components of a specific airsystem, that involve cost and time through repairs are permitted with the involvement of CEMILAC and DGAQA, by following the detailed technical requirements as given in **SUBPART M**.

Concessions may be raised by the contractor if modifications or Service Bulletins or other service instructions are not complied due to various reasons.

Production Quality Tests (PQT)/ Line Qualification Tests for all the aircraft components and equipment need to be finalised with design, production QA and DGAQA. The ground test and flight test for the acceptance of the aircraft are carried out based on the test schedules approved by DGAQA and CEMILAC in consultation with the flight test agency. Tests for inspection and acceptance of the aircraft and LRUs on ground are included in the set of drawings.

Each airsystem and airborne store produced must be uniquely identifiable before it is delivered. This is to comply with requirements of configuration, safety, operational and traceability of a recurrent failures of components to batches and hence interchange-ability. The detailed technical requirements for Identification are given in **SUBPART Q**.

After successful completion of the production, meeting all the test requirements satisfactorily the airsystem/airborne store is cleared for induction and regular operation by DGAQA through the Certificate of Airworthiness (CoA)/Release Note. The detailed technical requirements for Certificate of Airworthiness are given in **SUBPART H**.

Figure A.3 illustrates the procedure during the Production phase.

Products that are manufactured under license, starts with a signed agreement between the Licensor and the Licensee.

It is incumbent on the Licensor to provide all necessary inputs including documentation, wherewithal and to discharge of all obligations needed for the Licensee to manufacture the airsystem/airborne store within the scope of the licence agreement.

The Manufacture and testing is based on the licensor's documentation. The procedure followed for manufacture, deviations, modifications, concessions is similar to, as described

in the production phase. That apart, during manufacture, indigenous substitutions of airborne stores are also permitted. This is separately addressed in section 2.5 below.

2.4 Continued Airworthiness& Continuing Airworthiness

An aircsystem in serviceundergoes Modifications and Upgradations. Modifications to ensure that the conditions under which Initial Airworthiness Approvals have been granted, continue to be fulfilled during their validity period of these approvals, and Upgradations to enhance its usefulness and capability and to also address in-service obsolescence. These activities are part of Continued Airworthiness, wherein the certification coverage will be given by CEMILAC and DGAQA. Modifications are addressed through Local Modification Committee (LMC), Constituted by MoD. The procedures described in section 2.3 are applicable. Upgrades undergo design evaluation and testing. The procedures described in section 2.2 are applicable. The upgrades get formalised through an Amended Military Type Certificate (AMTC) or a Supplemental Military Type Certificate (SMTC). The detailed technical requirements for Continued Airworthiness are given at **SUBPART L**.

Continuing Airworthiness covers all the processes that ensure that, at any time in its operating life, the Aircsystem complies with the airworthiness requirements as applicable and is in a condition for safe operation. This is ensured by following the stipulatedperiodic maintenance procedure and from time to time incorporating the Urgent Operating Notice (UON), Servicing Instructions (SI), Special Technical Instructions (STI) and Service Bulletins (SB) issued by the OEM.

It may also so happen that a specific aircsystem (unique Tail number) might have suffered damages during operation. If there is a possibility to recover the component, bringing it back to the condition of its initial approval, then Repairs can be undertaken with the involvement of CEMILAC and DGAQA. The detailed technical requirements for Repairs are given in **SUBPARTM**.

2.5 Indigenous substitution

Indigenous substitution deals with indigenous development of an airborne store as a replacement of the ones bought-out from foreign sources. The development could be initiated on specific requirements by the user services or by the Design Authority. The Development can be undertaken by any agency i.e. Public Sector, Private Sector, Government Agencies, or the User Services.

Indigenous substitution comes under the following four categories.

- (a) Items for which a licence exists for indigenous manufacturing.
- (b) Items for which Technical Specifications, Qualification Test Procedure (QTP) and Production Acceptance Test (PAT) requirements are available.
- (c) Items for which only Technical Specification is available.
- (d) Items for which no Technical information is available.

For Licenced items the Quality Control Department of the approved Licence Manufacturer, shall ensure that items are manufactured and tested as per the licensor's documents, and accept the items. Such items may be intimated to CEMILAC and DGAQA.

For those items for which Technical Specifications, Qualification Test Procedure, Production Acceptance Test requirements are available, the main contractor may take up development after consultation with CEMILAC. Quality assurance shall be provided by DGAQA. Type Record to be submitted to CEMILAC for Provisional Clearance or Type Approval.

Items for which only Technical Specification is available, the type test schedule based on existing well known standards/ airworthiness requirements shall be prepared in consultation with CEMILAC. Batch acceptance test schedule shall be prepared in consultation with DGAQA. Type Record to be submitted CEMILAC for issue of Provisional Clearance and full Type Approval thereafter

Items for which no Technical Information is available, the process of indigenisation is mandated by LTCC, chaired by CEMILAC with members from indigenisation department, Head and design department of main contractor, quality, DGAQA and User Services. Non-critical item may be approved by LTCC after ensuring satisfactory testing. "Flight Safety Critical" or "Mission Critical" shall have to undergo the full extent of Type Approval. The Procedure mandates that the Specification and Type Test Schedule be approved by CEMILAC. Prototypes shall be inspected by the Quality Control Department of the main contractor and DGAQA or QA of the User Services wherever applicable. The prototypes to be tested as per the type test schedule out at an approved test house/laboratory witnessed by DGAQA or the QA or the User Services wherever applicable. The prototypes shall be flight evaluated in consultation with the flight test department, if called for in the Type Test Schedule. The outcome and the results to be discussed in LTCC.

For Standard Parts, the Main Contractor may develop the standard parts following the approved standard/specification. The design department in consultation with the Quality Control Department shall issue indigenisation clearance of the items after carrying out tests indicated in the drawing and/or carrying out end use functional checks. The detailed technical requirements for Indigenous substitution are given at **SUBPART K**.

Figure A.4 illustrates the procedure for indigenous substitution.

2.6 Organisation Approval

Airworthiness is to be ensured throughout the life cycle of the aircraft. Ensuring airworthiness throughout the life cycle of the aircraft, implies that, the aircraft is airworthy by design, it is manufactured as per the approved standard of preparation (SOP), and is maintained as per the approved procedure during its development, and in service. In order to ensure this, it is implicit that the Design Organisation, the Production Organisation and

the Maintenance Organisation are issued with Design, Production and Maintenance Organisation Approvals respectively. It is to be noted that the Organisation Approval should not be construed as a factor for empowering or facilitating the organisation to bid for a contract, but rather a statement that establishes the competency of the organisation in relevant domain for the scope stated therein, to perform quality tasks befitting the standards required of a military aviation product. Thus, an Organisation Approval is an enabler for the organisation's engagement with CEMILAC and DGAQA for seeking airworthiness and certification of the products. The procedure involves auditing of the firm by TAA, for its scope of task as per the Design/Production/Maintenance Organisation Exposition (DOE/POE/MOE) submitted by the firm. The Organisation Approval is issued after satisfactory evaluation. The detailed technical requirements for Organisation Approvals are given in **SUBPART G**.

2.7 Mutual Recognition

There can be scenarios where military projects may be undertaken under joint ventures or consortium, with distinct work packages, for application by the Indian User Services. In such cases provisions for Mutual recognition of Certification methodologies by the respective Airworthiness Certification Authorities of the participant countries, in a unilateral, bilateral or multilateral mode are provided to facilitate the overall certification of the product. The detailed technical requirements are brought in **SUBPART U**.

2.8 Bought out Air system and Airborne stores

In Indian Military aviation framework, there may be situations where an air system or an airborne store from a foreign OEM is acquired. The requirements in respect of Bought out Airsystem/airborne store, Customer Furnished Equipment (CFE), a Civil Certified aircraft for Military use are detailed in **SUBPART N**, **SUBPART S** and **SUBPART R** respectively.

3.0 Roles and Responsibilities of TAA (CEMILAC/DGAQA)

Regional Centre for Military Airworthiness (RCMA) is an unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the airsystem/airborne stores during design and development, production and In-service.

Likewise, Office of the Regional Director of Aeronautical Quality Assurance (ORDAQA) is the field unit of DGAQA which progresses on behalf of DGAQA, all aspects of Quality Assurance of the airsystem/airborne stores during Design, Development and production phases.

The roles and responsibilities of CEMILAC and DGAQA are discussed herein. It is to be noted that in the following sections RCMA and CEMILAC are used synonymously, ORDAQA and DGAQA are used synonymously.

3.1 Responsibilities of DGAQA

a. The Directorate General of Aeronautical Quality Assurance (DGAQA) is the organisation under the Dept. of Defence Production and Supplies in the Ministry of Defence responsible for Quality Assurance and Acceptance of Aircraft/Aero-engines/Aeronautical Stores manufactured/ overhauled/repared at various Divisions of Hindustan Aeronautics Limited and for such stores manufactured at Ordnance Factories, Public sector and in private sector, besides other responsibilities.

b. DGAQA to carry out Executive Quality Assurance functions at firms established for the purposes of manufacture/overhaul/repair of aeroengines/aircraft/ associated equipment. The primary function of DGAQA is to verify by adequate inspection, testing, quality audits and effective supervisory inspection control over the firm's Quality Assurance organisation, that all supplies and equipment delivered under the Ministry of Defence contracts / orders, which designate DGAQA as the Inspection Authority, conform to the stipulated requirements. The responsibilities of DGAQA are broadly defined as follows:

(i) Exercise control over the Quality Assurance Organisation of the firm and report to Headquarters of any fall in standard of the firm's Quality Assurance Organisation/Staff.

(ii) To ensure through physical supervision that the firm's Quality Assurance staff have carried out comprehensive Quality Assurance at all stages from the raw material stage to the final delivery of the product and introduce such checks and procedures as considered necessary from time to time.

(iii) Introduce stages of physical Quality Assurance which should be comprehensive and cover Quality Assurance right from the incoming raw material and stores to final assembly stage and the finished product. They are to be reviewed periodically for ensuring better supervision over the firm's Quality Assurance organisation. Wherever the DGAQA's stages of Quality Assurance have been communicated to the firm, the firm's Quality Assurance responsibility should be permitted. If there is need to deviate, it should be done in consultation with DGAQA.

(iv) To ensure that all deviations to stipulated requirements are properly authorised and recorded. Wherever there are deviations of major nature affecting safety or strength or interchangeability or other operational aspects, he shall refer the case to CEMILAC for his decision. Deviation affecting operational aspects shall be referred to Air/Naval/Army HQrs/CEMILAC for decision.

(v) Report to Headquarters, details of new design projects or manufacturing methods or processes which may affect the established inspection procedure and raise critical observations thereon.

(vi) Assist Headquarters, DGAQA in the indigenous substitution activity.

c. Whenever a new airborne store is developed under a contract, for which DGAQA is the Inspection Authority, DGAQA is associated with all phases of development and testing of stores from the initial stages, for progressive appraisal and for making critical observations of engineering features especially from maintenance, servicing and inspection point of view. Such report from DGAQA would be given consideration by CEMILAC before according the Type Approval.

d. DGAQA is responsible for the issue of a Certificate of Safety for Flight for undertaking any test flights at Contractor's works, for purposes of trials/acceptance and ferry to the user units in respect of aircraft underdevelopment/ manufacture/overhaul/repair. The Certificate is issued after inspection to ensure that the aircraft has been constructed/overhauled/repared and ground tested in accordance with the applicable drawings or approved schedules and that the requirements of the contractor have been complied with.

e. All stores manufactured/overhauled/repared under the Ministry of Defence contracts are accepted and so certified by DGAQA on the Contractors Advice and Inspection Note. This certificate forms the basis of all contractual transactions.

f. DGAQA will be associated with investigations of defects reported during development and in service and at the manufacturers works/overhaul agencies and make suitable recommendations as per laid down procedures.

g. Certification of Ground systems, test Rigs and Tools, Testers & Ground Equipment (TTGE).

h. DGAQA shall accord Production / Maintenance Organisation Approvals to firms.

3.2 Responsibilities of CEMILAC

a. CEMILAC is the Authority for Airworthiness Certification of Airsystem and airborne stores.

b. The main duty of CEMILAC is to ensure Airworthiness through evaluation of design by a process of FMEA, FMECA, Analysis of reports, Simulation Studies, Analogy Studies, Test schedules, Acceptance test procedures, Test results etc., CEMILAC is to ensure promulgation of such actions as are necessary for maintenance of Airworthiness of aircraft in service.

- c. CEMILAC may depute Visiting Officers to certain firms/organisations to attend to specific assignments in regard to type or development clearance of Airborne stores. Their functions as Visiting Technical Officers will be similar to those outlined below.
- d. CEMILAC is responsible for ensuring that the firm is cognizant with, correctly interprets and applies the technical requirements.
- e. CEMILAC shall evaluate design features of all military airsystem/airborne stores projects at the contractor's works and verify conformity to design requirements. CEMILAC is also responsible to ensure compliance of design and test requirements required for accordance of technical clearance of the stores by the CEMILAC.
- f. CEMILAC shall approve the Development and Qualification Test Schedule and specify the Test and Analysis requirements for clearance of airborne systems and stores.
- g. CEMILAC shall witness where necessary, ground tests and verify adequacy of loading and testing conditions. Where loading and testing are inadequate, he shall advise the contractor for revision of testing to the appropriate loading and test conditions.
- h. CEMILAC shall analyse ground test results/flight results and examine adequacy. Additional tests should be called for where necessary. CEMILAC shall attend the debriefing meeting where necessary.
- i. CEMILAC shall arrange to collect and maintain Type Records, including test reports on wind tunnel, structural, mechanical and system tests, bench test, proving trials and flight tests.
- j. CEMILAC shall be Chairman for Local Type Certification Committee, Local Concession Committee and Lifting Committee.
- k. CEMILAC shall examine the acceptability or otherwise concessions referred to by DGAQA, when strength, safety, interchangeabilities are affected.
- l. CEMILAC shall examine modification proposals put up by the contractor in respect of projects under his control, call for the tests required, technically accept mods and act as Chairman of the Local Modification Committee constituted for the various projects. In the discharge of this responsibility, he shall take all necessary action to ensure acceptance of the mod by User services prior to his formal technical clearance and prescription in the standard of preparation.

m. CEMILAC shall examine and approve all draft SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Service Bulletins, Lifting Policy that are required to be issued for the maintenance of airworthiness standard of aircraft manufactured at the contractor's works.

n. CEMILAC shall define periodically the design standard for production/overhaul aircraft; examine and approve changes to ground and flight test schedules; examine cases of concession put up by the contractor for non-compliance of modifications, SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Repair Schemes etc., during manufacture and overhaul of aircraft manufactured by the contractor.

o. In respect of aircraft in Service use, CEMILAC shall maintain day to day contact with Service Headquarters on matters arising from technical and operational experience of such aircraft and take action as considered necessary to ensure maintenance of airworthiness.

p. CEMILAC shall participate and ensure adequacy of investigations on defects and incidents carried out by the contractor on design aspects.

q. CEMILAC shall also examine tests carried out on components indigenously developed at the contractor's works for issuance of Type Approval.

r. CEMILAC shall satisfy himself of the adequacy of production ground and flight test schedules. He will approve the ground and flight test schedules and their amendments.

s. During certain phase of production of aircsystem/airborne stores the maincontractor may propose to indigenise or substitute from other countries material and components. On receipt of such proposal from contractor, it is the responsibility of CEMILAC to approve the specification/drawing of the material/component and lay down test requirement for approving the same.

t. All Defect Investigations carried out during development phase shall havemember from CEMILAC.

u. CEMILAC shall approve the technical specification of the Test rigs and TTGEs.

v. CEMILAC shall approve of Standard of Preparation (SOP) for the air system/airborne store.

w. CEMILAC shall accord Design Organisation Approval to Firms.

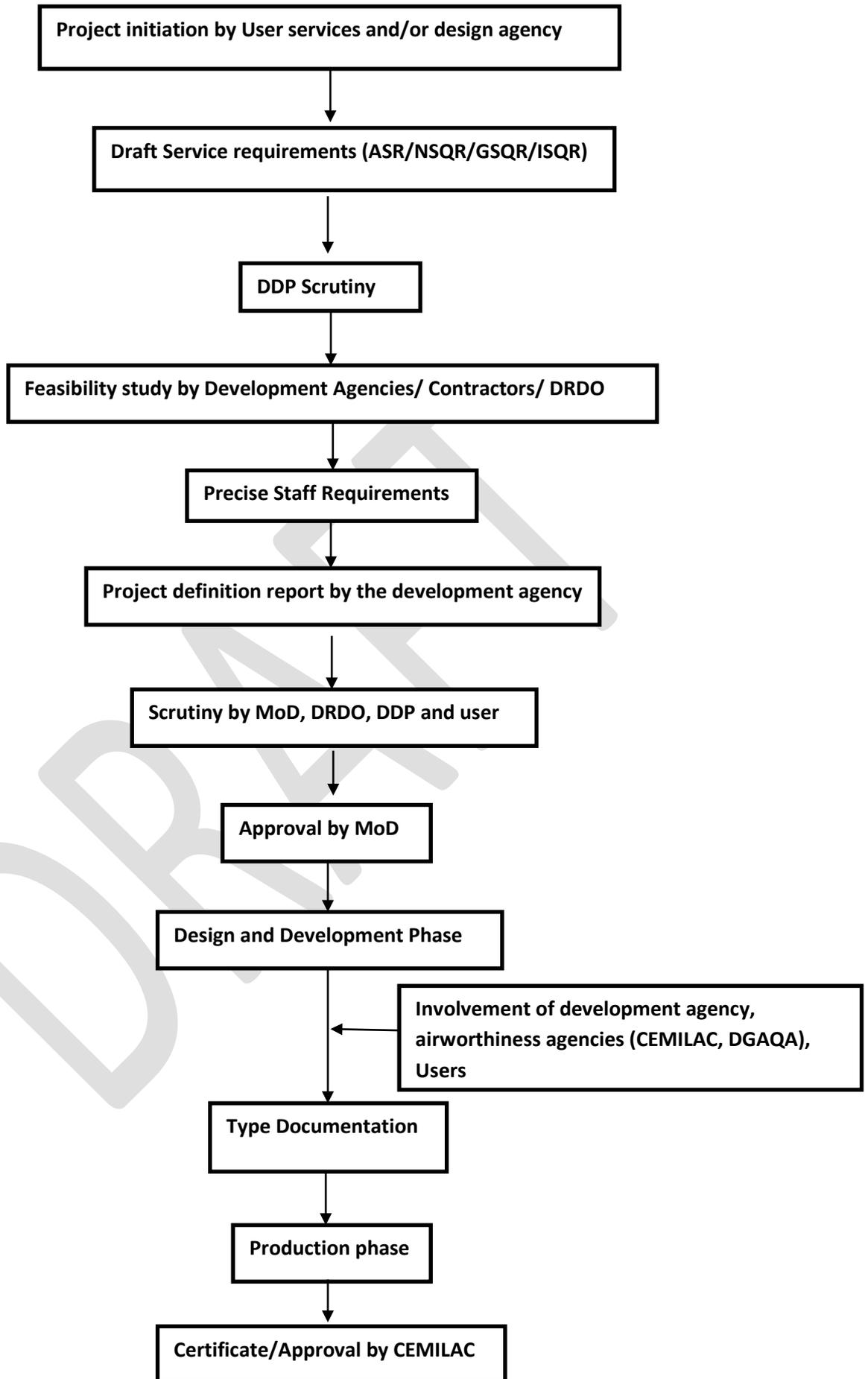


Figure A.1 Procedure for Project initiation

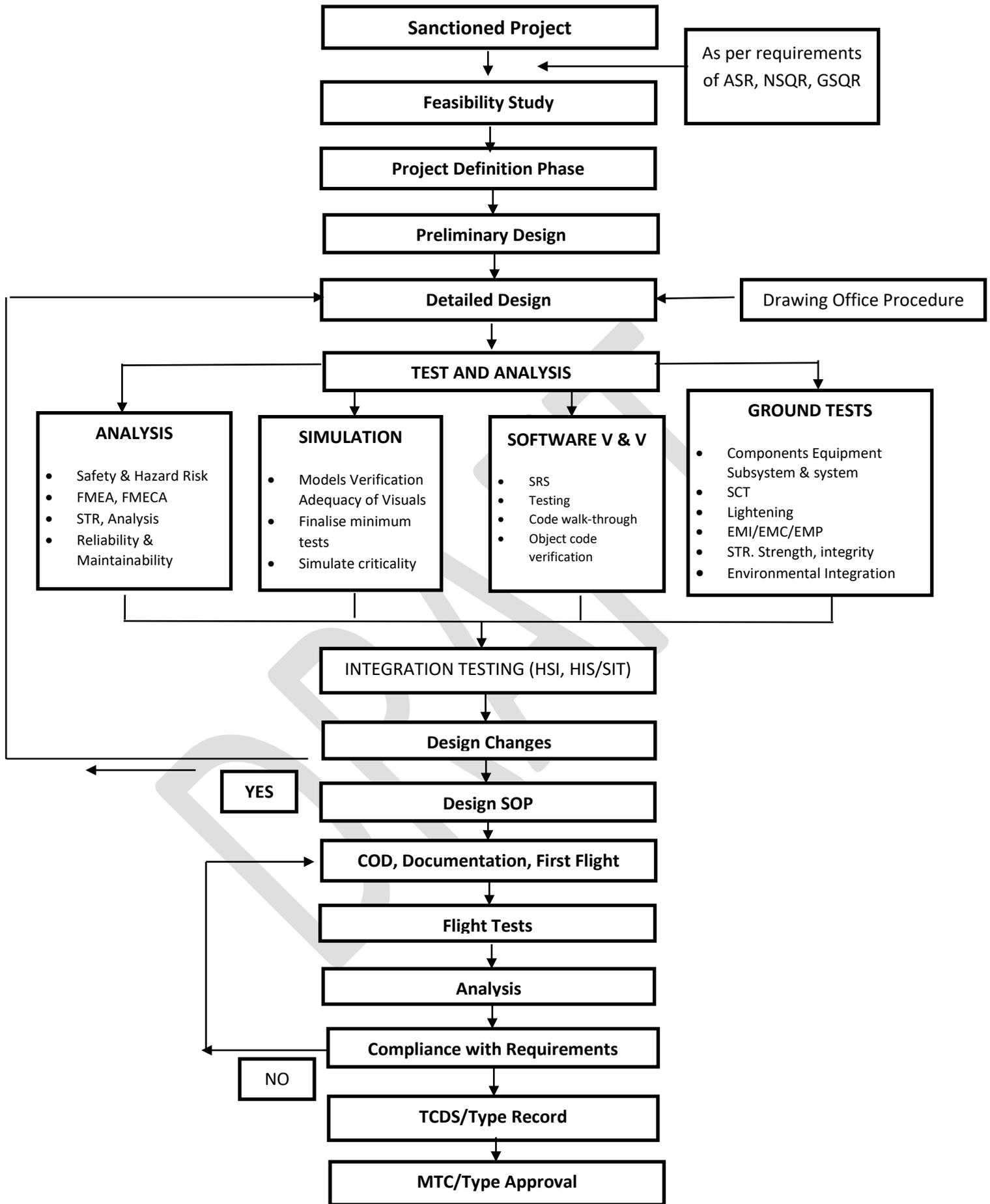


Figure A.2 Procedure for Ab-initio development

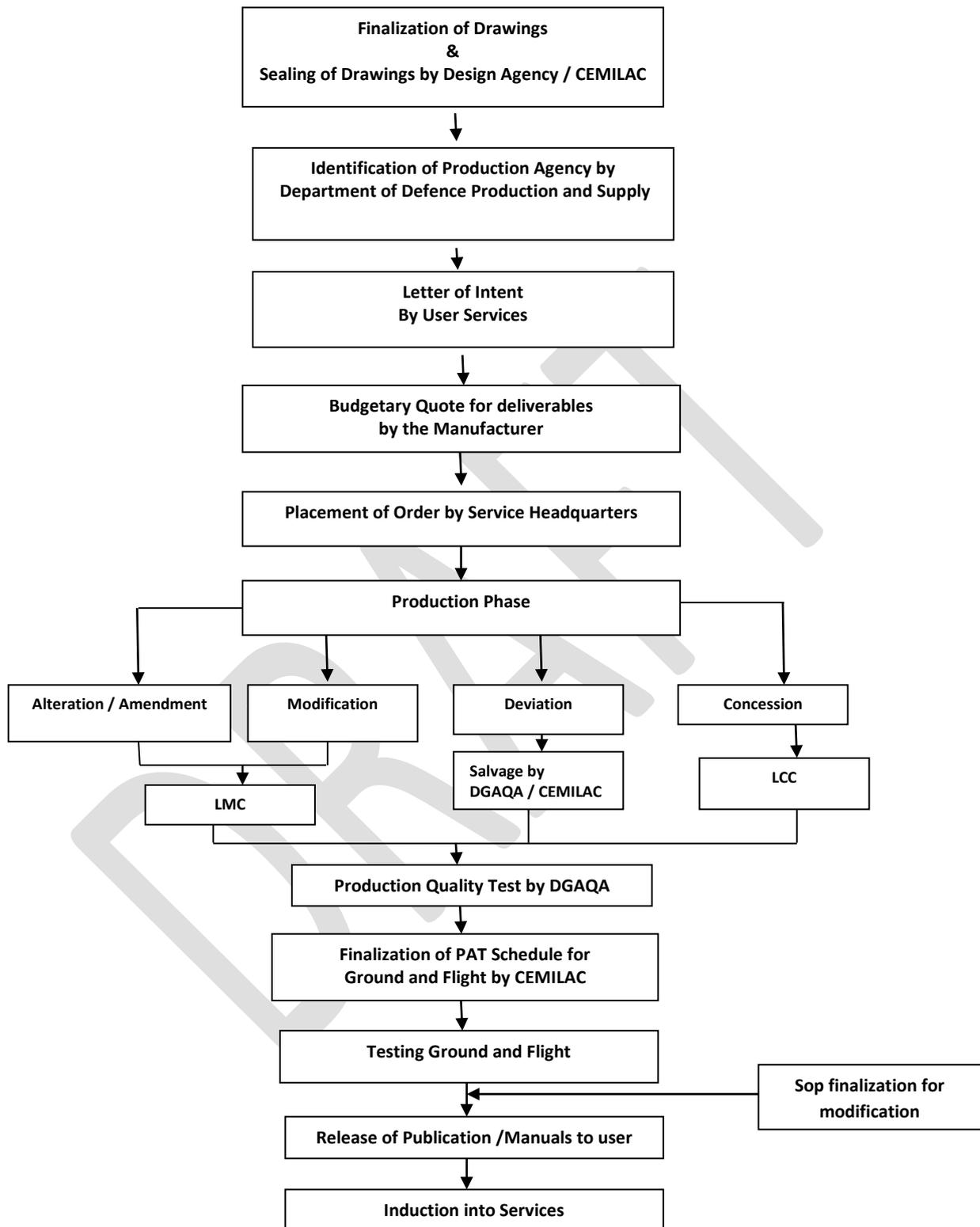


Figure A.3 Procedure for Production phase

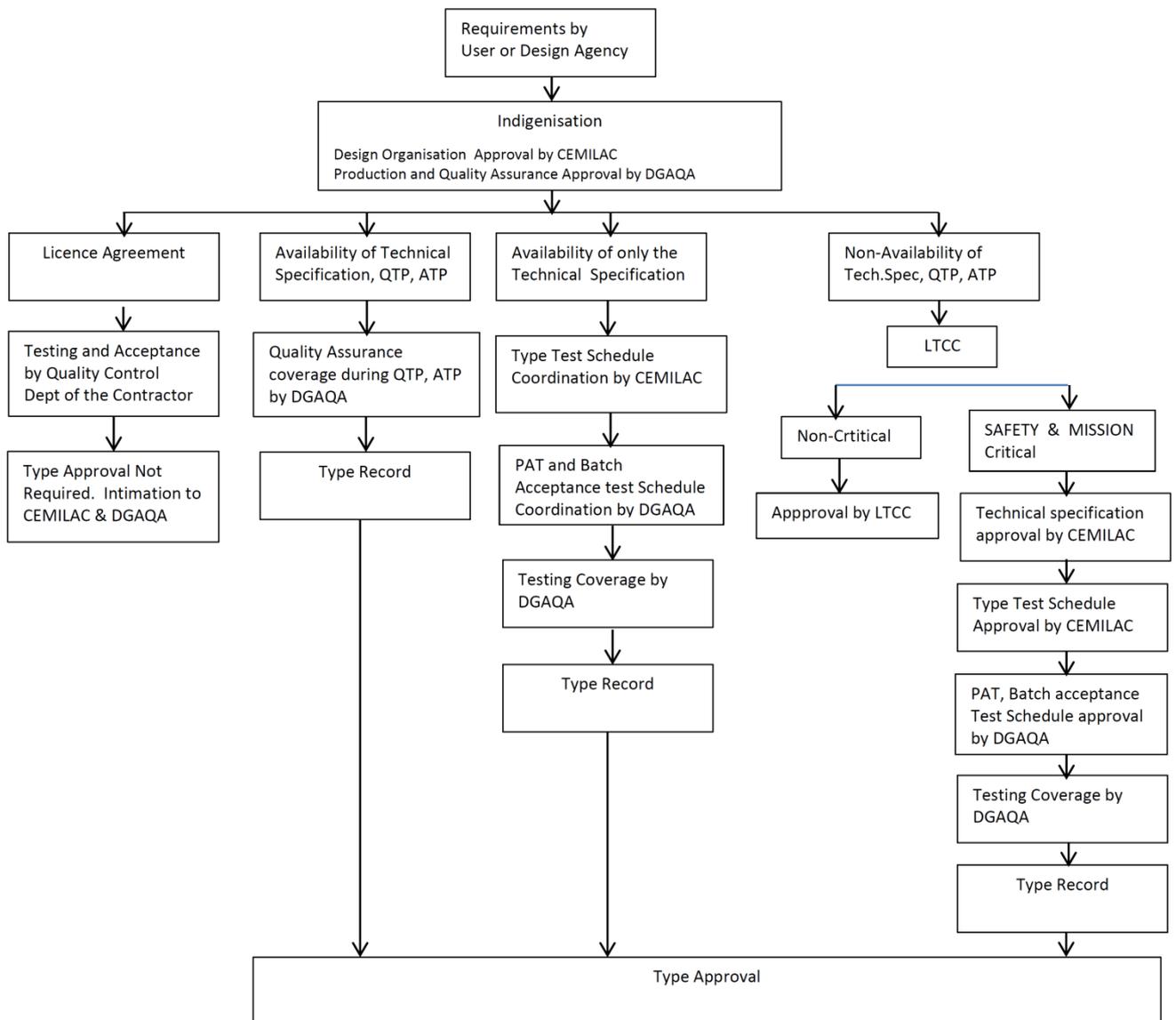


Figure A.4 Procedure for Licence Substitution

SUBPART B- AB-INITIO DEVELOPMENT OF AIR SYSTEM LEADING TO MTC/RMTC AND PRODUCTION

Rationale

Air System includes Piloted Aircraft (Fixed Wing-Rotary wing), Unmanned Air System (UAS), Air Launched Missile (ALM) and Engine. Project for development of Air System could be initiated on specific requirements by the user services. In addition, Design authority in Government, Public or Private Sector on their own may also initiate development activities considering the applicability of the same to the user services or export options. Air Systems shall be subjected to a certification and quality assurance process as agreed by the Technical Airworthiness Authorities (TAA), to ensure the safe operation and Mission success of the User services.

On completion of design, development and evaluation of Air System and upon showing compliance with the certification basis, CEMILAC shall issue Restricted Military Type Certificate (RMTC) or Military Type Certificate (MTC) to the Air System Design Organisation (ASDO).

Applicability

- a. This subpart is applicable for the development of following types of Air Systems:
 - i. Ab-initio design and development of Piloted Aircraft, which includes Fixed wing and Rotary wing. The regulations for such aircsystems are covered under 21.B1.
 - ii. Ab-initio development of Unmanned Air System (UAS). The regulations for such aircsystems are covered under 21.B2.
 - iii. Ab-initio development of Air Launched Missile (ALM). The regulations for such aircsystems are covered under 21.B3
 - iv. Ab-initio development of Engines and Subsystems. The regulations for such aircsystems are covered under 21.B4.
- b. This regulation can also be applied in the case of ab-initio developed Air Systems by an Indian Vendor for the export purpose.
- c. Air systems for which Specific User Requirements do not exist, but may be developed as Technology Demonstrators, which may have future potential applications with Indian Military Services, the development shall be as per the regulations given in Sub-Part I, Research Air Systems.

Contents

- i. 21.B1 - Ab-Initio Development of Aircraft**
- ii. 21.B2 - Ab Initio Development of Unmanned Air Systems (UAS)**
- iii. 21.B3 - Ab-Initio Development of Air Launched Missiles (ALMs)**
- iv. 21.B4 – Ab-Initio Development of Aero Engines and Sub Systems**

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21 B1- AB INITIO DEVELOPMENT OF AIRCRAFT

Rationale

It is necessary to demonstrate that an Aircraft (Fixed wing or Rotary wing) Type Design meets appropriate safety requirements. A systematic, independent Certification process is required for new types of INDIAN military registered Aircraft. The award of a Military Type Certificate (MTC) demonstrates that the military Aircraft has met the Type Design safety requirements.

Contents

21.B1.1	Applicability
21.B1.2	User Requirements
21.B1.3	Certification of INDIAN Military Registered Aircraft
21.B1.4	Application for Airworthiness Assessment of Aircraft
21.B1.5	Demonstration of Aircraft Design Organisation (ASDO) Capability
21.B1.6	Airworthiness Certification criteria / Special Conditions
21.B1.7	Aircraft Requirement Specification
21.B1.8	Type Certification Basis
21.B1.9	Airworthiness Certification Plan (ACP)
21.B1.10	Quality Assurance Plan
21.B1.11	Identification
21.B1.12	Design & Development
21.B1.13	Configuration Control
21.B1.14	Test rigs/test Equipment
21.B1.15	Test and Evaluation
21.B1.16	Deviations
21.B1.17	Flight Tests
21.B1.18	Compliance with Type Certification Basis with available User Requirements
21.B1.19	Issue of Restricted Military Type Certificate(RMTC)/ IOC
21.B1.20	Issue of Military Type Certificate (MTC)/FOC
21.B1.21	Issue of Release to Service Documents (RSD) along with Manuals
21.B1.22	Production
21.B1.23	Changes to Type Certificate for an Aircraft
21.B1.24	Responsibilities of the MTC Holder
21.B1.25	Transferability
21.B1.26	Duration and Continued Validity
21.B1.27	Record Keeping
21.B1.28	Instructions for Sustaining Type Airworthiness

21. B1.1 Applicability

Regulation

The regulation brought in this subpart is applicable to ab-initio development of manned fixed wing and Rotary wing aircraft against the Indian Military User requirements by an Indian Agency for military applications.

Acceptable Means of Compliance

The regulations mentioned in Subpart B1 have to be complied with for the issuance of MTC for the ab-initio developed Aircraft.

Guidance Material

- a. This regulation does not cover Lighter than Air Vehicle.
- b. This regulation is not applicable for Aircraft developed by Foreign Agency.
- c. This regulation can also be applied in the case of ab initio developed aircraft by an Indian Vendor for the export purpose
- d. This regulation is not applicable for Research aircraft and same is covered under subpart 'I'

21.B1.2 User Requirements

Regulation

The proposed aircraft development program shall have specific requirements for Indian Military applications

Acceptable Means of Compliance

- a. Services qualitative requirements such as GSQR/ASR/NSQR/ISQR/JSQR released by Indian Military services.
- b. Specific requirements by the Main contractor for Indian Military applications

Guidance Material

- a. The initial user requirements may be provided to the main contractor for the feasibility study.
- b. Based on the feasibility study and along with additional related inputs, the User Services may release GSQR/ASR/NSQR/ISQR/JSQR for a particular Aircraft

- c. Main contractor may take inputs from the services for finalising specific requirements of an aircraft

21.B1.3 Certification of Ab-initio developed Aircraft for Indian Military Application.

Regulation

Ab-initio designed and developed Military Aircraft by the Indian Agency shall be Military Type Certified.

Acceptable Means of Compliance

- a. Airworthiness certification of ab-initio designed and developed aircraft shall be carried out with the involvement of TAA leading to an issue of MTC by CEMILAC.
- b. Certification shall follow the regulations 21.B1.4 to 21.B1.28

Guidance Material

Nil

21.B1.4 Application for Airworthiness Certification of Aircraft

Regulation

Main contractor shall apply to TAA for the Airworthiness certification of an Aircraft.

Acceptable Means of Compliance

- a. Main contractor shall apply to CEMILAC for airworthiness certification coverage.
- b. Main contractor shall apply to DGAQA for Quality assurance coverage.

Guidance Material

The application shall include but not limited to

- a. A description of the firm and its approval status
- b. A description of the Aircraft being developed
- c. Timelines of the program
- d. Scope of the program
- e. Preliminary Technical details

21. B1.5 Demonstration of Aircraft Design Organisation (ASDO) Capability:

Regulation

Main Contractor the organization responsible for the design of the Aircraft can demonstrate its capability by holding an appropriate Aircraft Design Organization (DOA) Approval, or is in the process of applying for such an approval.

Acceptable Means of Compliance

- a. Design Organisation Approval from CEMILAC. Compliance to SUBPART G1.
- b. The Main Contractor, shall apply to CEMILAC for DOA under the Design Approved Organization Scheme (DAOS) for the scope of design activities. Main Contractor shall comply to SUBPART G1.

Guidance Material

SUBPART G1

21.B1.6 Airworthiness Certification criteria / Special Conditions

Regulation

The ASDO shall ensure that the Aircraft is designed based on the approved Airworthiness criteria.

Acceptable Means of Compliance

- a. Airworthiness Criteria as per the services requirement shall be used.
- b. In cases where the design is not to the standards specified by the User Services or the User Services have not specified the standards, the same shall be arrived at in consultation with CEMILAC.
- c. Formal approval should be sought from CEMILAC for the use of alternative Standards

Guidance Material

- a. Other Standards may be proposed. These need to be shown to deliver an acceptable level of safety and are consistent with the intent of the benchmark requirements.
- b. Equivalence evidence should be presented in a clear, traceable format and made available to CEMILAC for review, together with the underpinning compliance evidence documents.

- c. Version of Airworthiness Code to be clearly mentioned. The most recent version will be applied. Exceptionally, an earlier version may be acceptable for compatibility with the baseline design of the aircraft. In these cases the Main Contractor shall demonstrate that this is the most appropriate approach and that any associated risks are managed appropriately.
- d. Airworthiness Codes sourced from various Standards may be used, provided it is shown to deliver an acceptable level of safety and are consistent with the intent of the programme.
- e. If Airworthiness codes are judged to be inadequate Special Conditions may be introduced and shown to meet the intent with the approval of CEMILAC.
- f. Special Conditions may also be introduced if the Airworthiness codes do not contain adequate or appropriate safety standards for the aircraft or an element of its design, in any of the following circumstances, but not limited to them.
 - i. The aircraft has or may have novel or unusual design features relative to the design practices on which the applicable Airworthiness codes are based.
 - ii. The aircraft design usage assumptions do not match the intended military usage.
 - iii. Experience from other similar aircraft in service or having similar design features, has shown that 'unsafe conditions' may develop.
 - iv. Suitable Airworthiness codes do not exist for the concerned aircraft or specific design feature.

21. B1.7 Aircraft Specification

Regulation

The Main Contractor shall bring out the top level Aircraft Requirement Specification based on the User requirements.

Acceptable Means of Compliance

Aircraft Specification Document to be made by the Main Contractor and approved by CEMILAC. The document shall take into account the User requirements and shall address the system level requirements and its dependency on the other systems.

Guidance Material

- a. User Requirement document
- b. Main Contractor's preliminary investigations /studies defining the project.

- c. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the user requirements.
- d. The document shall pave way for defining the detailed individual System Technical Specification to facilitate design.
- e. Compliance to the Aircraft Specification shall also form the basis for the issuance of MTC.

21. B1.8 Type Certification Basis(TCB)

Regulations:

Main contractor and CEMILAC shall have a mutually agreed Type Certification Basis. Compliance to TCB forms one of the basis for the issuance of MTC and RSD.

Acceptable Means of Compliance

TCB shall be prepared by Main contractor and approved by CEMILAC. This is also applicable to the amendments to the TCB, if any.

Guidance Material

- a. TCB shall be arrived at based on the applicable Airworthiness Certification Criteria (21.B1.6) and Aircraft Requirement Specification (21.B1.7).
- b. Main contractor shall also specify the way of compliance to every requirement listed in the TCB.
- c. Wherever clarity on the means of compliance is not available, the objectives need to be specified. They are to be fulfilled during the demonstration of the basis with the proof of adhering to the equivalent level of safety.
- d. Main contractor may form committees with stake holders to look in to the adequacy of the proposed TCB.

21.B1.9. Airworthiness Certification Plan (ACP)

Regulation

The Main Contractor shall Plan development activities and engagement of TAA during the development to achieve compliance to TCB.

Acceptable Means of Compliance:

Main contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stake holders. ACP shall be approved by CEMILAC.

Guidance Material:

- a. The ACP can be developed step by step when the information needed is not available at the beginning of the project, the same shall be specified and needs to be agreed before demonstration of the compliance.
- b. ACP defines the development process and engagement of TAA during the development towards achieving compliance to TCB. The ACP identifies when the compliance documents or evidence will be available and includes periodic progress reviews between the TAA, Main Contractor and other relevant organizations.
- c. ACP may consider the nature of the project like criticality & complexity, roles of all the stake holders, development &T&E process, maturity of ASDO.

21.B1.10 Quality Assurance Plan

Regulation

The Main Contractor shall Plan Quality assurance activities and engagement of TAA during the design & development.

Acceptable Means of Compliance:

Main contractor shall prepare a D&D Quality Assurance Plan (QAP) with the involvement of all stake holders. QAP shall be approved by DGAQA.

Guidance Material:

- a. The QAP can be developed step by step when the information needed is not available at the beginning of the project, the same shall be specified and needs to be agreed by DGAQA.
- b. QAP defines the Quality assurance activities and engagement of DGAQA during the development. The QAP identifies stages of inspection, delegation details, handling of deviations & concessions, and includes periodic progress reviews between the DGAQA, Main Contractor and other relevant organizations.

21.B1.11 Identification

Regulation

Each prototype Aircraft shall be uniquely identified with specific information of Manufacturer's name, Type No/Part No, and the Manufacturer's Serial Number.

Acceptable means of Compliance:

Identification shall be in accordance with Subpart Q

Guidance material

All documentations specific to each prototype shall bear the identification details.

21. B1.12 Design & Development

Regulation

The main contractor shall have a design & development process that results in aircraft meeting the user requirements and the Type Certification Basis.

Acceptable Means of Compliance

- a. The design and development activities shall follow a System Engineering Life Cycle Process. A System Engineering Plan Document shall be prepared and the documents shall elaborate the design and development life cycle activities, responsibilities and milestones.
- b. ASDO shall evolve inter alia System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP).
- c. Review Process: ASDO shall carry out inter alia Requirement Review, Design Reviews, Test Adequacy & Readiness Review, Compliance Reviews.
- d. ASDO shall prepare documents but not limited to Reviews, Design, Analysis and Simulation documents, Quality Assurance documents.
- e. Main contractor shall establish processes for Failure Reporting, Analysis and Corrective Action System (FRACAS) during design and development phase.
- f. Main contractor shall establish processes for configuration Management.(21.B1.13)
- g. The design shall be considered to be adequate for prototype realisation as marked by base lining the Drawings and Equipment Standard of Preparation (ESOP).
- h. Fabrication of Prototype development shall be carried out under a DGAQA approved Quality Assurance Process.

Guidance Materials

- a. The Design & Development plan shall be in accordance with 21.B1.7 to 21.B1.11 above.
- b. The Technical Specification is that which lays down the design and test requirements of a general nature. As the technical specification is made at the beginning of the project for each system, it may not fully describe the designer's intention. There may also arise a need to revise the Technical specification as the development progresses because of various reasons such as inability to implement the initial design concepts or changes in the user's requirement. Such inadequacies in the technical specification are overcome by issuing amendments to the technical specification through a well defined configuration control procedure. At the earliest opportunity, the original technical specification and all subsequent revisions are combined to correctly describe the product.
- c. In Project definition phase, main contractor shall identify the major systems/equipment that are intended to be used in the prototype keeping in view the user's qualitative and quantitative requirements and the technical specification for the Aircraft. Preliminary testing and analysis may be carried out for arriving at the sizing and aerodynamic configuration of the aircraft.
- d. In Preliminary Design, the design parameters are established for configuration, performance, flying qualities, stores management, weight and CG, compliance to users requirement, trade-off in the design etc. This also takes into consideration inputs from several tests such as wind tunnel tests for aerodynamic configuration and sizing. Mock up studies for cockpit management, ergonomics, vision requirements etc., are also carried out during this phase. Specifications for various equipment, sub-systems and systems that are to be used in the aircraft are also finalised.
- e. In Detailed design, the detail design of all components, subsystems, systems including their process parameters are carried out during this phase. This phase is also concurrent with analysis carried out on the structural integrity and systems through FMECA, FTA, Hazard Analysis, risk analysis etc.
- f. PDRs and CDRs to be conducted. The Documentation for PDRs and CDRs to be made available to the stakeholders well in advance before the reviews. The PDR, CDR compliance reports to be completed.
- g. Mechanisms to control changes in configuration to be in place.
- h. LRU development shall be adequately mechanised through appropriate documentation covering design and testing to meet the aircraft requirement specification.
- i. Ground Test Rigs and Ground testing for system validation shall be adequately supported with technical specifications, Test schedules and Test Reports, Certificate of Design in accordance with the requirements.

- j. Mechanism for SOP baselining to be established for Prototype realisation.

21.B1.13 Configuration Management:

Regulation

Main Contractor shall establish and implement a means by which the configuration of the aircraft is managed over the D&D life cycle.

Acceptable Means of Compliance:

- a. Main contractor shall prepare a Configuration Management Plan (CMP) document.
- b. The main contractor shall ensure that the configuration items are identified, change is managed, configuration status is accounted for, and verification and audit of configuration changes are conducted as per CMP and this information is disseminated to all stakeholders.
- c. The main contractor shall have a configuration Management Process during the development.

Guidance Materials:

- a. Change control and traceability of changes shall be maintained. This requires that life cycle data identified in the plans shall be secured and retrievable.
- b. Configuration Control Boards shall be constituted to address the changes proposed.
- c. Any change in requirements or incorporation of additional requirements shall be referred to CCBs.
- d. Changes resulting from Defect Investigation shall be referred to CCBs only when it calls for a requirement change or incorporation of additional requirements.
- e. There may be multiple levels of configuration control boards to address issues at different levels
- f. Configuration Control Board to be chaired by experts from respective domain.
- g. The Configuration Control Board consisting of the following members:
 - i. Rep RCMA / CEMILAC
 - ii. Rep Main Contractor responsible for design and development
 - iii. Rep. Main Contractor responsible for Quality Assurance
 - iv. Rep. Main Contractor responsible for manufacturing
 - v. Rep DGAQA
- h. Configuration items are uniquely identified and documented.

- i. An approved Engineering Change Note (ECN) for hardware Components and related documents and Software Change Note (SCN) for Software components, along with approved baseline configuration shall be treated as the revised baseline configuration.
- j. There shall at least two levels of CCBs. A Central Configuration Control Board (CCCB) shall address the changes in configuration which may affect multiple sub-systems or major performance enhancements. A Local Configuration Control Board (LCCB) shall address the changes in configuration which are confined to the Airborne Store/System.
- k. If found appropriate, CCBs at different levels also may be created.
- l. Configuration management plan shall clearly differentiate the role of CCBs in each program.
- m. Main Contractor to make a configuration management plan to full fill the objectives of configuration management through Configuration Control Board.

21.B1.14 Test rigs/Equipment

Regulation

The Main Contractor shall ensure availability of test rigs / test equipment that are capable of performing the indented testing and evaluation during all the lifecycle phases of the Aircraft development program.

Acceptable Means of Compliance

- a. Realization of all the required test rigs / test equipment including TTGEs shall be carried out as per the regulations given in Subpart T.
- b. The main Contractor shall ensure availability of required test rigs / test equipment including TTGEs at the appropriate stages of design & development phase of Aircraft as outlines in the approved Airworthiness Certification Plan (ACP).
- c. The Main Contractor shall ensure that the Test rigs/ test equipment and TTGEs are approved by the appropriate authorities as given in Subpart T, wherever the requirement is for the approved test rigs / test equipment and TTGEs. The test rig software, if any shall be evaluated and approved as per the regulations given in Subpart C6.
- d. The Main Contractor shall ensure that the test rigs / test equipment and TTGEs have their calibration validity up to date, wherever applicable and these are also periodically maintained.

Guidance Material

Refer Subpart T and Subpart C6

21.B1.15 Test and Evaluation

Regulation

Aircraft shall be test evaluated for its stated performance as per user requirements.

Acceptable means of compliance

- a. Aircraft shall be tested for its performance evaluation as per user requirements during ground & flight testing.
- b. Ground testing for Aircraft shall be made to finalize design at Rigs i.e. System on system integration Rig, SCT, GVT, etc.
- c. Aircraft as a whole shall be tested for its complete functionality at ground including possible failure mode checks and redundancy checks i.e. EGR, Aircraft ground checkout tests, LSTT, HSTT etc.
- d. Aircraft shall be flight tested for its overall performance including mission functionalities, environmental conditions etc. as per user requirements with the help of adequate test instrumentations and telemetry setup at ground.

Guidance material

NIL

21.B1.16 Deviations

Regulation

All deviations arising from test and evaluation of Aircraft shall be listed as limitations/concessions/waivers and to be indexed by the main contractor.

Acceptable means of compliance

- a. All deviations arising from rig/ground/flight testing of Aircraft shall be listed as design limitations by the main contractor. These limitations to be mitigated with design improvements to the maximum possible.
- b. A defined process shall be in place at main contractor to handle the deviations arising during design and development of an Aircraft.
- c. Deviations resulting in unsafe operation of Aircraft shall not be accepted and it must be mitigated through design improvements.
- d. For those deviations not possible to mitigate through design improvements shall be listed and indexed as concessions or waivers w.r.t user requirements by main contractor with user concurrence.

- e. Concessions shall have PDC for its mitigation as design improvements post issuance of RMTC with the concurrence of user.
- f. Waivers shall be obtained by main contractor from user for those deviations, which is not possible to mitigate as design improvements in the present configuration of Aircraft.

Guidance material

NIL

21. B1.17 Flight tests

Regulation

Aircraft shall be flight tested for validation of user requirements and insuring compliance to type certification basis.

Acceptable means of compliance

- a. Emphasis shall be given to validate the maximum possible user requirements at dynamic rigs, simulators, test beds etc.
- b. Flight testing of an Aircraft shall be conducted in progressive manner giving due diligence to flight safety.
- c. Flight test points shall be evolved by the flight testing department of the main contractor or user services mapping to user requirements for compliance to TCB.
- d. Flight testing shall be followed as per Subpart P.

Guidance Material

NIL

21.B1.18 Compliance with Type Certification Basis (TCB) with available user requirements

Regulation

Aircraft shall be complied for TCB to meet user requirements.

Acceptable means of compliance

- a. TCB shall be complied either through rig test/simulation/flight test.
- b. Main contractor shall present the compliance of TCB to CEMILAC for issuance of RMTC or MTC.

Guidance material

NIL

21.B1.19 Issue of Restricted Military Type Certificate (RMTC)/IOC

Regulation

Aircraft shall be issued with RMTC/IOC by CEMILAC to main contractor after compliance to TCB meeting minimum operational requirements acceptable to users without affecting safety.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB meeting minimum operational requirements acceptable to users without affecting safety.
- b. Build standard shall be submitted by main contractor to CEMILAC along with compliance to TCB for approval.
- c. Aircraft limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of RMTC/IOC.
- d. CEMILAC on satisfying with TCB and type certification data sheet shall issue RMTC/IOC of Aircraft stating limitations thereof to the main contractor.
- e. Prior to issue of RMTC/IOC main contractor or the identified production agency shall obtain production organization approval from DGAQA.

Guidance material

NIL

21.B1.20 Issue of Military Type Certificate (MTC)/ FOC

Regulation

Aircraft shall be issued with MTC/FOC by CEMILAC to main contractor after compliance to TCB meeting user requirements.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB meeting user requirements without affecting safety.
- b. Build standard shall be submitted by main contractor to CEMILAC along with compliance to TCB for approval.

- c. Aircraft limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of MTC/FOC.
- d. CEMILAC on satisfying with TCB and type certification data sheet shall issue MTC/FOC of Aircraft stating limitations thereof to the main contractor.
- e. Prior to issue of RMTC/IOC main contractor or the identified production agency shall obtain production organization approval from DGAQA.

Guidance Material

NIL

21.B1.21 Issue of Release to Service Document (RSD) along with manuals

Regulations

Aircraft shall be issued with RSD by CEMILAC along with manuals released by main contractor to user services after compliance to TCB meeting user requirements.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB meeting user requirements.
- b. Aircraft limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of RSD to user services.
- c. CEMILAC on satisfying with TCB and type certification data sheet shall issue RSD of Aircraft stating limitations thereof to the user services.
- d. Manuals shall be classified into flight publication and technical publication.
- e. Flight publication shall be prepared by main contractor in consultation with design team and flight agency and submitted to CEMILAC for approval. Same shall be released to all the stake holders after CEMILAC approval.
- f. Technical publication shall be prepared by the main contractor in consultation with design team and reviewed by maintenance department of user services. Technical publication shall be released by the main contractor to user services.
- g. CEMILAC shall not approve the technical publication.

Guidance Material

NIL

21.B1.22 Production

Regulation

The MTC holder shall carry out production under the DGAQA approved quality management process.

Acceptable Means of Compliance

The MTC Holder shall have production organization approval from DGAQA before taking up production of the type certified aircraft as per IMTAR 21 Subpart F

Guidance Material

- a. MTC is a design-cum-production certificate. Hence MTC holder can take up production of aircraft after obtaining production organization approval.
- b. In case the MTC Holder wants to take up production through production partner, then the MTC holder may enter licensed agreement.

21.B1.23 Changes to Type Certificate for an Aircraft

Regulation

Any changes to Military Type Certificate, including Restricted MTC, shall be carried out with the approval of the Technical Airworthiness Authorities (TAA).

Acceptable Means of Compliance

Any changes to the design of the aircraft which results in changes to Type Certification Data Sheet (TCDS) shall be carried out as per IMTAR 21 Subpart D.

Guidance Material

Changes may be required in the design to due to production requirements, new user requirements, improvements in design, address limitation. Such changes may be put up through the Local Modification Committee.

21.B1.24 Responsibilities of the MTC Holder

Regulation

The Military Type Certificate holder for the Aircraft shall adhere to all the clauses mentioned in MTC to maintain the type certification status of the Aircraft.

Acceptable Means of Compliance

- a. The MTC holder shall adhere to all the clauses of the MTC including conditions & limitations mentioned in type certificate.

- b. Any changes required in the aircraft at any stage shall be carried out only after the approval of CEMILAC.
- c. MTC can be withdrawn if the conditions & limitations mentioned in it are not followed.
- d. The main contractor to resolve all design related issued of the aircsystem in service to the satisfaction of the user services.

Guidance Material

- a. Any deviation / deficiency / abnormality faced at any stage during production or regular service use of the aircraft should be intimated to all the relevant stakeholders and properly investigated.
- b. Quality control requirements at production stage shall be followed as laid down by DGAQA.

21.B1.25 Transferability

Regulation

The transfer of Military Type Certificate, including RMTC, shall be made only to an organization having requisite infrastructure(ASDOA) as of the main contractor within the Indian Defence Air Environment and who is able to fulfill the responsibilities of MTC holder.

Acceptable Means of Compliance

- a. An MTC or RMTC may not be transferred to an export customer even when the Aircraft has been withdrawn from Indian service. The TAA issued MTC or RMTC assumes usage within the confines of the main contractor Regulatory Publications.
- b. The Type Approval Holder can only transfer the TC with the approval of CEMILAC.

Guidance Material

The following is not considered transfer:

- a. The TA holder changing its name
- b. Changes to the Registered Address or Relocating their facility (ie Works).
- c. The acquisition of the TA holder by another company if the acquired company (i.e. TA Holder) continues to exist as the same legal entity to which the TA was issued, provided
 - i. The acquired company (TA Holder) continues to retains possession of the Design documents, Type Records and the responsibilities under the original TA
 - ii. The acquired company retains the same quality system.

Case -1 : Change of Registered Address or Relocating of Facility (Works):

In case of change of Registered Address, the firm should submit the details along with revised Certification of incorporation obtained from Registrar of Companies. The MTC/RMTC certificate will be amended and re-issued.

In case of relocating of the facility (Works), MTC holder has to submit the details of relocation along with information whether this change would call for any change in the SOP. In case of changes to the SOP, the concerned RCMA may visit the new facility and suggest to carry out any additional testing on the items produced in the new facility and based on the evaluation, may recommend for Type Certificate.

Case -2 : Change of TA Holder name

In case of Change of name, the TA holder may submit an affidavit on a notarized non-judicial stamp paper of minimum value to the CEMILAC. Along with the affidavit, the Certificate of Incorporate from RoC with the new name shall be submitted.

Case -3 : Acquisition of MTC holder by another holding company without change to legal status

Since the name of the company nor its legal status has changed, the acquisition of the MTC holder needs to confirm to CEMILAC that

- a. The acquired company retains possession of the Type Records and the responsibilities under the original MTC
- b. The acquired company retains the same quality system

The information is only for retention by CEMILAC and no amendment to MTC is issued.

Transferability of Type Certificate

Other than the three cases given above, MTC is non-transferable. The following are the reasons for this clause:

- a. To prevent the sale and purchase of Type Certificates. A Type Certificate is not an asset owned by the MTC Holder. It is an authorization issued by CEMILAC that the MTC Holder is the D&D agency of the store (Based on the CoD) and it allows the MTC Holder to produce the store.
- b. Military Type Certification is the culmination of various rigorous, D&D, Testing and Certification activities. When a company acquires the MTC holding company, (either through purchase of asset or stock) it CEMILAC is not cognizant of the extent of transfer of knowledge/responsibility.

- c. Under the above conditions, the following are the options
- d. A prior to or within 30 days of the acquisition/merger process, the MTC holder and acquiring company together can provide a joint affidavit on MTC transfer. On satisfactory details, CEMILAC will amend the same MTC with new MTC Holder name.
- e. If the above is not done, the MTC is automatically cancelled. The acquirer/new company needs to reapply for TC.

21.B1.26 Duration and Continued Validity

Regulation

RMTC subject to any constraints, shall remain valid for a period not exceeding 3 years; a MTC shall remain valid for a period not exceeding 7 Years; and RSD Certificate without limit, provided the certificate has not been suspended or revoked by CEMILAC.

Acceptable Means of Compliance

- a. CEMILAC shall include the duration of validity at the time of issue of the TC and RSD
- b. CEMILAC shall suspend or revoke a Type Certificate/RSD if the MTC holder has not met the responsibility as given in 21.B1.24 and 21.B1.28 or if the aircrafts in service have not been able to meet the safety and operational requirements.

Guidance Material

- a. CEMILAC may consider suspending or revoking a TC when the TC holder or the licensed manufacturer do not meet the obligations during the continued airworthiness activities of the aircraft.
- b. CEMILAC may obtain from services the safety record of the aircraft at regular intervals. If, the Operating user services and the TAA find it necessary, CEMILAC may revoke or suspend a RSD.

21. B1.27 Record Keeping

Regulation

The main contractor shall ensure that all relevant design information inter-alia documents, drawings, QA records, test procedures, reports, for the identified Aircraft are held by the appropriate ASDO.

Acceptable Means of Compliance

The ASDO shall have a Record Keeping Plan Document. The record keeping shall be for a period not less than 5 years after the decommission of the aircraft from services.

Guidance Material

The document shall identify all the records that needs to be archived and details like the mode of archival, the periodicity of accounting audit.

Guidance Material

Nil

21.B1.28 Instructions for Sustaining Type Airworthiness and RSD

Regulation

The TC Holder shall update the documents necessary for sustaining the TCDS and the RSD.

Acceptable Means of Compliance

- a. The TC holder shall update the TCDS and disseminate the information to TAA, Users and the other relevant stakeholders
- b. The TC holder shall update the RSD and disseminate the information to users, TAA and other relevant stakeholders

Guidance Material

Changes may be required in the TCDS to due to meeting production requirements, new user requirements, improvements in design, obsolescence etc. Such changes shall be planned and dissemination of the same shall be stakeholders by the Main Contractor after obtaining the necessary approval from TAA.

Changes may be required continued and continuing airworthiness like issue of service bulletins, UON needs to be forwarded to all the stakehors.

SUBPART B2 – AB-INITIO DEVELOPMENT OF UNMANNED AIR SYSTEMS (UAS)

Rationale

It is necessary that the design and development of UAS leading to MTC shall meet the appropriate safety requirements. A systematic and independent Certification process is required to ensure that the design does not pose any hazard to other users of the Airspace or personnel in the vicinity. The award of a Military Type Certificate (MTC) demonstrates that the UAS has met the Type Design safety requirements.

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21.B2.29	Instructions for Sustaining Type Airworthiness

21.B2.1. Categorisation

Regulation

The Main Contractor shall declare the category of the UAS to CEMILAC.

Acceptable means of Compliance

Declaration of the Main Contractor based on guidelines given in Annex B2 .

Guidance Material

- a. Annex B2
- b. The declaration shall be accompanied by the technical details and calculation as stipulated in Annex B2
- c. The applicable proportional regulatory regime shall be as per Table B2.1 for the declared category of the UAS.

21.B2.2. Applicability

Regulation

The regulation brought in this subpart is applicable to ab-initio development of Light and Heavy Fixed wing and Rotary wing UAS categorized & certification mandated as per 21.B2.1, by an Indian Agency for military applications.

Acceptable Means of Compliance

The regulations mentioned in Subpart B2 have to be compiled with for the issuance of MTC for the ab-initio developed UAS.

Guidance Material

- a. Annex B2
- b. Not all UAS warrants airworthiness certification. Certification is limited to Light and Heavy UAS, following the Categorisation and its Certification mandate as per Annex B2.

21.B2.3. User Requirements

Regulation

The proposed UAS development program shall have specific requirements for Indian Military applications

Acceptable Means of Compliance

- a. Services qualitative requirements such as GSQR/ASR/NSQR/ISQR/JSQR released by Indian Military services.

- b. Specific requirements by the Main contractor for Indian Military applications

Guidance Material

- a. The initial user requirements may be provided to the main contractor for the feasibility study.
- b. Based on the feasibility study and along with additional related inputs, the User Services may release specific qualitative requirements as GSQR/ASR/NSQR/ISQR/JSQR.
- c. Main contractor may take inputs from the services for finalising specific requirements of the UAS.

21.B2.4. Certification of Ab-initio developed UAS for Indian Military Application.

Regulation

Ab-initio designed and developed Military UAS by the Indian Agency shall be Military Type Certified.

Acceptable Means of Compliance

- a. Airworthiness certification of ab-initio designed and developed UAS shall be carried out with the involvement of TAA leading to an issue of MTC by CEMILAC.
- b. Certification shall follow the regulations 21.B2.5 to 21.B2.28

Guidance Material

Airworthiness Certification is for both the Air Segment i.e the UAV as well as the ground Segment i.e the GOS, component of the UAS.

21.B2.5. Application for Airworthiness Certification of UAS

Regulation

Main contractor of the UAS that warrants Airworthiness Certification as per 21.B21 shall apply to TAA for the Airworthiness certification of UAS.

Acceptable Means of Compliance

- a. Main contractor shall apply to CEMILAC for Airworthiness Certification coverage.
- b. Main contractor shall apply to DGAQA for Quality Assurance coverage.

Guidance Material

- a. The application shall include but not limited to:
 - i. A description of the firm and its approval status
 - ii. A description of the UAS being developed

- iii. Timelines of the program
- iv. Scope of the program
- v. Requirements
- vi. Preliminary Technical details

b. Application to DGAQA shall be accompanied with a request for authorisation of the QA department of the Main contractor for QA coverage during the development.

21.B2.6. Demonstration of UAS Design Organisation Capability

Regulation

Main Contractor responsible for the design of the UAS shall hold a Design Organisation Approval (DOA) from CEMILAC based on the Design Approved Organisation Scheme (DAOS), or in the process of applying for such an approval .

Acceptable Means of Compliance

- a. Design Organisation Approval from CEMILAC. Compliance to SUBPART G1.
- b. The Main Contractor, shall apply to CEMILAC for DOA under the Design Approved Organization Scheme (DAOS)for the scope of design activities . Main Contractor shall comply to SUBPART G1.

Guidance Material

SUBPART G1

21.B2.7. Airworthiness Certification criteria / Special Conditions

Regulation

The Main Contractor shall ensure that the UAS is designed based on the approved Airworthiness criteria.

Acceptable Means of Compliance

- a. Airworthiness Criteria as per the services requirement shall be used.
- b. In cases where the design is not to the standards specified by the User Services or the User Services have not specified the standards, the same shall be arrived at in consultation with CEMILAC.
- c. Formal approval should be sought from CEMILAC for the use of alternative Standards

Guidance material

- a. Other Standards may be proposed. These need to be shown to deliver an acceptable level of safety and are consistent with the intent of the bench mark requirements.

- b. Equivalence evidence should be presented in a clear, traceable format and made available to CEMILAC for review, together with the underpinning compliance evidence documents.
- c. Version of Airworthiness Code to be clearly mentioned. The most recent version will be applied. Exceptionally, an earlier version may be acceptable for compatibility with the baseline design of the UAS. In these cases the Main Contractor shall demonstrate that this is the most appropriate approach and that any associated risks are managed appropriately.
- d. Airworthiness Codes sourced from various Standards may be used, provided it is shown to deliver an acceptable level of safety and are consistent with the intent of the programme.
- e. If Airworthiness codes are judged to be inadequate Special Conditions may be introduced and shown to meet the intent with the approval of CEMILAC.
- f. Special Conditions may also be introduced if the Airworthiness codes do not contain adequate or appropriate safety standards for the UAS or an element of its design, in any of the following circumstances, but not limited to them.
 - i. The UAS has or may have novel or unusual design features relative to the design practices on which the applicable Airworthiness codes are based.
 - ii. The UAS design usage assumptions do not match the intended military usage.
 - iii. Experience from other similar UAS in service or having similar design features, has shown that 'unsafe conditions' may develop.
 - iv. Suitable Airworthiness codes do not exist for the concerned UAS or specific design feature.

21.B2.8. UAS Requirement Specification

Regulation

The Main Contractor shall bring out the top level UAS Requirement Specification based on the User requirements.

Acceptable Means of Compliance

UAS Specification Document to be made by the Main Contractor and approved by CEMILAC.

The document shall take into account the User requirements and shall address the system level requirements and its dependency on the other systems

Guidance Material

- a. User Requirement document
- b. Main Contractor's preliminary investigations /studies defining the project.
- c. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the user requirements.

- d. The document shall pave way for defining the detailed individual System Technical Specification to facilitate design.
- e. Compliance to the UAS Specification shall also form the basis for the issuance of MTC.

21.B2.9. Type Certification Basis(TCB)

Regulation

Main contractor and CEMILAC shall have a mutually agreed Type Certification Basis. Compliance to TCB forms one of the basis for the issuance of MTC and RSD.

Acceptable Means of Compliance

TCB shall be prepared by Main contractor and approved by CEMILAC. This is also applicable to the amendments to the TCB, if any.

Guidance Material

- a. TCB shall be arrived at based on the applicable Airworthiness Certification Criteria, Special Conditions (21.B2.7) and UAS Requirement Specification (21.B2.8).
- b. Main contractor shall also specify the means of compliance to every requirement listed in the TCB.
- c. Wherever clarity on the means of compliance is not available, the objectives need to be specified. They are to be fulfilled during the demonstration of the basis with the proof of adhering to the equivalent level of safety.
- d. Main contractor may form committees with stake holders to look in to the adequacy of the proposed TCB.
- e. Compliance to TCB and mitigations that provide an equivalent level of safety, if any, forms one of the basis of issuance of MTC.

21.B2.10. Airworthiness Certification Plan (ACP)

Regulation

The Main Contractor shall Plan development activities and engagement of TAA during the development to achieve compliance to TCB.

Acceptable Means of Compliance:

Main contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stake holders. ACP shall be approved by CEMILAC.

Guidance Material

- a. The ACP can be developed step by step when the information needed is not available at the beginning of the project, the same shall be specified and needs to be agreed before demonstration of the compliance.
- b. ACP defines the development process and engagement of TAA during the development towards achieving compliance to TCB. The ACP identifies, when the compliance documents or evidence will be available and includes periodic progress reviews between the TAA, Main Contractor and other relevant organizations.
- c. ACP may consider the nature of the project like criticality & complexity, roles of all the stake holders, development ,Test &Evaluation process, maturity of the ASDO.

21.B2.11. Quality Assurance Plan

Regulation

The Main Contractor shall Plan Quality assurance activities and engagement of TAA during the design & development.

Acceptable Means of Compliance:

- a. Main contractor shall prepare a D&D Quality Assurance Plan (QAP) with the involvement of all stake holders. QAP shall be approved by DGAQA.
- b. The QAP shall clearly state the roles of the Quality Assurance Department of the Main Contractor and those that of DGAQA during the development.

Guidance Material

- a. The QAP can be developed step by step when the information needed is not available at the beginning of the project, the same shall be specified and needs to be agreed by DGAQA.
- b. QAP defines the Quality assurance activities and engagement of DGAQA, during the development. The QAP identifies stages of inspection, delegation details, handling of deviations & concessions, and includes periodic progress reviews between the DGAQA, Main Contractor and other relevant organizations.

21.B2.12. Identification

Each prototype UAS shall be uniquely identified with specific information of Manufacturer's name, Type No/Part No, and the Manufacturer's Serial Number.

Acceptable means of Compliance

UAS identification will be in accordance with Subpart Q.

Guidance material

All documentations specific to each prototype shall bear the identification details.

21.B2.13. Design & Development

Regulation

The main contractor shall have a design & development process that results in aircraft meeting the user requirements and the Type Certification Basis.

Acceptable Means of Compliance

- a. The design and development activities shall follow a System Engineering Life Cycle Process. A System Engineering Plan Document shall be prepared and the documents shall elaborate the design and development life cycle activities, responsibilities and milestones.
- b. The Main Contractor shall evolve inter alia System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP).
- c. Review Process:ASDO shall carry out inter alia Requirement Review, Design Reviews, Test Adequacy & Readiness Review, Compliance Reviews.
- d. ASDO shall prepare documents but not limited to Reviews, Design, Analysis and Simulation documents, Quality Assurance documents.
- e. Main contractor shall establish processes for Failure Reporting, Analysis and Corrective Action System (FRACAS) during design and development phase.
- f. Main contractor shall establish processes for configuration Management.(21.B1.13)
- g. The design shall be considered to be adequate for prototype realisation as marked by base lining the Drawings and Equipment Standard of Preparation (ESOP).
- h. Fabrication of Prototype development shall be carried out under a DGAQA approved Quality Assurance Process.

Guidance Materials

- a. The Design & Development plan shall be in accordance with 21.B2.7 to 21.B2.12 above.
- b. The Technical Specification is that which lays down the design and test requirements of a general nature. As the technical specification is made at the beginning of the project for each system, it may not fully describe the designer's intention. There may also arise a need to revise the Technical specification as the development progresses because of various reasons such as inability to implement the initial design concepts or changes in the user's requirement. Such inadequacies in the technical specification are overcome by issuing amendments to the technical specification through a well defined configuration control procedure. At the earliest opportunity, the original technical specification and all subsequent revisions are combined to correctly describe the product.

- c. In Project definition phase, main contractor shall identify the major systems/equipment that are intended to be used in the prototype keeping in view the user's qualitative and quantitative requirements and the technical specification for the UAS. Preliminary testing and analysis may be carried out for arriving at the sizing and aerodynamic configuration of the aircraft.
- d. In Preliminary Design, the design parameters are established for configuration, performance, flying qualities, stores management, weight and CG, compliance to users requirement, trade-off in the design etc. This also takes into consideration inputs from several tests such as wind tunnel tests for aerodynamic configuration and sizing. Mock up studies for cockpit management, ergonomics, vision requirements etc., are also carried out during this phase. Specifications for various equipment, sub-systems and systems that are to be used in the UAS are also finalised.
- e. In Detailed design, the detail design of all components, subsystems, systems including their process parameters are carried out during this phase. This phase is also concurrent with analysis carried out on the structural integrity and systems through FMECA, FTA, Hazard Analysis, risk analysis etc.
- f. PDRs and CDRs to be conducted. The Documentation for PDRs and CDRs to be made available to the stakeholders well in advance before the reviews. The PDR, CDR compliance reports to be completed.
- g. Mechanisms to control changes in configuration to be in place.
- h. LRU development shall be adequately mechanised through appropriate documentation covering design and testing to meet the UAS requirement specification.
- i. Ground Test Rigs and Ground testing for system validation shall be adequately supported with technical specifications, Test schedules and Test Reports, Certificate of Design in accordance with the requirements.
- j. Mechanism for SOP base lining to be established for Prototype realisation.

21.B2.14. Configuration Management

Regulation

Main Contractor shall establish and implement a means by which the configuration of the UAS is managed over the D&D life cycle.

Acceptable Means of Compliance

- a. Main contractor shall prepare a Configuration Management Plan (CMP) document.
- b. The main contractor shall ensure that the configuration items are identified, change is managed, configuration status is accounted for, and verification and audit of configuration changes are conducted as per CMP and this information is disseminated to all stakeholders.
- c. The main contractor shall have a configuration Management Process during the development.

Guidance Materials

- a. Change control and traceability of changes shall be maintained.
- b. Configuration Control Boards shall be constituted to address the changes proposed.
- c. Any change in requirements or incorporation of additional requirements shall be referred to CCBs.
- d. Changes resulting from Defect Investigation shall be referred to CCBs only when it calls for a requirement change or incorporation of additional requirements.
- e. There may be multiple levels of configuration control boards to address issues at different levels
- f. Configuration Control Board to be chaired by experts from respective domain.
- g. The Configuration Control Board consisting of the following members:
 - i. Rep CEMILAC
 - ii. Rep Main Contractor responsible for design and development
 - iii. Rep. Main Contractor responsible for Quality Assurance
 - iv. Rep. Main Contractor responsible for manufacturing
 - v. Rep DGAQA
- h. Configuration items are to uniquely identified and documented.
- i. An approved Engineering Change Note (ECN) for hardware Components and related documents and Software Change Note (SCN) for Software components, along with approved baseline configuration shall be treated as the revised baseline configuration.
- j. There shall at least two levels of CCBs. A Central Configuration Control Board (CCCB) shall address the changes in configuration which may affect multiple sub-systems or major performance enhancements. A Local Configuration Control Board (LCCB) shall address the changes in configuration which are confined to the Airborne Store/System.
- k. If found appropriate, CCBs at different levels also may be created.
- l. Configuration management plan shall clearly differentiate the role of CCBs in each program.
- m. Main Contractor to make a configuration management plan to full fill the objectives of configuration management through Configuration Control Board

21.B2.15. Test Equipment

Regulation

The Main Contractor shall ensure availability of test rigs / test equipment that are capable of performing the indented testing and evaluation during all the lifecycle phases of the UAS development program.

Acceptable Means of Compliance

- a. Realization of all the required test rigs / test equipment including TTGEs shall be carried out as per the regulations given in Subpart T.

- b. The main Contractor shall ensure availability of required test rigs / test equipment including TTGEs at the appropriate stages of design & development phase of UAS as outlines in the approved Airworthiness Certification Plan (ACP).
- c. The Main Contractor shall ensure that the Test rigs/ test equipment and TTGEs are approved by the appropriate authorities as given in Subpart T, wherever the requirement is for the approved test rigs / test equipment and TTGEs. The test rig software, if any shall be evaluated and approved as per the regulations given in Subpart C6.
- d. The Main Contractor shall ensure that the test rigs / test equipment and TTGEs have their calibration validity up to date, wherever applicable and these are also periodically maintained.

Guidance Material

Refer Subpart T and Subpart C6

21.B2.16. Test and Evaluation

Regulation

The Main Contractor shall ensure that the ground testing of the UAS is undertaken in such a manner that no feature or characteristics makes the UAS unsafe. TAA shall have right of access to any report, any inspection or to witness any test necessary.

Acceptable Means of Compliance

- a. Ground Testing and Evaluation for both the Air segment and the Ground segment of the UAS shall be in accordance with ACP.
- b. Test specification of the rigs to enable functional testing of the system with recording of data. The rig specification will be approved by CEMILAC. The Rig will be certified by DGAQA.
- c. Test plan document to be adequate and correct in accordance with the system specifications/functionality along with pass-fail criteria. The test plan document shall be approved by CEMILAC

Guidance Material

- a. The test equipment and all measuring equipment used for tests are adequate for the test and are appropriately calibrated. This shall be approved DGAQA.
- b. Configuration control items for test to be managed.
- c. Test report to be in accordance with the test plan and to record the configuration of the test item tested. The test report will be coordinated by DGAQA.

21.B2.17. Prototype Realisation

Regulation

The Main Contractor shall realize the prototype based on the base-lined and approved Standard of Preparation (SOP) by CEMILAC.

Acceptable Means of Compliance

- a. Prototype Realisation shall be in accordance with QAP(21.B2.11)
- b. The Main contractor shall ensure with the involvement of TAA that no feature or characteristics of the SOP for prototype realization is untested or unsafe.
- c. The Jigs and Fixtures required for prototype realization shall be approved by DGAQA following the QAP.

Guidance Material

- a. Drawing Applicability List (DAL) and (Equipment Standard of Preparation) may be finalized based on the baseline version and the subsequent amendments to it during the development.
- b. Main Contractor shall have mechanisms in place to ensure Configuration control of the approved items during prototype realization.
- c. If the Main Contractor desires to salvage deviations to approved drawings, the deviations shall be put up to DGAQA with technical details, that such a deviation shall not affect safety. The disposition by DGAQA shall be final. If required DGAQA may refer such deviations to CEMILAC for disposition. In such cases the disposition by CEMILAC shall be treated as final.

21.B2.18. Flight tests

Regulation

UAS shall be flight tested for validation of user requirements and compliance to type certification basis.

Acceptable means of compliance

- a. Emphasis shall be given to validate the maximum possible user requirements at dynamic rigs, simulators, test beds etc.
- b. Flight testing of an Air system shall be conducted in progressive manner giving due diligence to flight safety.
- c. Flight test points shall be evolved by the flight testing department of the main contractor or user services mapping to user requirements for compliance to TCB.

d. Flight testing shall be followed as per Subpart P

Guidance Material

NIL

21.B2.19. Compliance with Type Certification Basis (TCB) with available user requirements

Regulation

UAS shall be comply to the TCB to meet user requirements.

Acceptable means of compliance

- a. TCB shall be complied either through rig test/simulation/flight test.
- b. Main contractor shall present the compliance of TCB to CEMILAC for issuance of RMTC or MTC.

Guidance material

NIL

21.B2.20. Issue of Restricted Military Type Certificate (RMTC)/IOC

Regulation

UAS shall be issued with RMTC/IOC by CEMILAC to main contractor after compliance to TCB, meeting minimum operational requirements acceptable to users without affecting safety.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB, meeting minimum operational requirements acceptable to users without affecting safety.
- b. Build standard shall be submitted by main contractor to CEMILAC along with compliance to TCB for approval.
- c. Air system limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of RMTC/IOC.
- d. CEMILAC on satisfying with TCB and type certification data sheet shall issue RMTC/IOC of Air system stating limitations thereof to the main contractor.
- e. Prior to issue of RMTC/IOC main contractor or the identified production agency shall obtain production organization approval from DGAQA.

Guidance material

NIL

21.B2.21. Issue of Military Type Certificate (MTC)/ FOC

Regulation

UAS shall be issued with MTC/FOC by CEMILAC to main contractor after compliance to TCB meeting user requirements.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB meeting user requirements without affecting safety.
- b. Build standard shall be submitted by main contractor to CEMILAC along with compliance to TCB for approval.
- c. Air system limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of MTC/FOC.
- d. CEMILAC on satisfying with TCB and type certification data sheet shall issue MTC/FOC of Air system stating limitations thereof to the main contractor.
- e. Prior to issue of RMTC/IOC main contractor or the identified production agency shall obtain production organization approval from DGAQA.

Guidance Material

NIL

21.B2.22. Issue of Release to Service Document (RSD) along with manuals

Regulation

UAS shall be issued with RSD by CEMILAC along with manuals released by main contractor to user services after compliance to TCB meeting user requirements.

Acceptable means of compliance

- a. Main contractor shall submit to CEMILAC compliance to TCB meeting user requirements.
- b. Air system limitation as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by main contractor along with type certification data sheet for issuance of RSD to user services.
- c. CEMILAC on satisfying with TCB and type certification data sheet shall issue RSD of Air system stating limitations thereof to the user services.
- d. Manuals shall be classified into flight publication and technical publication.
- e. Flight publication shall be prepared by main contractor in consultation with design team & flight testing agency and submitted to CEMILAC for approval. Same shall be released to all the stake holders after CEMILAC approval.

- f. Technical publication shall be prepared by the main contractor in consultation with design team and reviewed by maintenance department of user services. Technical publication shall be released by the main contractor to user services.
- g. CEMILAC shall not approve the technical publication.

Guidance Material

NIL

21.B2.23. Production

Regulation

The MTC holder shall carry out production under the DGAQA approved quality management process.

Acceptable Means of Compliance

The MTC Holder shall have production organization approval from DGAQA before taking up production of the type certified aircraft as per IMTAR 21 Subpart F

Guidance Material

- a. MTC is a design-cum-production certificate. Hence MTC holder can take up production of aircraft after obtaining production organization approval.
- b. In case the MTC Holder wants to take up production through production partner, then the MTC holder may enter licensed agreement.

21.B2.24. Changes to Type Certificate for an Air System

Regulation

Any changes to Military Type Certificate, including Restricted MTC, shall be carried out with the approval of the Technical Airworthiness Authorities (TAA).

Acceptable Means of Compliance

Any changes to the design of the UAS which results in changes to Type Certification Data Sheet (TCDS) shall be carried out as per IMTAR 21 Subpart D

Guidance Material

Changes may be required in the design to due to production requirements, new user requirements, improvements in design, address limitation. Such changes may be put up through the Local Modification Committee.

21.B2.25. Responsibilities of the MTC Holder

Regulation

The Military Type Certificate holder for the UAS shall adhere to all the clauses mentioned in MTC to maintain the type certification status of the UAS.

Acceptable Means of Compliance

- a. The MTC holder shall adhere to all the clauses of the MTC including conditions & limitations mentioned in type certificate.
- b. Any changes required in the UAS at any stage shall be carried out only after the approval of CEMILAC.
- c. MTC can be withdrawn if the conditions & limitations mentioned in it are not followed.
- d. The MTC holder shall resolve all the design related issues of the UAS in service to the satisfaction of the user services.

Guidance Material

- a. Any deviation / deficiency / abnormality faced at any stage during production or regular service use of the UAS should be intimated to all the relevant stakeholders and properly investigated.
- b. Quality control requirements at production stage shall be followed as laid down by DGAQA.

21.B2.26. Transferability

Regulation

The transfer of Military Type Certificate, including RMTC, shall be made only to an organization having requisite infrastructure(ASDOA) as of the main contractor within the Indian Defence Air Environment and who is able to fulfil the responsibilities of MTC holde.

Acceptable Means of Compliance

- a. An MTC or RMTC may not be transferred to an export customer even when the Air System has been withdrawn from Indian service. The TAA issued MTC or RMTC assumes usage within the confines of the main contractor Regulatory Publications.
- b. The Type Approval Holder can only transfer the TC with the approval of CEMILAC.

Guidance Material

The following is not considered transfer:

- a. The TA holder changing its name
- b. Changes to the Registered Address or Relocating their facility (ie Works).

- c. The acquisition of the TA holder by another company if the acquired company (i.e. TA Holder) continues to exist as the same legal entity to which the TA was issued, provided
 - i. The acquired company (TA Holder) continues to retain possession of the Design documents, Type Records and the responsibilities under the original TA
 - ii. The acquired company retains the same quality system.

Case -1 : Change of Registered Address or Relocating of Facility (Works):

In case of change of Registered Address, the firm should submit the details along with revised Certification of incorporation obtained from Registrar of Companies. The MTC/RMTC certificate will be amended and re-issued.

In case of relocating of the facility (Works), MTC holder has to submit the details of relocation along with information whether this change would call for any change in the SOP. In case of changes to the SOP, the concerned RCMA may visit the new facility and suggest to carry out any additional testing on the items produced in the new facility. Based on the evaluation, CEMILAC may issue Military Type Certificate.

Case -2 : Change of Type Approval (TA) Holder name

In case of Change of name, the TA holder may submit an affidavit on a notarized non-judicial stamp paper of minimum value to the CEMILAC. Along with the affidavit, the Certificate of Incorporate from RoC with the new name shall be submitted.

Case -3 : Acquisition of MTC holder by another holding company without change to legal status

Since the name of the company nor its legal status has change, the acquisition of the MTC holder needs to confirm to CEMILAC that

- a. The acquired company retains possession of the Type Records and the responsibilities under the original MTC
- b. The acquired company retains the same quality system

The information is only for retention by CEMILAC and no amendment to MTC is issued.

Transferability of Type Certificate

Other than the three cases given above, MTC is non-transferable. The following are the reasons for this clause:

- a. To prevent the sale and purchase of Type Certificates. A Type Certificate is not an asset owned by the MTC Holder. It is an authorization issued by CEMILAC that the MTC Holder is the D&D agency of the store (Based on the CoD) and it allows the MTC Holder to produce the store.

- b. Military Type Certification is the culmination of various rigorous, D&D, Testing and Certification activities. When a company acquires the MTC holding company, (either through purchase of asset or stock) it CEMILAC is not cognizant of the extent of transfer of knowledge/responsibility.
- c. Under the above conditions, the following are the options
- d. Aprior to or within 30 days of the acquisition/merger process, the MTC holder and acquiring company together can provide a joint affidavit on MTC transfer. On satisfactory details, CEMILAC will amend the same MTC with new MTC Holder name.
- e. If the above is not done, the MTC is automatically cancelled. The acquirer/new company needs to reapply for TC.

21.B2.27. Duration and Continued Validity

Regulation

RMTC subject to any constraints, shall remain valid for a period not exceeding 3 years; a MTC shall remain valid for a period not exceeding 7 Years; and RSD without limit, provided the document has not been suspended or revoked by CEMILAC.

Acceptable Means of Compliance

- a. CEMILAC shall include the duration of validity at the time of issue of the MTC and RSD.
- b. CEMILAC shall suspend or revoke a Type Certificate/RSD if the MTC holder has not met the responsibility as given in 21.B2.25 and 21.B2.29 or if the aircrafts in service have not been able to meet the safety and operational requirements.

Guidance Material

- a. CEMILAC may consider suspending or revoking a TC when the TC holder or the licensed manufactured no not meet the obligations during the continued airworthiness activities of the aircraft.
- b. CEMILAC may obtain from services the safety record of the aircraft at regular intervals. If, the Operating user services and the TAA find it necessary, CEMILAC may revoke or suspend a RSD.

21.B2.28. Record Keeping

Regulation

The main contractor shall ensure that all relevant design information inter-alia documents, drawings, QA records, test procedures, reports, for the identified Air System are held by the appropriate ASDO.

Acceptable Means of Compliance

The ASDO shall have a Record Keeping Plan Document. The record keeping shall be for a period not less than 5 years after the decommission of the aircraft from services.

Guidance Material

The document shall identify all the records that needs to be archived and details like the mode of archival, the periodicity of accounting audit.

21.B2.29. Instructions for Sustaining Type Airworthiness and RSD

Regulation

The TC Holder shall update the documents necessary for sustaining the TCDS and the RSD.

Acceptable Means of Compliance

- a. The TC holder shall update the TCDS and disseminate the information to TAA, Users and the other relevant stakeholders
- b. The TC holder shall update the RSD and disseminate the information to users, TAA and other relevant stakeholders

Guidance Material

Changes may be required in the TCDS to due to meeting production requirements, new user requirements, improvements in design, obsolescence etc. Such changes shall be planned and dissemination of the same shall be stakeholders by the Main Contractor after obtaining the necessary approval from TAA.

Changes may be required continued and continuing airworthiness like issue of service bulletins, UON needs to be forwarded to all the stake holders.

Annex B2 : UAS Categorization Process

1.0 Introduction :

The categorization of an UAS is an important step in the development, operation and management of the system which will define its regulatory regime. The categorization system permits a proportional regulatory regime across the entire spectrum of UAS. The Maximum Take Off Weight (MTOW) is used as the initial determinant of UAS categorization. While MTOW is used as the basis for the categorisation, the intended use, the impact energy due to a unpremeditated descent scenario or a loss of control scenario, the range for adequate visuals, the speeds for quick control for avoidance and the altitude for potential interference with other air users are also considered as significant factors in understanding the 2nd and 3rd party hazard that it poses. MTOW will not be considered the sole determinant of the final categorization of an UAS but must also be considered alongside the aggravating and mitigating factors of its operation and characteristics.

2.0 Aggravating and Mitigating factors :

Mitigating factors	Aggravating factors
Visual line of sight range of operation	Beyond Visual line of sight
Lower Altitude operation	Higher altitude operation- possible conflict of air space users
Lower speeds of operation	Higher speeds – affecting quick response to avoid potential collision
Lower levels of autonomy	Higher autonomy – affecting manual take over

3.0 UAS Categorisation :

Based on the MTOW, UAVs are classified as follows,

Micro	Less than 1 Kilogram
Mini	Between 1 Kilogram to 10 Kilogram
Light	Between 10 Kilogram to 100 Kilogram
Heavy	Greater than 100 Kilogram

4.0 Category of UAS and its Certification mandate :

UASs that come under the purview of certification are listed.

S.No	UAS Categorisation	Regulatory Mandate
1	Micro & Mini UAVs	Certification is NOT MANDATORY
2	Light UAVs	Certification NOT MANDATORY, if all the following conditions are met i) The Operating speed at full power in level flight is less than 130 Kmph IAS ii) Impact, Kinetic Energy is less than 95 KJ in both unpremeditated descent scenario and loss of control scenario iii) Range of Operation is within 500 meters of UAV pilot iv) Flown at altitudes not exceeding 122 meters (400 feet) AGL If any of the above conditions are violated, then Certification is MANDATORY.
3	Heavy UAVs	Certification is MANDATORY

Note :

Unpremeditated Descent Scenario :

A Failure (or a combination of failures) occurs which results in the inability to maintain a safe altitude above the surface.

Loss of Control Scenario:

A failure (or a combination of failures) which results in loss of control and may lead to impact at high velocity.

Impact Kinetic Energy Calculation:

The Kinetic Energy of the UAV upon impact can inflict third party damages. The calculation of the impact kinetic energy for fixed wing UAVs and Rotary wing UAVs for the unpremeditated descent scenario and the loss of control scenario are as follows.

The Kinetic Energy is given as follows,

$$KE = \frac{1}{2} mV^2 \quad \text{Joules}$$

Where m = All Up Weight in Kilograms;

V = Velocity in meter/sec

i) In an unpremeditated descent scenario,

For fixed wing UAVs: $V = 1.3 \times \text{stalling speed (landing configuration) in meters/sec}$

For rotary wing UAVs: $V = \text{scalar value of the auto rotation velocity vector}$

ii) In a loss of control scenario,

For fixed wing UAVs: $V = 1.4 \times V_{mo}$, Where V_{mo} = Maximum operating speed

For rotary wing UAVs: $V = \text{terminal velocity with rotors stationary}$

Table B2.1 : Proportionate Regulatory Regime of UAS

IMTAR Category	Micro UAS	Mini UAS	Light UAS (if Section 4, SI 2 is violated)	Heavy UAS
Registration on the Indian Military Aircraft Register	No	No	Yes	Yes
MTOW	1 Kg	10 Kg	Less than 100 Kg	Greater than 100 Kg
Categorisation Required	Yes	Yes	Yes	Yes

Altitude of Operation	NA	NA	Greater than 122 m	Greater than 122 m
Speed of operation	NA	NA	Greater than 130kmph	Greater than 130kmph
Range of operation	NA	NA	Greater than 500 m	Greater than 500 m
Trained and Authorised personnel for operations	No	No	Yes	Yes
FCN	No	No	Yes	Yes
MTC & Release to Service	No	No	Yes	Yes
Certificate of Usage	No	No	Yes	Yes
Occurrence Reporting	No	No	Yes	Yes

SUBPART – B3: AB-INITIO DEVELOPMENT OF AIR LAUNCHED MISSILES (ALMs)

Rationale

A systematic design & development process and an independent certification process is required to ensure that a newly developed Air Launched Missile (ALM) meets its Type Design and safety requirements. The award of a Military Type Certificate (MTC) testifies that the given ALM has demonstrated its capability and has met all the Type Design & safety requirements.

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- 21.B3.1. Applicability**
- 21.B3.2. User Requirements**
- 21.B3.3. Feasibility Study**
- 21.B3.4. Certification of ALM for Indian Military Applications**
- 21.B3.5. Application for Airworthiness Certification of ALM**
- 21.B3.6. Demonstration of Air System Design Organisation (ASDO) Capability**
- 21.B3.7. Airworthiness Certification Criteria/Special Conditions**
- 21.B3.8. ALM Requirement Specifications**
- 21.B3.9. Type Certification Basis (TCB)**
- 21.B3.10. Airworthiness Certification Plan (ACP)**
- 21.B3.11. Quality Assurance Plan (QAP)**
- 21.B3.12. Identification**
- 21.B3.13. Design & Development**
- 21.B3.14. Configuration Management**
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- 21.B3.18. Flight Tests**
- 21.B3.19. Compliance with Type Certification Basis**
- 21.B3.20. Application for RMTC/MTC along with Type Certification Data Sheet (TCDS)**
- 21.B3.21. Issue of Restricted Military Type Certificate(RMTC)/ IOC**
- 21.B3.22. Issue of Military Type Certificate (MTC)/FOC**
- 21.B3.23. Issue of Release to Service Documents (RSD) along with Manuals**
- 21.B3.24. Production**
- 21.B3.25. Changes Requiring SMTC / AMTC / New Type Certificate**
- 21.B3.26. Responsibilities of MTC Holder**
- 21.B3.27. Transferability**
- 21.B3.28. Duration and Continued Validity**
- 21.B3.29. Record Keeping**
- 21.B3.30. Instructions for Sustaining Type Airworthiness**

Regulatory Articles (RA):

21.B3.1. Applicability

Regulation

The regulations contained in this subpart are applicable to ab-initio development of air launched missiles by an Indian agency for Indian military applications.

Acceptable Means of Compliance

The regulations as per this Subpart B3 have to be complied with for the issuance of RMTC / MTC for the ab-initio developed ALM.

Guidance Material

- a. These regulations are not applicable to air armaments other than ALMs. The air armaments are covered at Airborne Stores level as per the regulations given in **Subpart C**.
- b. These regulations are not applicable for ALM developed by Foreign Agency.

21.B3.2. User Requirements

Regulation

The proposed ALM development program shall have specific requirements for Indian military applications.

Acceptable Means of Compliance

- a. Services qualitative requirements such as GSQR/ASR/NSQR/ISQR/JSQR released by Indian Military Services.
- b. Specific requirements finalized by the Main Contractor for Indian Military applications
- c. Concepts of operation (CONOPS) document provided by the user enumerating the intended usage of the ALM.

Guidance Material

- a. The initial user requirements may be provided to the Main Contractor for the feasibility study.

- b. Based on the feasibility study and along with additional related inputs, the User Services may release GSQR/ASR/NSQR/ISQR/JSQR for a particular ALM.
- c. Main Contractor may take inputs from the User Services for finalising specific requirements of an ALM

21.B3.3. Feasibility study

Regulation

Feasibility study shall be carried out by the main contractor for ab-initio design & development of ALM for Indian military applications.

Acceptable Means of Compliance

Feasibility report bringing out available alternatives, proposed configuration, published literature in support, areas of concern, mitigation measures etc.

Guidance Material

- a. The feasibility study should bring out the state of art and/or development of new technology, if any.
- b. The feasibility study should be the basis for designer to start the design.
- c. Based on feasibility studies, formal finalization of user requirements can take place.

21.B3.4. Certification of ALM for Indian Military Applications

Regulation

Ab-initio designed and developed ALM by an Indian Agency shall be Military Type Certified.

Acceptable Means of Compliance

- a. Airworthiness certification of ab-initio designed and developed ALM shall be carried out with the involvement of TAA leading to an issue of MTC by CEMILAC.
- b. Certification shall follow the regulations 21.B3.5 to 21.B3.30.

Guidance Material

- a. The system level requirements for ALMs designed and developed for the Indian Military Airborne platforms will follow from the requirements of main Air System Platform.

- b. The approach to development and certification, leading to MTC and the continued Airworthiness throughout its life should be set out in beginning of Military Certification Process (MCP) in accordance with the certification criteria adopted. In general the process has the following 6 phases:

Phase 1 – Identify the requirement for, and obtain, organizational approvals.

Phase 2 – Establish and agree the Type Certification Basis (TCB).

Phase 3 – Concurrence of CEMILAC to the ACP.

Phase 4 – Demonstrate compliance with the TCB.

Phase 5 – CEMILAC Review of Certification Evidences and issue of RMTC/MTC.

Phase 6 – Post Certification Activities.

21.B3.5. Application for Airworthiness Certification of ALM

Regulation

Main contractor shall apply to TAA for the Airworthiness certification of an ALM.

Acceptable Means of Compliance

- a. Main contractor shall apply to CEMILAC for airworthiness certification coverage.
- b. Main contractor shall apply to DGAQA for quality assurance coverage.

Guidance Material

- a. The design agency shall inform the TAA during the initial stages of the project even prior to formal project sanction so as to enable capture of the certification requirements from project conceptualisation stage itself.
- b. The representatives of TAA typically work along with the members of a project team, project managers, MOD executives, and User Services. As the input from TAA and certification requirement and test facility requirements can directly impact the cost and time duration of the project involvement of TAA in the early conceptual stage of the project is beneficial.
- c. The application may include but not limited to:
 - i. A description of the firm and its organizational approval status
 - ii. A description of the ALM being developed

- iii. Timelines of the program
- iv. Scope of the program
- v. Preliminary Technical details

d. Application to DGAQA shall be accompanied with a request for authorisation of the QA department of the Main contractor for QA coverage during the design & development phase.

21.B3.6. Demonstration of Air System Design Organisation (ASDO) Capability

Regulation

Main Contractor or the organization responsible for the design & development of the ALM shall demonstrate its capability by holding an appropriate Airsystem Design Organization (DOA) Approval, or shall be in the process of applying for such an approval.

Acceptable Means of Compliance

- a. Design Organisation Approval from CEMILAC in compliance with **SUBPART G1**.
- b. In case the organisation is in the process of obtaining the approvals from CEMILAC, the evidence in this regard needs to be submitted to CEMILAC

Guidance Material

Refer **Subpart G1**

21.B3.7. Airworthiness Certification Criteria/ Special Conditions

Regulation

The Main Contractor shall ensure that the ALM is designed & developed based on the approved airworthiness certification criteria and the special conditions identified & agreed, if any.

Acceptable Means of Compliance

- a. Applicable codes / standards as per the approved Airworthiness Certification Criteria finalised based on the user services requirements shall be used.
- b. In cases where the design is not to the standards specified by the User Services or the User Services have not specified the standards, the same shall be arrived at in consultation with CEMILAC.

- c. Formal approval shall be sought from CEMILAC for the use of alternative standards

Guidance Material

- a. Alternative standards may be proposed by the main contractor. However, these need to be shown to deliver an acceptable level of safety and are consistent with the intent of the benchmark requirements.
- b. Equivalence evidence should be presented in a clear, traceable format and made available to CEMILAC for review, together with the underpinning compliance evidence documents.
- c. Version of airworthiness codes shall be clearly mentioned. The most recent version will be applied. Exceptionally, an earlier version may be acceptable for compatibility with the baseline design of the ALM. In these cases, the Main Contractor shall demonstrate that this is the most appropriate approach and that any associated risks are managed appropriately.
- d. Airworthiness Codes sourced from various Standards may be used, provided it is shown to deliver an acceptable level of safety and are consistent with the intent of the programme.
- e. If Airworthiness codes are judged to be inadequate Special Conditions may be introduced and shown to meet the intent with the approval of CEMILAC.
- f. Special Conditions may also be introduced if the Airworthiness codes do not contain adequate or appropriate safety standards for the ALM or an element of its design, in any of the following circumstances, but not limited to : -
 - i. The ALM has or may have novel or unusual design features relative to the design practices on which the applicable Airworthiness codes are based.
 - ii. The ALM design usage assumptions do not match the intended military usage.
 - iii. Experience from other similar ALM in service or having similar design features, has shown that 'unsafe conditions' may develop.
 - iv. Suitable airworthiness codes do not exist for the concerned ALM or specific design feature proposed.

21.B3.8. ALM Requirement Specifications

Regulation

The Main Contractor shall bring out the top level ALM Requirement Specifications document based on the user requirements.

Acceptable Means of Compliance

- a. ALM Requirement Specifications document shall be prepared by the Main Contractor and approved by CEMILAC.
- b. The document shall take into account the user requirements and shall address the system level requirements and its dependency on the other systems

Guidance Material

- a. Service qualitative requirements from user services
- b. Main Contractor's preliminary investigations /studies defining the project.
- c. The document may specify proposed systems/ subsystems and details of architecture and also top level specifications and interfaces to meet the user requirements.
- d. The document shall pave way for defining the detailed individual Subsystem Technical Specifications to facilitate design.

21.B3.9. Type Certification Basis (TCB)

Regulation

Main contractor and CEMILAC shall identify a mutually agreed Type Certification Basis. Compliance to TCB shall form one of the basis for the issuance of MTC and RSD.

Acceptable Means of Compliance

- a. TCB shall be prepared by Main contractor and approved by CEMILAC. This is also applicable for the amendments to the TCB, if any.
- b. TCB shall be effective for a period of 5 years from the date of MTC application. If MTC is not achieved within that timeframe, a review of the changes to the Airworthiness criteria / codes / standards that defined the TCB will be required to assess any shortfall of agreed TCB against contemporary requirements.

Guidance Material

- a. TCB shall be arrived at based on the applicable Airworthiness Certification Criteria / Special Conditions (21.B3.7) and ALM Requirement Specifications (21.B3.8).
- b. Main contractor shall also specify the means of compliance to every requirement listed in the TCB.
- c. Wherever clarity on the means of compliance is not available, the objectives need to be specified. These are to be fulfilled during the compliance demonstration of the basis with the proof of adhering to the equivalent level of safety.
- d. Main contractor may form committees with various stakeholders to look into the adequacy of the proposed TCB.
- e. Compliance to TCB and mitigations that provide an equivalent level of safety, if any, forms one of the basis of issuance of MTC and RSD.

21.B3.10. Airworthiness Certification Plan (ACP)

Regulation

The Main Contractor shall plan all the activities and engagement of TAA throughout the design and development phase of ALM development to achieve compliance to TCB.

Acceptable Means of Compliance

The Main contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stake holders. This ACP shall be approved by CEMILAC.

Guidance Material

- a. The ACP can be developed step by step when the information needed is not available at the beginning of the project. However, it shall be ensured that the finalized ACP is available before demonstration of the compliance.
- b. ACP defines the design & development process and engagement of TAA during this phase towards achieving compliance to TCB. The ACP identifies, when the compliance documents or evidence will be available and includes periodic progress reviews between the TAA, Main Contractor and other relevant organizations.
- c. ACP may consider the nature of the project like criticality & complexity, roles of all the stakeholders, development, Test & Evaluation process, maturity level of the ASDO etc.,

- d. ACP shall contain the sequence of activities during ab-initio design & development broadly encompassing the details given in **Annex 21.B3.A.**

21.B3.11. Quality Assurance Plan (QAP)

Regulation

The Main Contractor shall plan quality assurance activities and engagement of TAA during the design & development phase.

Acceptable Means of Compliance

- a. Main contractor shall prepare a D&D Quality Assurance Plan (QAP) with the involvement of all stake holders. QAP shall be approved by DGAQA.
- b. The QAP shall clearly bring out the roles of the Quality Assurance Department of the Main Contractor and that of DGAQA during the design & development phase.
- c. The extent of authorisation of the QA department of the Main contractor for QA coverage during the design & development phase shall also be brought out in QAP.

Guidance Material

- a. The QAP can be developed step by step when the information needed is not available at the beginning of the project. However, the same shall be specified and need to be agreed to by DGAQA.
- b. QAP defines the Quality assurance activities and engagement of DGAQA during the design & development. The QAP identifies stages of inspection, witnessing of qualification tests, delegation details, handling of deviations & concessions, and includes periodic progress reviews between the DGAQA, Main Contractor and other relevant organizations.
- c. QA department of the Main Contractor will be responsible for veracity of the information supplied by it to the representatives of DGAQA.
- d. The responsibility of the Main Contractor also includes the subcontracted portion of work, if any. Such sub-contracting arrangements are to be duly communicated to DGAQA well in advance.

21.B3.12. Identification

Regulation

Each ALM type shall be uniquely identified with specific information of Manufacturer's name, Type No/Part No, and the individual units of a type shall be identified by Manufacturer's Serial Number along with Manufacturer's name, Type No/Part No.

Acceptable Means of Compliance

ALM identification shall be in accordance with the regulations given in Subpart Q.

Guidance Material

All documentations specific to each ALM type shall bear the identification details.

21.B3.13. Design & Development

Regulation

The main contractor shall have a design & development process that results in ALM meeting the user requirements and the Type Certification Basis.

Acceptable Means of Compliance

Successful completion of all the activities / documents listed below shall together form the acceptable means of compliance to the regulation on design & development of ALM: -

System Engineering Life Cycle Process:

- a. The design and development activities shall follow a System Engineering Life Cycle Process. A System Engineering Plan Document shall be prepared and the document shall elaborate the design and development life cycle activities, responsibilities and milestones.

Planning:

- b. The Main Contractor shall evolve inter alia System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP) etc.,

ENTEST Specifications:

- c. Environmental extremities at ALM level shall be formulated based on the system studies simulations, platform characteristics and deployment scenario commonly referred as ENTEST Specifications. All elements of the ALM shall be designed to meet these

specifications. Emphasis shall be given to kinetic heating effects on the ALM for the full flight envelope.

Criticality Classification:

- d. Preliminary design studies of various domains such as system studies, aerodynamics, structure, propulsion system, warhead, etc, shall be carried out leading to finalisation of preliminary configuration of ALM. For the finalised configuration, System Safety Assessment shall be carried out at ALM level to identify the criticality levels of various subsystems and LRUs based upon their functional importance. The criticality levels shall be Safety Critical, Mission Critical and Non-Critical. A Criticality Classification Document containing the criticality level details of all the subsystems / LRUs shall be prepared by the Main Contractor and approved by CEMILAC.

QA Coverage:

- e. The design & development of subsystems/LRUs of ALM shall be progressed as per the regulations for airborne stores given in **Subpart C** with the following specific provisions pertaining to quality assurance coverage by DGAQA: -
 - i. The quality assurance coverage for safety-critical subsystems/LRUs of ALM shall be the responsibility of DGAQA.
 - ii. For the remaining subsystems/LRUs of ALM, the coverage for quality assurance aspects shall be the responsibility of the internal quality assurance group of the main contractor duly authorized by DGAQA.
- f. The quality assurance coverage at the level of fully assembled ALMs during the design & development phase shall be the responsibility of DGAQA.

Review Process:

- g. The Main Contractor shall carry out reviews inter alia Requirement Review, Design Reviews, Test Adequacy & Readiness Review, Flight Readiness Review, Flight Safety Board, Post Flight Analysis, Compliance Reviews etc. at appropriate stages.
- h. The Main Contractor shall prepare documents related to Reviews, Design, Analysis and Simulation, Quality Assurance etc.,

FRACAS:

- i. The Main contractor shall establish processes for Failure Reporting, Analysis and Corrective Action System (FRACAS) during design and development phase.

Configuration Management:

- j. The Main contractor shall establish processes for Configuration Management (21.B3.14).

ALM Domain Certification:

- k. Since an ALM is a complex system involving multiple inter-disciplinary fields viz. Aerodynamics & Structure, Material, Avionics & software, explosive, electro-mechanical, electro-chemical, the airworthiness and certification requirement for each domain will differ based on the nature, functions, etc. Domain certification activities for each domain of ALM shall be carried out to meet the system requirements stipulated by systems group of the Main Contractor.

Hardware Realization:

- l. The design shall be considered to be adequate for prototype realisation as marked by baselining of the Drawings and Equipment Standard of Preparation (ESOP).
- m. Fabrication of ALM Prototype i.e. Hardware realization shall be initiated after comprehensive design reviews and shall be carried out under a DGAQA approved Quality Assurance Plan.
- n. Applicable ALM level and subsystem / LRU level documents shall be available prior to start of hardware realization. These shall be prepared by the main contractor and approved by CEMILAC. Subsystem / LRU level applicable documents shall be as per the **Subpart C**. At ALM level, the applicable documents shall include Drawing Applicability List (DAL), MDI, Integration (Mechanical & Electrical) and Bill of Materials (BOM).

Software Realization:

- o. Software development and certification for all the software elements of ALM shall be carried out as the applicable regulations given in **Subpart C6**.

Guidance Material

- a. The Design & Development plan encompasses various aspects related to regulations 21.B3.7 to 21.B2.12 above.
- b. In Project definition phase, main contractor shall identify the major systems/LRUs that are intended to be used in the prototype keeping in view the users' requirements and the ALM Requirement Specification. Preliminary testing and analysis may be carried out for arriving at the sizing and aerodynamic configuration of the ALM.
- c. In Preliminary Design, the design parameters are established for configuration, performance, warhead, weight and CG, compliance to users' requirement, trade-off in

the design etc. This also takes into consideration inputs from several tests such as wind tunnel tests for aerodynamic configuration and sizing. Specifications for various sub-systems and LRUs that are to be used in the ALM are also finalised.

- d. An expert committee can be formed to formulate the ALM level environmental extremities in the form of ENTEST Specifications. The experience of ENTEST philosophy for earlier indigenous ALM development programs can be factored into this exercise.
- e. In Detailed design, the detail design of all components, LRUs, subsystems including their process parameters is carried out. This phase is also concurrent with analysis carried out on the structural integrity and systems through FMECA, FTA, Hazard Analysis, risk analysis etc. For the detailed list of analyses to be included in the design document, refer **Annex 21.B3.B.**
- f. PDRs and CDRs to be conducted. The Documentation for PDRs and CDRs to be made available to the stakeholders well in advance before the reviews. The PDR, CDR compliance reports to be completed.
- g. The detailed guidelines on design and development of ALMs w.r.t. domain certification are given in **Annex 21.B3.C.**
- h. Ground Test Rigs and ground testing for subsystem validation shall be adequately supported with Technical specifications, Test schedules and Test Reports, Certificate of Design in accordance with the requirements.
- i. Mechanism for SOP baselining to be established for Prototype realisation.
- j. In case of any dispute between the Main Contractor and CEMILAC on criticality classification, the decision of CEMILAC shall be considered final.

21.B3.14. Configuration Management

Regulation

Main Contractor shall establish and implement a means by which the configuration of the ALM is managed throughout all the lifecycle phases.

Acceptable Means of Compliance

- a. Main contractor shall prepare a Configuration Management Plan (CMP) document.
- b. The main contractor shall ensure that the configuration items are identified, change is managed, configuration status is accounted for, and verification and audit of configuration changes are conducted as per CMP and this information is disseminated to all stakeholders.

- c. The main contractor shall have a configuration Management Process during the development.
- d. Configuration Control Boards (CCBs) shall address the changes in the configuration.

Guidance Material

- a. Change control and traceability of changes shall be maintained.
- b. Any change in requirements or incorporation of additional requirements shall be referred to CCBs.
- c. Changes resulting from Defect Investigations shall be referred to CCBs only when it calls for a requirement change or incorporation of additional requirements.
- d. There may be multiple levels of configuration control boards to address issues at different levels
- e. Configuration Control Boards to be chaired by experts from respective domains.
- f. The Configuration Control Board consisting of a domain expert as the chairman and the following members may be constituted:
 - i. Rep, CEMILAC
 - ii. Rep Main Contractor responsible for design and development
 - iii. Rep. Main Contractor responsible for Quality Assurance
 - iv. Rep. Main Contractor responsible for Manufacturing
 - v. Rep DGAQA
- g. Configuration items are to be uniquely identified and documented.
- h. An approved Engineering Change Note (ECN) for hardware Components and related documents and Software Change Note (SCN) for Software components, along with approved baseline configuration shall be treated as the revised baseline configuration.
- i. There shall at least two levels of CCBs. A Central Configuration Control Board (CCCB) to address the changes in configuration which may affect multiple sub-systems or major performance enhancements. A Local Configuration Control Board (LCCB) shall address the changes in configuration which are confined to the Airborne Store/ Subsystem.
- j. If found appropriate, CCBs at other levels also may be created.
- k. Configuration management plan shall clearly differentiate the role of different CCBs in the ALM development program.

21.B3.15. Test Rigs /Test Equipment

Regulation

The Main Contractor shall ensure availability of test rigs / test equipment that are capable of performing the indented testing and evaluation during all the lifecycle phases of the ALM development program.

Acceptable Means of Compliance

- a. Realization of all the required test rigs / test equipment including TTGEs shall be carried out as per the regulations given in **Subpart T**.
- b. The main Contractor shall ensure availability of required test rigs / test equipment including TTGEs at the appropriate stages of design & development phase of ALM as outlines in the approved Airworthiness Certification Plan (ACP).
- c. The Main Contractor shall ensure that the Test rigs/ test equipment and TTGEs are approved by the appropriate authorities as given in **Subpart T**, wherever the requirement is for the approved test rigs / test equipment and TTGEs.
- d. The Main Contractor shall ensure that the test rigs / test equipment and TTGEs have their calibration validity up to date, wherever applicable and these are also periodically maintained.

Guidance Material

Refer **Subpart T**

21.B3.16. Test and Evaluation

Regulation

The Main Contractor shall ensure that the testing and evaluation of the ALM at appropriate levels prior to flight testing.

Acceptable Means of Compliance

- a. The main contractor should inform the testing plan to TAA (CEMILAC and DGAQA) and shall follow the testing requirements as per the Airworthiness Certification Plan (ACP) document.
- b. At subsystem / LRU level, the compliance to qualification test requirements as per approved ENTEST Specifications shall be achieved using the Safety of Flight Testing

(SOFT) / Limited Qualification Testing (LQT) / Full QT / Similarity Analysis routes as applicable.

- c. The ALM shall be tested on ground in its fully assembled configuration for functionality and performance, using test rigs wherever applicable, as per the test plans approved by CEMILAC.
- d. Prior to taking up ALM level ground testing, all the subsystems / LRUs shall be fully tested for functionality and performance using their individual test rigs / test equipment as per the applicable regulations given in **Subpart C**.
- e. All the applicable Test Plan documents shall be prepared by the Main Contractor and approved by CEMILAC prior to start of actual testing activities.
- f. Prior to submission of test plan documents to CEMILAC for approval, the Main Contractor shall constitute the Test Adequacy Review Boards (TARBs), wherever needed, with the involvement of domain experts to review the readiness of the test article and the adequacy of the testing proposed.
- g. The qualification tests at ALM level, wherever applicable, shall be carried out as per the requirements given in the approved ENTEST Specifications.
- h. The guiding principle of qualification testing during the design & development phase shall to meet the safety of flight requirements so as to move faster to the flight testing phase. Full qualification tests shall be taken up subsequently after making necessary improvements in the design, if required based on the feedback from flight testing phase.
- i. Witnessing of qualification testing by DGAQA shall be mandatory only for safety critical subsystems / LRUs identified in the Criticality Classification document. For the remaining subsystems / LRUs, the internal QA group of the Main Contractor can witness the testing based on the authorization by DGAQA. For qualification testing at ALM level, if required any, the witnessing of tests shall be by DGAQA only. (Note: In absence of authorized test witnessing agency, the agency shall clear the test results submitted by main contractor in electronic/audio/video form.)
- j. Test reports duly approved by either DGAQA itself or the authorized internal QA group of the Main Contractor, wherever such authorization is given by DGAQA, shall form the basis for issue of clearances by CEMILAC.
- k. Evaluation of the software shall be undertaken as per the regulations given in **Subpart C6**.
- l. Since ALM will have to be integrated on an airborne platform for its useful exploitation, the appropriate level of testing shall be carried out on ground with ALM integrated on

the intended airborne platform prior to undertaking flight testing. Airborne platform level tests such as EMI/EMC tests shall be carried out at this stage. Towards this, the test plans shall be prepared by the Main Contractor and approved by CEMILAC. Witnessing of the tests shall be by DGAQA.

- m. The level of involvement in reviewing test plan documents / test reports or overseeing any activity shall be as decided by the TAA.
- n. A defect arising at any stage during the testing & evaluation phase shall be analyzed and corrective action shall be taken with the involvement of all the stakeholders (Refer 21.B3.17). Design changes, if necessary shall be carried out with the concurrence of CEMILAC.

Guidance Material

- a. For the purpose of qualification testing, the development can be divided in two phases: -
 - i. Development Phase-I: This phase will be up to developmental flight testing. In this phase, SOFT / LQT route can be followed for qualification testing based on the criticality of the subsystem / LRU. SOFT route is for LRUs of Avionics and Electrical Subsystem and LQT for Structures / Warhead / Propulsion subsystems.
 - ii. Development Phase-II: This phase will culminate in freezing of SOP for production. In this phase, full QT will have to be carried out.
- b. Configuration of the test items throughout the testing & evaluation phase to be properly managed.
- c. For further guidelines refer **Annex 21.B3.D : ALM Test and Evaluation**

21.B3.17. Deviations

Regulation

The Main Contractor shall ensure that a systematic process to handle deviations / non-conformance / defects during all the lifecycle phases of ALM development program is in place.

Acceptable Means of Compliance

- a. All deviations / non-conformances arising during design & development phase or from rig/ground/flight testing of ALM shall be documented and disposed of as per the process put in place by the main contractor.

- b. Deviations shall be analyzed to understand whether their root cause of occurrence is due to design deficiencies or process deficiencies.
- c. All defects observed during any phase of development program shall be analyzed and corrective action shall be taken with the involvement of all the stakeholders.
- d. The deviations which may lead to unsafe operation of the ALM shall not be accepted and must be mitigated with design improvements.
- e. The deviations not leading to unsafe operation but resulting in limitations at ALM level shall be mitigated with design / process improvements to the maximum extent possible
- f. The deviations which cannot be mitigated through design / process improvements shall be listed and indexed by the main contractor as concessions or waivers w.r.t user requirements.
- g. Concessions w.r.t. user requirements shall be granted with the concurrence of user services and shall have PDC for their mitigation by design improvements post issuance of RMTC.
- h. Waivers w.r.t. user requirements shall be obtained by the main contractor from user services for those deviations, which are not possible to be mitigated by way of design improvements in the present configuration of ALM.
- i. Any deviation from airworthiness requirements shall be regulated through any of the following boards as applicable.
 - i. Non-Conformances Review Board (NCRB)
 - ii. Configuration Control Board (CCB)
 - iii. Failure Analysis Board (FAB)
 - iv. Waiver Board

Guidance Material

- a. The purpose of the process to deviation / non-conformance is to document non-conformances, action non-conformances and to ideally stop similar non-conformances from occurring in the future by identifying the root cause. The non conformance report (NCR) is a framework for following a good non conformance procedure.
- b. The above Boards shall consist of a domain expert as the chairman and the following members:

- i. Rep, CEMILAC
- ii. Rep Main Contractor responsible for design and development
- iii. Rep. Main Contractor responsible for Quality Assurance
- iv. Rep. Main Contractor responsible for Manufacturing
- v. Rep DGAQA

21.B3.18. Flight Tests

Regulation

An ALM under development shall be subjected to flight testing to validate its design, ensure its airworthiness & safety, obtain the actual performance and to demonstrate compliance to user requirements.

Acceptable Means of Compliance

- a. Flight testing for ALM shall be undertaken broadly as per the regulations given in **Subpart P** with some specific provisions given in this regulation.
- b. Subsystems / LRUs of ALM shall have valid Development Flight Clearances (DFCs) prior to issue of Development Flight Clearance (DFC) at ALM level.
- c. The ALM DFC shall form one of the basis for issue of FCN for airborne platform on which ALM has been integrated for undertaking developmental flight testing.
- d. For ALMs, the flight testing shall be a stepwise process of Captive Flight Trials (CFT) followed by Release Flight Trials (RFT).
- e. Flight trials shall be undertaken with a clear flight test schedule. Flight test schedule shall be formulated in consultation with the Main Contractor, CEMILAC, flight testing agency and User.
- f. Safety of Flight clearance in the form of Form 1090 shall be issued by DGAQA prior to development flight testing.
- g. The flight testing feedback endorsed by the user/ customer shall be provided to CEMILAC for evaluation of flight test results.

Guidance Material

- a. The limitations, if any, are to be brought out clearly by the respective agencies i.e. Main Contractor, CEMILAC, DGAQA and Users before and after flight trials.

- b. The Main Contractor may constitute an expert committee to review the flight test results with the emphasis on the following: -
 - i. Validity of the developmental flight test data
 - ii. Performance parameters and bounds of the ALM and its subsystems captured during the trials
 - iii. Hardware/software Improvements, needed if any.

21.B3.19. Compliance with Type Certification Basis

Regulation

After successful completion of all the phases of ALM development program, the Main Contractor shall prepare compliance to requirements listed in TCB in the form of Type Certification Data Sheet (TCDS).

Acceptable Means of Compliance

- a. The Main Contractor shall prepare TCDS with the supporting evidences for submission to CEMILAC along with the application for issue of RMTC / MTC.
- b. All the supporting evidences shall be from the configuration management process followed for ALM development program.
- c. Non-compliances to TCB requirements, if any shall be clearly brought out with proper analysis reports bringing out their impact on type certification.
- d. Limitations arising at any phase of ALM development shall be clearly brought out in TCDS with proper justification for their temporary / permanent acceptance.

Guidance Material

- a. The format for Type Certification Data Sheet (TCDS) prescribed by CEMILAC and available as part of Manuals to be used.
- b. Wherever applicable, the supporting evidences to be approved by authorities responsible for the same.

21.B3.20. Application for RMTC/MTC along with Type Certification Data Sheet (TCDS)

Regulation

The Main contractor shall apply to CEMILAC with the Type Certification Data Sheet (TCDS) along with supporting evidences for the issue of RMTC/ MTC for the ALM under development.

Acceptable Means of Compliance

- a. The application for RMTC/MTC shall be in the prescribed format including the necessary supporting documents.
- b. The Main contractor can approach CEMILAC for RMTC/IOC even if complete certification requirements have not been fully completed covering the whole type design and the corresponding documentation, but the certification evidence has been demonstrated to the satisfaction of the User Service and CEMILAC for partial compliance of type design and all the safety of flight tests/analysis have been satisfactorily completed.
- c. ALM limitations as agreed with CEMILAC and concessions & waivers as agreed with users shall be submitted by the main contractor along with application for issuance of RMTC/MTC.

Guidance Material

Nil

21.B3.21. Issue of Restricted Military Type Certificate (RMTC)/ IOC

Regulation

RMTC / IOC for the ALM shall be issued by CEMILAC to the Main Contractor on partial compliance to TCB and user requirements provided it has been proven that all safety requirements as per TCB have been complied with and the user services are ready to accept the ALM based on their operational requirements.

Acceptable Means of Compliance

- a. Prior to issue of MRTC /IOC, TCDS shall be reviewed by CEMILAC for its completeness and correctness w.r.t requirements for which partial compliance has been claimed by the Main Contractor.

- b. The RMTC/ IOC for ALM shall be issued only after the Main Contractor has provided the substantiating evidence that there is no impact on the safety of the ALM as well as the airborne platform on which the ALM is integrated.
- c. RMTC / IOC shall be temporary in nature and to be issued only to facilitate the Main Contractor to start the limited series production and supply of the qualified subsystems/LRUs. MTC /FOC shall be mandatory for continuation of production beyond the expiry period of the RMTC / IOC.
- d. Build standard submitted by the Main Contractor along with TCDS shall be approved by CEMILAC for subsequent production of ALM.
- e. Along with the valid RMTC and the approved build standard, the MTC holder shall have necessary Production Organization Approval (POA) from DGAQA to initiate production of ALM.
- f. RMTC / IOC shall enable the user services to operationally exploit the ALM to meet their operational requirements pending issue of MTC/FOC.

Guidance Material

- a. RMTC/IOC is typically required where the complete certification requirements have not been fully satisfied covering the whole type design and documentation, but the certification evidence has been assessed to the satisfaction of the User Service and CEMILAC for partial compliance of type design and documentation and the safety of flight is not affected in any manner.
- b. The limitations / concessions / waivers should be provided by the Main Contractor along with plan of action for resolving them, wherever required for their proper reflection in the MTC.

21.B3.22. Issue of Military Type Certificate (MTC)/FOC

Regulation

MTC/ FOC for the ALM shall be issued by CEMILAC to the Main Contractor on successful demonstration of compliance to TCB and User requirements.

Acceptable Means of Compliance

- a. TCDS shall be reviewed by CEMILAC for its completeness and correctness prior to issue of MTC /FOC.
- b. The Main Contractor shall be issued with a MTC /FOC when CEMILAC has accepted that the type certification requirements as identified in the TCB have been fully satisfied and

the Main Contractor has confirmed that his organization is appropriately placed in terms of resources, contractual position and access to design information to manage the MTC.

- c. Build standard submitted by the Main Contractor along with TCDS shall be approved by CEMILAC for subsequent production of ALM.
- d. A valid MTC is required for the MTC holder to initiate production of ALM as per the approved build standard provided necessary Production Organization Approval (POA) has been obtained from DGAQA. In case production has already been initiated based on RMTC, the same can be continued further as per the approved revised build standard.
- e. Expiry of the MTC shall not have any implication on the airworthiness of previously produced and supplied ALMs. However, withdrawal of MTC shall mean that the ALM is no more airworthy.

Guidance Material

The limitations / concessions / waivers should be provided by the Main Contractor along with plan of action for resolving them, wherever required for their proper reflection in the MTC.

21.B3.23. Issue of Release to Service Documents (RSD) along with Manuals

Regulation

After the ALM has received MTC, CEMILAC shall issue Release to Service Documents (RSD) incorporating the details of manuals released by the Main Contractor enabling the user services for regular service use of the ALM.

Acceptable Means of Compliance

- a. ALM limitations as agreed with CEMILAC and concessions & waivers as agreed with user services shall be submitted by the main contractor along with type certification data sheet which shall be considered for issuance of RSD to user services.
- b. Technical publications for the ALM shall be prepared by the main contractor in consultation with design team and shall be reviewed by maintenance development organisations of user services.
- c. Technical publications shall be released by the main contractor to user services and CEMILAC approval shall not be required for these.

Guidance Material

Nil

21.B3.24. Production

Regulation

The MTC holder shall carry out production of the ALM as per the approved build standard.

Acceptable Means of Compliance

- a. The MTC Holder shall have production organization approval from DGAQA before taking up production of the type certified aircraft as per **IMTAR 21 Subpart G2**.
- b. In case the production of the ALM is to be carried out by a production partner of the MTC holder, the necessary Transfer of Technology (ToT) requirements stipulated by TAA shall be fulfilled as part of license agreement.
- c. The MTC Holder / Production Partner shall plan for the supply chain management and development of vendors and their quality assurance systems with the due approvals from DGAQA.

Guidance Material

- a. MTC is a design-cum-production certificate. Hence MTC holder can take up production of ALM after obtaining production organization approval from DGAQA.
- b. For details on production organization approval, refer **Subpart G2**.
- c. Identifying production partners in advance and strategic partnerships for Co-development and co-production agreements may be helpful in avoiding delays in regular production and supply to User services.

21.B3.25. Changes Requiring SMTC / AMTC / New Type Certificate

Regulation

- a. Changes proposed to an already type certified ALM shall be analysed and approved in the form of issue of Supplementary Military Type Certificate (SMTC) or Amended Military Type Certificate (AMTC) to the existing MTC.
- b. Major changes in the type certified ALM shall require recertification programme with the involvement of TAA.

Acceptable Means of Compliance

- a. The MTC holder shall submit details of the changes proposed to CEMILAC along with the criticality assessment.
- b. Changes requiring issue of Supplementary Military Type Certificate (SMTC) or Amended Military Type Certificate (AMTC) to the existing MTC shall be handled as per the regulations given in **Subpart D**.
- c. Major changes in the type certified ALM shall require recertification programme as per the regulations given in this Subpart B3.

Guidance Material

- a. Changes may be required in the design to due to production requirements, new user requirements, improvements in design, to address limitations etc. Such changes may be put up through the Local Modification Committee.
- b. For details refer **Subpart D** on the modifications.

21.B3.26. Responsibilities of the MTC Holder

Regulation

The Military Type Certificate holder for the ALM shall adhere to all the clauses mentioned in MTC to maintain the type certification status of the ALM.

Acceptable Means of Compliance

- a. The MTC holder shall adhere to all the clauses of the MTC including conditions & limitations mentioned in type certificate.
- b. Any changes required in the ALM at any stage shall be carried out only after the approval of CEMILAC.
- c. MTC can be withdrawn if the conditions & limitations mentioned in it are not followed.
- d. If performance of the ALM during regular service use is not satisfactory based on the feedback from User Services, the MTC can be withdrawn by CEMILAC till resolution of all the issues related to performance of ALM to the satisfaction of the user services.

Guidance Material

- a. Any deviation / deficiency / abnormality faced at any stage during production or regular service use of the ALM should be intimated to all the relevant stakeholders and properly investigated.

- b. Quality control requirements at production stage shall be followed as laid down by DGAQA.

21.B3.27. Transferability

Regulations

- a. In normal circumstances, the MTC Holder shall not be allowed to transfer the MTC of an ALM issued to it to any other agency as MTC is not an asset owned by the MTC Holder but an authorization by CEMILAC to produce specific store/stores.
- b. The transfer of MTC shall be made only in special conditions (stipulated in guidance material) to an organization with ASDO approval from CEMILAC.

Acceptable means of Compliance

- a. For possible MTC transfer in special conditions, the MTC holder shall prepare MTC transfer plan in consultation and subsequent approval from CEMILAC. The transfer of Military Type Certificate, including RMTC, shall be allowed only to an organization having requisite infrastructure (ASDOA) and capabilities as that of the MTC holder and who is able to fulfil the responsibilities of MTC holder.
- b. The MTC shall not be transferred to a non-Indian entity.
- c. The MTC shall not be transferred to an export customer even when the ALM has been withdrawn from Indian user services.

Guidance Material

- a. The following are some of the special conditions having a bearing on transfer of MTC:
 - i. The MTC holder changing its name
 - ii. Changes to the Registered Address or Relocation of their facility
 - iii. The acquisition of the MTC holder by another company if the acquired company (i.e. MTC Holder) continues to exist as the same legal entity to which the MTC was issued, provided:

The acquired company (MTC Holder) continues to retain possession of all the Design documents, Type Records and the responsibilities under the original MTC and also retains the quality management system.

21.B3.28. Duration and Continued Validity

Regulation

- a. RMTC shall remain valid for a period not exceeding 3 years.
- b. MTC shall remain valid for a period not exceeding 7 Years.
- c. RSD Certificate shall continue to remain valid till its suspension / withdrawal by CEMILAC.

Acceptable Means of Compliance

- a. Prior to expiry of RMTC, if MTC is not obtained by the RMTC holder, the further production activities by RMTC holder or its production partner shall not be carried out.
- b. On expiry of MTC, the further production activities by MTC holder or its production partner shall not be carried out.
- c. The MTC holder shall apply to CEMILAC in prescribed Proforma for the renewal of MTC six months prior to the expiry of the certificate.
- d. The expiry of RMTC / MTC shall have no bearing on the airworthiness status of the ALMs already produced and supplied to the user services. It only results in stoppage of further production activities for the ALM.
- e. Suspension / withdrawal of RSD shall result in no further regular service use of the ALM by the user services as well as the stoppage of test flying activities undertaken during production stage by the MTC holder or its production partner.
- f. In case of expiry of MTC for more than one year, the MTC holder has to carry out LQT on the ALM/systems to prove his capability.

Guidance Material

- a. CEMILAC may consider suspending or revoking a MTC when the MTC holder or its production partner do not meet the obligations during the continued airworthiness activities of the ALM.
- b. CEMILAC may obtain from user services the performance and safety record of the ALM at regular intervals. Based on the feedback received, if the user services and the TAA find it necessary, CEMILAC may suspend or withdraw a RSD.

21.B3.29. Record Keeping

Regulation

The MTC holder for the ALM shall ensure proper record keeping of all the data contained in TCDS.

Acceptable Means of Compliance

- a. The MTC holder shall have a Record Keeping Plan Document concurred by TAA.
- b. The record keeping shall be for a period not less than 5 years after the decommission of the ALM by the user services.
- c. All revisions to the TCDS and Technical publications shall be properly carried out and proper traceability shall be maintained.

Guidance Material

The Record Keeping Plan Document shall identify all the records that needs to be archived and details like the mode of archival, the periodicity of accounting audit etc.

21.B3.30. Instructions for Sustaining Type Airworthiness (ISTA)

Regulation

The Main contractor shall ensure that complete set of regularly updated Instructions for Sustaining Type Airworthiness (ISTA) are provided to the user services.

Acceptable Means of Compliance

- a. The Main contractor shall provide all the relevant ISTA to the User services to keep the ALM and its sub systems in Airworthy condition at all times.
- b. Changes to the ISTA shall be periodically made available by the main contractor to the user services.

Guidance Material

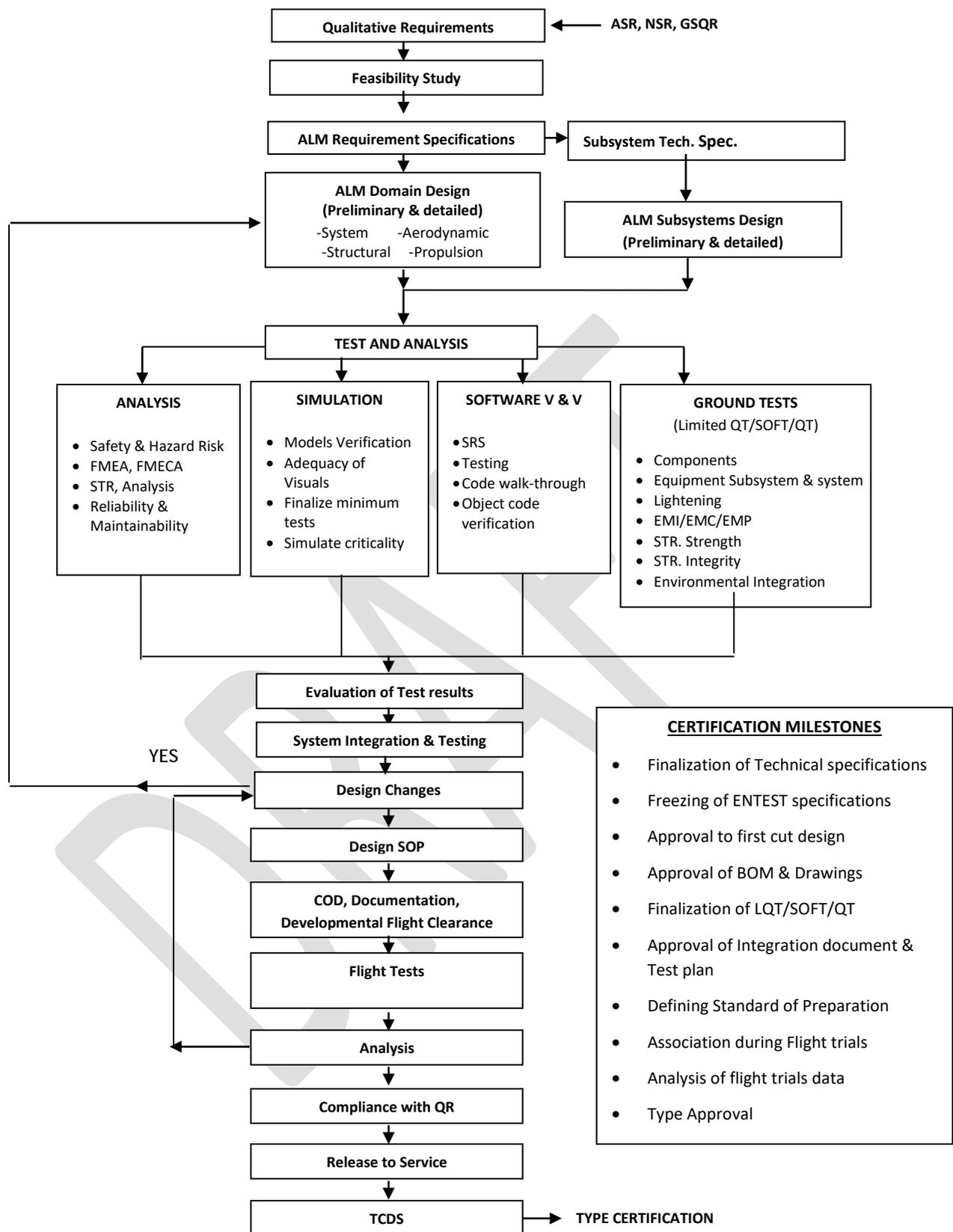
- a. The availability of some manuals or portions of variations to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into service, but should be available before any of the products reaches the relevant age or flight hours/cycles, by which time this information is required to sustain type airworthiness.

- b. Changes may be required in the TCDS to due to meeting production requirements, new user requirements, improvements in design, obsolescence etc. Such changes shall be planned and dissemination of the same shall be stakeholders by the Main Contractor after obtaining the necessary approval from TAA.
- c. Changes may be required during continued and continuing airworthiness like issue of service bulletins, UON etc., which need to be forwarded to all the stakeholders.

Annex 21.B3.A Airworthiness Certification of Air Launched Missiles

(To be used only as guidelines and not to be cited as the regulatory requirements)

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Annex 21.B3.B : Detailed List of Analyses to be Included in the Design Documents

(To be used only as guidelines and not to be cited as the regulatory requirements)

Avionics subsystem	Propulsion Subsystem	Structures	Aerodynamics
Power Estimation Reliability De-rating Electronic Packaging Signal Integrity Wt budget EMI hardening	Stability Analysis of Combustion. Heat Transfer Analysis of RM, liners, etc. and their bonding characteristics. Structural strength analysis of RM shell, propellant grains, joints, etc., Thermal Analysis of nozzle metallic covering with liner (convergent, divergent & throat). Study of Erosive behaviour Life assessment Provisioning of Safety interlocks FMECA/FMEA	SF & BM diagrams for all combinations of loads Stress Analysis Heat Transfer Analysis Modal Analysis Aero Elastic Analysis Launch Phase Dynamic Analysis	Stability Analysis Control effectiveness of the Fins & Hinge moment analysis CFD analysis for missile with fins & wings Generation of force & moments coefficients for all types of combination Mass, CG & MI estimation Store Separation analysis for the ALM
Warhead		Software	ALM Level
Chemistry & Engineering of explosives studies Detonic Studies Safe /Arm Technologies Fuzing technologies Explosive- metal interaction studies Interaction of kill mechanism & target Insensitive munition studies		Safety interlocks IV&V	Control Parameters Effectiveness Damping Guidance schemes Electrical Integration Mechanical integration Safety

Lethality studies		Reliability
Life assessment		Failure Modes
FMECA/FMEA		

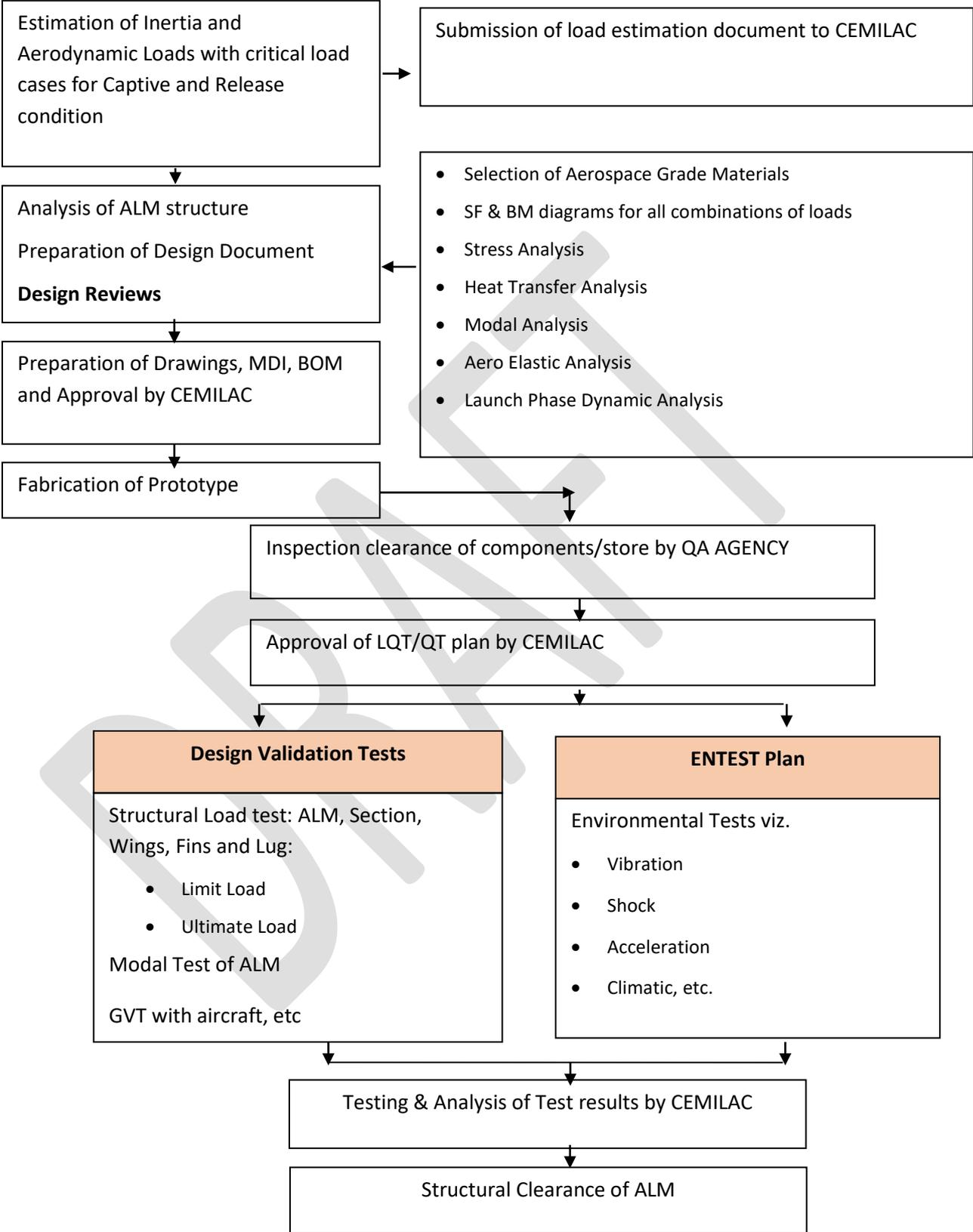
Annex A.21.B3.C : Guidance Material on ALM Development Process

(To be used only as guidelines and not to be cited as the regulatory requirements)

A.21.B3.C.1: Guidance Material on Structural Clearance for ALM Airframe

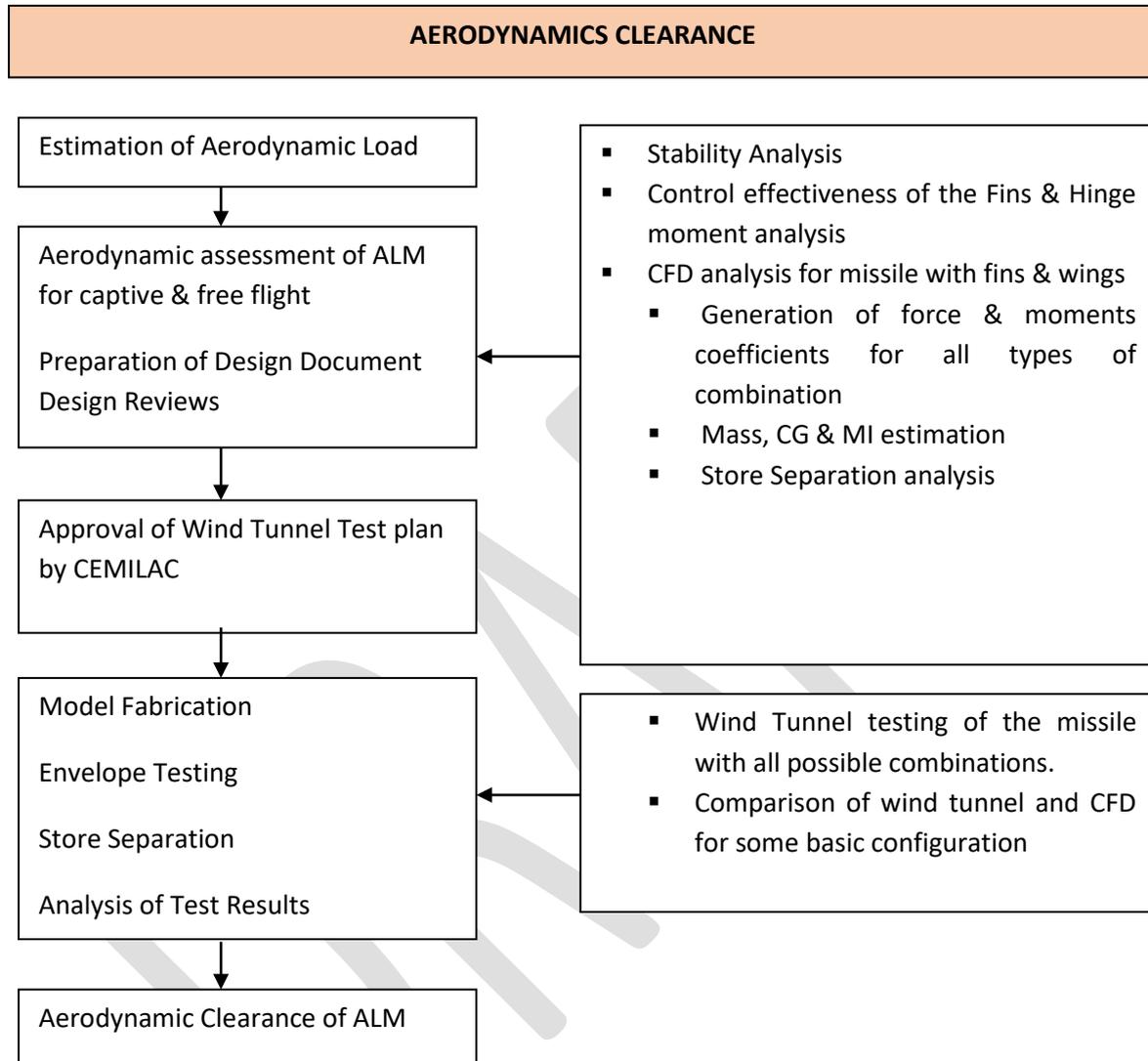
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AIRFRAME STRUCTURAL CLEARANCE FOR ALM



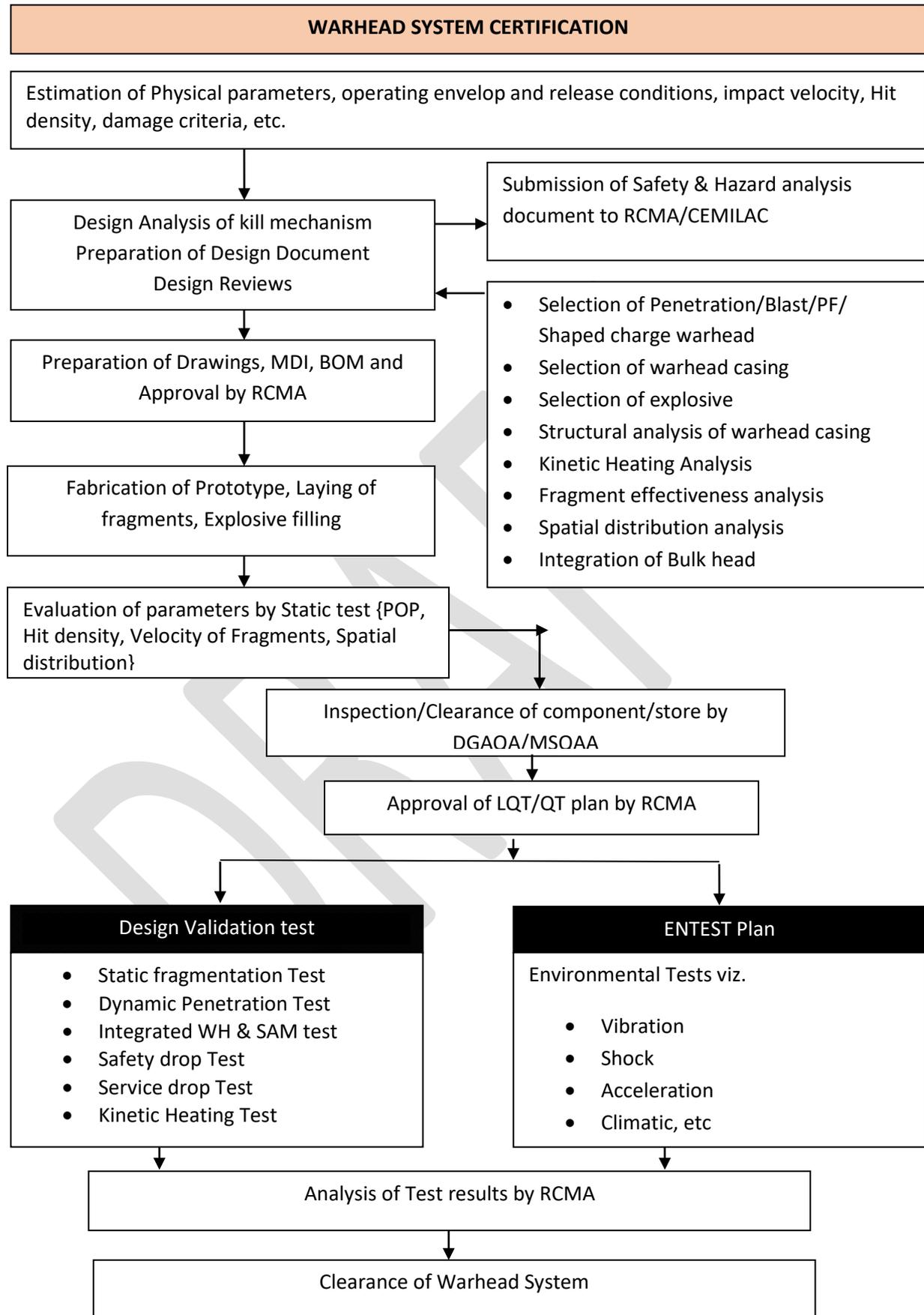
A.21.B3.C.2: Guidance Material on Aerodynamics Clearance for ALM

(To be used only as guidelines and not to be cited as the regulatory requirements)



A.21.B3.C.3: Guidance Material on Warhead Subsystem Clearance for ALM

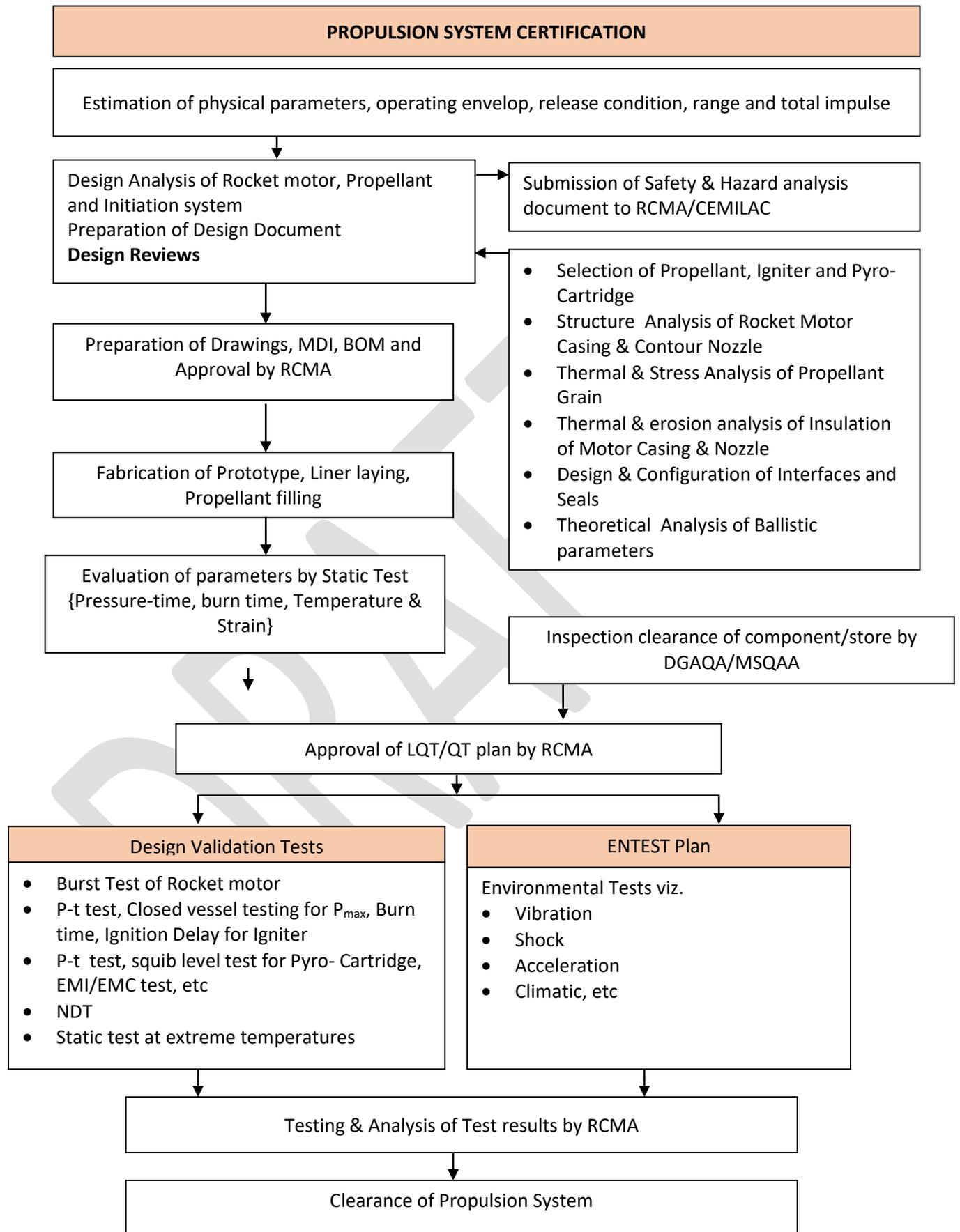
(To be used only as guidelines and not to be cited as the regulatory requirements)



A.21.B3.C.4: Guidance Material on Propulsion Subsystem Clearance for ALM

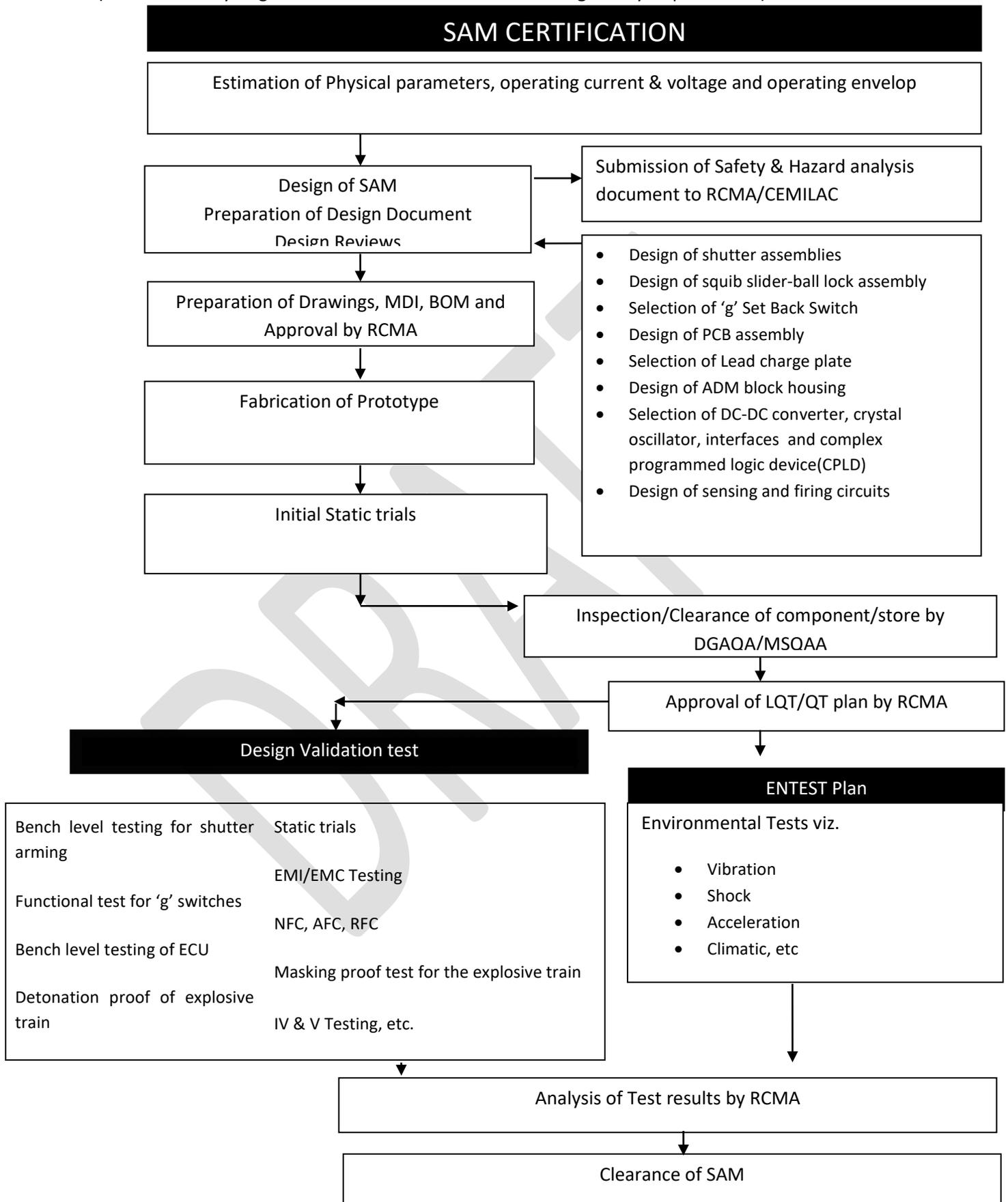
(To be used only as guidelines and not to be cited as the regulatory requirements)

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A.21.B3.C.5: Guidance Material on SAM Subsystem Clearance for ALM

(To be used only as guidelines and not to be cited as the regulatory requirements)



Annex 21.B3.D : Guidance Material on ALM Test and Evaluation

(To be used only as guidelines and not to be cited as the regulatory requirements)

- 21.B3.D.1 Safety of Flight Testing (SOFT)**
- 21.B3.D.2 Limited Qualification Testing (LQT)**
- 21.B3.D.3 Incremental Qualification Testing (IQT)**
- 21.B3.D.4 Full Qualification Testing (QT)**
- 21.B3.D.5 Integrated ALM Level Testing or All Round Up Testing**
- 21.B3.D.6 Test Adequacy Review Board (TARB)**
- 21.B3.D.7 Test Rigs**

21.B2.D.1 Safety of Flight Testing (SOFT)

1. SOFT shall be carried out on mission critical avionics/electronics subsystems prior to the development flight trials. If a subsystem for the missile is being certified in SOFT route, the limit on the number of units to be cleared under SOFT is relaxed as subsystems are consumed in ALWs trials.
2. SOFT specifies minimum test requirements to ensure functional aspects in representative environments of any flight trial. SOFT tested unit is not yellow banded and same unit can be used for flight trials.
3. The necessary Design review should be completed for the subsystem prior to start of SOFT.
4. The main contractor shall carry out ground tests as are necessary to ensure compliance with the ALM specification. A programme and plan of tests to be made, detailed test schedules including the instrumentation for the tests, acceptance criteria for all tests etc., shall be prepared in conjunction with the CEMILAC. The tests can be conducted after CEMILAC accepts the test schedules.
5. SOP, Test rig specification, instrumentation required for the tests including telemetry, SOF Test Plan and Functional Test Procedure should be prepared by the main contractor and approved by CEMILAC before commencement of tests.

6. Design changes, if necessary during the SOFT process should be only with the concurrence of CEMILAC.
7. The SOF tests should be carried out by the main contractor with coordination of QA AGENCY.
8. Software certification should be carried out for all the software components in the system.
9. The test results and compliance chart, both endorsed by QA AGENCY shall be analysed by CEMIALC.
10. Pre – requisites before commencement of SOFT/ LQT/IQT/Full QT:
 - a. Inspection of components /connectors/PCBs as per BOM/MDI/Drawings/Schematics/ Data Sheets/CoCs etc. with proper traceability/markings
 - b. Screening of non-mil components as per CEMILAC screening directive no.81/2003 dated 10th Jan 2004.
 - c. The configuration of Cables used for EMI/EMC tests shall be preferably same as actual flight cables.
 - d. The fixtures used for En-tests shall be approved by CEMILAC and the mounting scheme during en-tests shall replicate mounting scheme in flights.
 - e. Test-jig used for validation of system/sub-system has to be cleared by Inspection agencies. If test-jig contains software, it has to be verified/validated by IV & V teams before test jig clearance.
 - f. If the system has the application software alone (instead of En-test software), this shall exercise (shall be able to validate all hardware resources during qualification) the complete hardware irrespective of being used in the current mission. The same may be certified by Project/System Manger.
 - g. This software also to be verified & validated before commencement of En-tests, however if the project schedules call for early qualification then IV & V tasks can also progress in concurrence with qualification tests. However, hardware versions and Software checksums have to be documented in Version Description Document (VDD) [Software Configuration Index Record].
 - h. Functional test procedure for performance checks during non-mil screening, ESS, EMI/EMC, pre-SOFT, during SOFT and Post-SOFT has to be explicitly defined.
 - i. All standard equipment used as part of test-jig shall be calibrated.

- j. All test facilities used for qualification of test item shall be calibrated.
 - 11. For systems that have already been qualified for other platforms, SOF requirements shall be accordingly tailored while finalising delta test requirements.
 - 12. If there are limitations to the airborne system in terms of meeting the performance specifications or test specifications, a waiver request is to be raised by the main contractor for consideration of the applicable Waiver Board and acceptance of CEMILAC.

21.B3.D.2 Limited Qualification Testing (LQT)

- 1. LQT is mainly required for conducting developmental flight trial where for safety critical and single shot systems. Hence, Mechanical, Electromechanical & Single shot systems/subsystems viz., Rocket motor, Pyro devices, Missile/Launcher structure, Explosive devices, etc., shall be subjected to LQT.
- 2. LQT specifies minimum qualification requirements to ensure functional, structural and safety aspects to enable CEMILAC to clear the subsystem for developmental flight trials.
- 3. The system undergoing limited qualification tests shall be of production standard w.r.t. processes, make, SOP etc.
- 4. LQT tested subsystem shall be yellow-banded after the test and it is not to be used in the flight trials.
- 5. The necessary Design review should be completed for the subsystem prior to start of SOFT.
- 6. The main contractor shall carry out ground tests as are necessary to ensure compliance with the ALM specification. A programme and plan of tests to be made, detailed test schedules including the instrumentation for the tests, acceptance criteria for all tests etc., shall be prepared in conjunction with the CEMILAC. The tests can be conducted after CEMILAC accepts the test schedules.
- 7. SOP, Test rig specification, instrumentation required for the tests including telemetry, SOF Test Plan and Functional Test Procedure should be prepared by the main contractor and approved by CEMILAC before commencement of tests.
- 8. After completion of pre-defined subset of qualification tests (LQT), test results coordinated by QA AGENCY shall be submitted to CEMILAC.
- 9. The SOP of the subsystem should be placed under configuration control and modifications shall be only with concurrence of CEMILAC.

10. Pre – requisites before commencement of LQT: Refer 21.B3.C.1.10 above.

21.B3.D.3 Incremental Qualification Testing (IQT)

1. Incremental Qualification tests shall be conducted on subsystem which is already qualified for airborne use, and requires to be adapted for different platform or if any major hardware modifications have been carried out after QT.
2. Provisional Clearance or Type Approval should be available for the subsystem.
3. The main contractor and CEMILAC should jointly prepare Airworthiness Certification Plan (ACP) where required, keeping in view the additional certification requirements.
4. The main contractor should amend the original documentation which is affected by the changes in hardware or environment. These documents should be approved by CEMILAC and placed under configuration control.
5. The main contractor should prepare Incremental QT plan which should be approved by CEMILAC.
6. The main contractor should submit Incremental Qualification test results to CEMILAC. The test results should be co-ordinated by QA AGENCY.
7. Software certification should be completed, if required, for all the airborne software components and reports should be generated.
8. The SOP of the system shall be placed under configuration control and modifications shall be only with concurrence of CEMILAC.
9. The system undergoing incremental qualification shall be of production standard w.r.t. processes, make, SOP etc.
10. Pre – requisites before commencement of IQT: Refer 21.B3.C.1.10 above.

21.B3.D.4 Full Qualification Testing (QT)

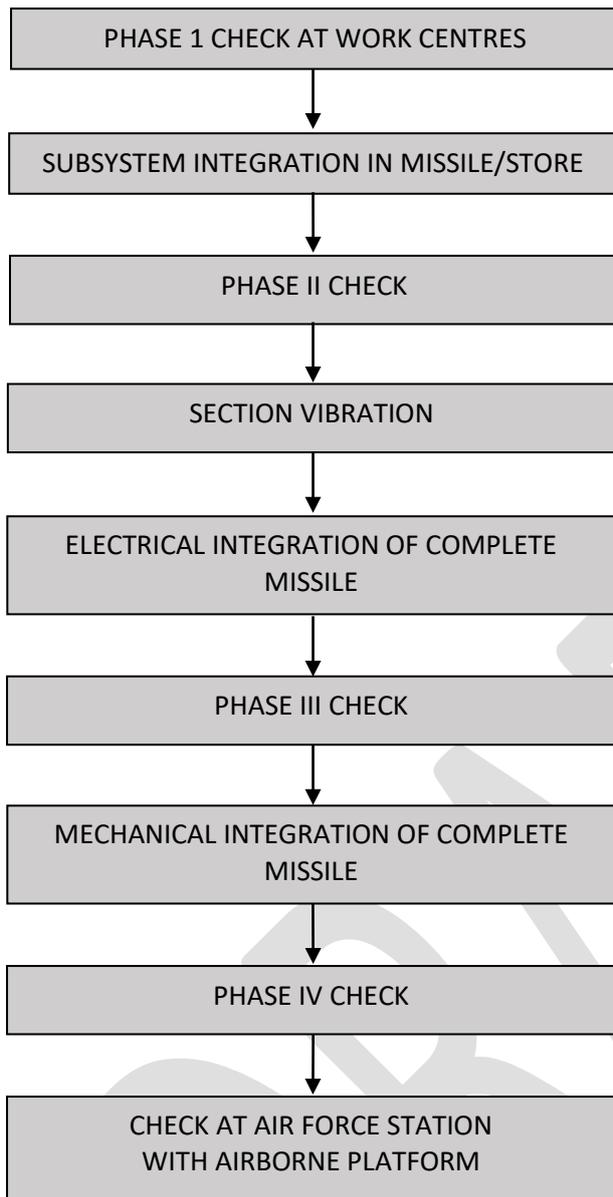
1. The airborne subsystem shall undergo Full Qualification Tests (QT) before productionisation and service use.
2. The main contractor and RCMA should jointly prepare Airworthiness Certification Plan (ACP) keeping in view the criticality and user requirements. Complete Software IV & V as per the required standard should be covered during the qualification.
3. Preliminary Design Review and Critical Design Review should be conducted by the Main Contractor covering the hardware and software design aspects.

4. The Main Contractor should prepare Test rig specifications, Functional Test Procedure and QT plan.
5. All the Qualification tests as per the approved QTP should be conducted on the subsystem / LRU.
6. The Main Contractor should submit Qualification test results to CEMILAC. The test results should be co-ordinated by QA AGENCY.
7. Software certification should be completed for all the airborne software components and reports should be generated.
8. The SOP of the subsystem should be placed under configuration control and modifications shall be only with concurrence of CEMILAC.
9. The system undergoing qualification shall be of production standard w.r.t. processes, make, SOP etc.
10. Pre – requisites before commencement of Full QT: Refer 21.B3.C.1.10 above.

21.B3.D.5 Integrated ALM Level Testing or All Round Up Testing

1. Integrated ALM level test shall be carried out prior to integration of the newly designed ALM on intended airborne platform. Wherever applicable, the special rig to replicate airborne platform interfaces on ground shall be carried out.
2. The systems/subsystems should have completed SOF or LQT or IQT or Full QT.
3. The various subsystems are integrated and integrated testing including hardware-software testing shall be carried out. The test plans for all integration testing (Phase Checkout testing) shall be frozen in consultation with CEMILAC. The tests shall be witnessed by DGAQA with test reports coordinated by them.
4. If the test results are satisfactory and the limitations, if any are acceptable, then CEMILAC should issue rig/airborne platform integration clearance for the subsystem.
5. The SOP of the cleared subsystem should be approved by CEMILAC.
6. **Phase Checks:** Phase check procedures will be carried out on ALM using a PC-based Checkout System having MIL 1553 interface as per approved Phase Check/Check out document. The aim of phase checks is to ensure the health of each on-board subsystem after its integration in the ALM and also to ensure that the electrical interfaces and software protocols between the subsystems are correctly functioning. The procedures have the overall objective of confirming that the ALM under test is functionally fit for the flight trial. The phase check procedures will have four phases mentioned below:

- i. **Phase-I Checks:** The checks carried out by the work-centre for their respective subsystem comprise the Phase-I checks. These checks are the component level, PCB level, functional and environmental checks carried out on the subsystem at the work-centre. Each subsystem that is sent for integration in the ALM is to be accompanied by an inspection clearance note, which gives a summary of all the tests carried out on the unit at the work-centre. Phase-I checks ensure that the unit being used for integration in the ALM is a fully functional, acceptance unit.
- ii. **Phase-II Checks:** After all subsystems are integrated in the ALM sections, Phase-II checks are carried out to ensure that the subsystems, their interfaces and the electrical integration scheme are functional. Phase-II checks ensure that the ALM sections are ready for carrying out section vibration checks.
- iii. **Phase-III Checks:** After completion of section vibration **as per approved full QT/LQT/IQT/SOFT plan**, the ALM is ready for Phase-III checks. The ALM sections are electrically integrated but mechanically not integrated. These checks ensure the health of the subsystems and their electrical interfaces after section level vibration.
- iv. **Phase-IV Checks:** The ALM is mechanically integrated and Phase-IV checks are carried out. These checks confirm the subsystems are functional and the cable harnesses are intact after mechanical integration of the ALM. On successful completion of Phase-IV checks, the ALM is ready for launch.
- v. The phase check sequence is shown in Figure 1.
- vi. Phase-I checks are specific to the subsystems and the same are not discussed in this document.



vii.

Figure 1: Phase Check Sequence

7. **Auto-Launch checks:** Auto launch checks are to be performed to ensure the communication and functional interfaces of ALM, launcher with airborne platform and to validate the mission software.

8. **Hardware In-Loop Simulation (HILS) Test:** Hardware-In-Loop-Simulation is used for system design verification, validation of Guidance, Navigation & Control and system integration, pre-flight and post-flight Performance Evaluation.

9. **Daily Inspection (DI) Procedure:** Daily Inspection (DI) Procedure to be carried out by QA AGENCY & CEMILAC at Air Force Station before/during/after loading the ALM on airborne platform as per approved DI procedure document.

10. **O-Level Checks:** O-Level checks are to be carried out at Air Force Station after loading the ALM on airborne platform.
 11. **Airborne Platform Level Qualitative EMI/EMC checks:** Airborne Platform level Qualitative EMI/EMC checks are to be carried out (if required) as per approved Airborne Platform level EMI/EMC test plan.
- a. The Objective of these tests is to establish the Electromagnetic Compatibility (i.e. without any Electromagnetic Interference) of the metric launcher & metric ALM avionics with existing avionics suite of airborne platform. These tests will establish any degradation in performance in the equipment/systems, due to electromagnetic interference, if any, caused by on-board emission sources and vice versa. The airborne platform stations connectors will be wired for EMI/EMC puffers and the ALM pyro connectors will be wired for squibs to detect the presence of voltage, if any.
12. Rig integration by the airborne platform integrator rules out interfacing and compatibility issues on the airborne platform. Airborne platform integration checks on the ground confirm the acceptability of the system before undertaking flight trials.
 13. Especially the systems with large number of interfaces which may be difficult to test on the airborne platform or flight safety critical systems should have detailed rig testing on ground before installing them in the airborne platform.
 14. If there are limitations to the airborne system in terms of meeting the performance specifications or test specifications at the rig, a waiver request is to be raised by the Main Contractor for consideration of Waiver Board and acceptance of CEMILAC.

21.B3.D.6 Test Adequacy Review Board (TARB)

1. The test methodology and philosophy, adequacy of the testing proposed and also the readiness of the test article shall be reviewed by Test Adequacy Review Board (TARB) before commencement of the ground testing.
2. TARB shall be constituted by the Main Contractor with the involvement of domain experts. CEMILAC and DGAQA shall be part of the TARB committee.
3. The test plan agreed by TARB shall be reviewed and approved by CEMILAC
4. Testing methodology and philosophy w.r.t test article shall be reviewed which includes QA aspects of hardware/components fabricated, Test rig details, instrumentation details, boundary condition imposed on the test article, etc.
5. The subsystem undergoing testing shall be of production standard w.r.t. processes, make, SOP etc.

21.B3.C.7 Test Rigs

1. The airborne subsystem needs to be tested on bench and during environmental tests, for compliance with the technical and functional specification. ATE/Test Rig is used during Design, Development, production and service use.
2. The Main Contractor shall use approved test rig or Automatic Test Equipment (ATE) for testing of airborne subsystems during D&D, production & service use phases.
3. The software ported into the test rig/ATE, the test software ported into the system for conducting the tests, the software used for generating the test cases/ test data/ simulation files etc. are covered under "Test Rig Software" which needs to be certified before use.
4. The criticality level applicable to the test software should be the same as that of the system that is certified using the test Software.
5. The Technical specification, software requirements and Version description for the Test rig/ Automatic Test Equipment (ATE) shall be approved by CEMILAC.
6. The test rig/ATE shall have identification part number, hardware and software versions, and last calibration date clearly marked on the nameplate.
7. The compliance of the test rig/ ATE to the approved specifications shall be confirmed by QA AGENCY.
8. Only the DGAQA approved test rig/ATEs shall be used for hardware/ software certification activities of the system.
9. The simulation of airborne platform interfaces and test conditions with the ATE/test rig shall be as close to the actual environment as possible.
10. Environmental tests applicable for ATE/Test jig should be tailored as per the standards, operating environment and delivery requirement of the test rigs.

SUB PART - B4: AB INITIO DEVELOPMENT OF AERO ENGINES AND SUB SYSTEMS

Rationale

A systematic and independent Certification process is required to demonstrate that a newly developed (or derivative) Engine meets Type Design and safety requirements. The award of a Military Type Certificate (MTC) testifies that the given engine demonstrates its capability and has met all the Type Design requirements.

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- 21.B4.1. Applicability**
- 21.B4.2. User Requirements**
- 21.B4.3. Certification of Aero Engines for INDIAN Military Registered Air Systems**
- 21.B4.4. Application for Airworthiness Assessment of Air System**
- 21.B4.5. Demonstration of Air System Design Organisation (ASDO)Capability**
- 21.B4.6. Airworthiness Certification Standards/Code/Special criteria identification**
- 21.B4.7. Engine Requirement Specification**
- 21.B4.8. Finalisation of Type Certification Basis (TCB)**
- 21.B4.9. Airworthiness Certification Plan (ACP)**
- 21.B4.10. Quality Assurance Plan (QAP)**
- 21.B4.11. Design & Development of Aero Engine**
- 21.B4.12. Configuration Control**
- 21.B4.13. Test Rigs /Test Facilities**
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- 21.B4.15. Deviations (Non-Conformance)**
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- 21.B4.17. Compliance with Type Certification Basis with available User Requirements**
- 21.B4.18. Application for RMTC/MTC along with Type Records**
- 21.B4.19. Issue of Restricted Military Type Certificate(RMTC)/ IOC**
- 21.B4.20. Issue of Military Type Certificate (MTC)/FOC**
- 21.B4.21. Issue of Release to Service Documents (RSD) along with Manuals**
- 21.B4.22. Production**
- 21.B4.23. Changes Requiring a New Type Certificate for an Air System**
- 21.B4.24. Responsibilities of the MTC Holder**
- 21.B4.25. Transferability**
- 21.B4.26. Duration and Continued Validity**
- 21.B4.27. Record Keeping**
- 21.B4.28. Instructions for Sustaining Type Airworthiness (ISTA)**

Regulatory Articles (RA):

21.B4.1. Applicability

Regulation

The regulation brought in this subpart is applicable to ab-initio development (including derivative engines) of all classes of aero engines like Turbofan, Turbojet, Turboshaft, rotary and reciprocating engines that require a MTC for Indian military applications.

Acceptable means of Compliance

The provisions stipulated in this SUBPART to be complied through a Certification programme, on satisfactory culmination of which CEMILAC may grant MTC according to the Airworthiness Assurance Policy.

Guidance Material

- a. Aero Engines designed and developed as an integral part of the Air Vehicle, which in turn registered as per the provisions of the rules for registration of Air Vehicle / Weapon system with Indian Military Services shall be Military Type certified prior to release to Service.
- b. These regulations are applicable to all aero engines used that require a MTC except for the categories for which exception has been granted by CEMILAC.
- c. The Technical Airworthiness Authority (TAA) responsible for the introduction of new Indian Military Air Systems, except for certain Unmanned Air Systems (UAS) Class exemptions detailed IMR, should ensure that they are certificated in accordance with requirements detailed in this document.

21.B4.2. User Requirements

Regulation

Air systems used in Indian Military Service are to be designed and developed based on User requirements in terms of ASR/PSQR/GSQR. In case of acquisition of the ready to use products, they shall confirm to the requirements specified by User Service or system requirements derived from the top-level system which complies with the User Requirements.

Acceptable means of Compliance

- a. The ASDO/SSDO shall capture the technical requirements from the User requirements and shall have the concurrence of CEMILAC.

- b. The Technical Specification document and the Military Certification Process (MCP) shall be derived keeping the user requirements and shall be verified through a system study/analysis and shall be confirmed during PDR and CDR.
- c. In case of acquisition of the ready to use products, sub systems and systems for aero engines, the ASDO shall ensure the compliance with the applicable airworthiness codes with relevant test evidences and documentations taking into consideration of Users Requirements in terms of Performance, Flight envelope, Climatic envelope, Lifing, Safety, Reliability etc.

Guidance Material

- a. Often user requirements deal with how a user will interact with a system and what the user expects. The user requirements in terms of ASR/PSQR/GSQR, has to be broken into multiple system requirements corresponding to various systems and subsystems, different operating scenarios, and finally what performance is expected in the worst-case scenario.
- b. Analytical / simulation studies to be conducted to confirm that the design values assigned to the sub-systems are good enough to meet the user requirements and shall have concurrence of CEMILAC prior to design implementation.

21.B4.3. Certification of Aero Engines for Indian Military Registered Air Systems

Regulation

Engine designed and developed or Procured for the Indian Military Airborne platforms shall obtain certification coverage from the TAA.

Acceptable means of Compliance

Tests, analysis, demonstration and similarity substantiation as decided in the Airworthiness certification plan and their compliance duly approved by TAA, shall be the acceptable means of compliance for grant of MTC.

Guidance Material

- a. The system level requirements for engine or subsystems designed and developed for the Indian Military Airborne platforms will follow from the requirements of main Air System Platform.
- b. Any newly designed and developed system/component of a propulsion system is likely to affect hazard state of the Air System and therefore can influence the Risk assessment for that Air System.

- c. To minimize the risk from the overall perspective it is desirable to ensure that each subsystem is safe and reliable before integrating to the main air system. It is achieved by conducting Qualification Tests (QT), and introducing acceptance and test criteria, based on considerations for life, safety margins, reliability, intersystem compatibility and maintainability during service operation.
- d. For already Type Certified, but changes in the Type Design were carried out, complimentary certification commensurate with the extent of Modification as agreed by TAA shall be carried out.
- e. The approach to Certification, leading to MTC and the Airworthiness Assurance Plan throughout its Life should be set out in beginning of Military Certification Process (MCP) in accordance with the certification criteria adopted. In general the process shall have following 6 phases:

Phase 1 – Identify the requirement for, and obtain, organizational approvals.

Phase 2 – Establish and agree the Type Certification Basis (TCB).

Phase 3 – Concurrence of CEMILAC to the Certification Programme (CP).

Phase 4 – Demonstrate compliance with the TCB as CP.

Phase 5 – CEMILAC Review of Certification Evidences and issue of RMTC/MTC.

Phase 6 – Post Certification Activities.

21.B4.4. Application for Airworthiness Assessment of Air System

Regulation

The ASDO/SSDO/Main contractor/Agency responsible for engine acquisition shall apply to CEMILAC and DGAQA for the Airworthiness Assurance and Quality assurance coverage respectively

Acceptable means of Compliance

ASDO /SSDO/Main contractor/Agency responsible for engine acquisition shall co-ordinate with TAA and an early intimation of the project plan to be provided to TAA so that their participation can be available from the beginning of the development project.

Guidance Material

- a. The design agency shall inform the TAA during the initial stages of the project even prior to formal project sanction so as to enable capture of the certification requirements from project conceptualisation stage itself.

- b. The representatives of TAA typically work along with the members of a project team, project managers, MOD executives, and User Services. As the input from TAA and certification requirement and test facility requirements can directly impact the cost and time duration of the project, involvement of TAA in the early conceptual stage of the project is beneficial.

21.B4.5. Demonstration of Air System Design Organisation (ASDO) Capability

Regulation

ASDO/SSDO/Main contractor/Agency responsible for aero engine/ subsystem acquisition shall be Organisations with demonstrated capability and are approved by CEMILAC as per the provisions of Subpart G, 'Demonstration of Capability'. Firms engaged in design /development / repair /overhaul of systems, subsystems and components of propulsion system shall have the corresponding approvals from CEMILC as applicable.

Acceptable means of Compliance

- a. The necessary approvals for the applicable scope of work shall be obtained from CEMILAC or authorised or delegated agencies.
- b. In case the organisation is in the process of obtaining the approvals from TAA, the evidence related in this regard needs to be submitted to CEMILAC

Guidance Material

Refer 21.G1 of Subpart G for the approval of organisations

21.B4.6. Airworthiness Certification Standards/Code/ Special criteria identification

Regulation

The Engine/subsystem design agency (ASDO/SSDO) shall ensure that the aero engine and its subsystems are designed to Airworthiness standards/codes. The standards shall be followed as per the international guidelines and shall have the concurrence of CEMILAC. Certification of Aero Engines intended for Military manned and unmanned platforms shall be specified in the Type Certification Basis (TCB).

Acceptable means of Compliance

- a. Airworthiness code as per the User Services requirement and in concurrence with TAA shall be specified in the Type Certification Basis (TCB). However, in cases where User

Services have not specified the codes that need to be used, the same shall be decided by ASDO/SSDO in consultation with CEMILAC.

b. It is necessary to establish the Type Certification Basis (TCB) for the Type Design of the system or Major modifications. Formal approval should be sought from CEMILAC for the use of alternative specifications or Airworthiness code.

c. All amendments to the TCB by the Main Contractor shall be after concurrence by CEMILAC.

d. In all cases the TCB will be effective for a period of 5 years from the date of MTC application. If MTC is not achieved within that timescale, a review of the changes to the Airworthiness codes that defined the TCB will be required to assess any shortfall against contemporary requirements.

Guidance Material

The detailed Guidance material for the design, development and certification of aero engines is provided in Annex A.21.B4. A: Aero Engine Development Process

21.B4.7. Engine Requirement Specification

Regulation

Engine /sub systems requirements shall be derived from the User requirements that flowed down to aircraft level requirements and keeping the current state of the art technology available for manufacturing the components and systems. The Engine Technical Specification document thus derived shall have the concurrence of CEMILAC.

Acceptable means of Compliance

- a. The Technical specification of engine /sub systems shall be prepared by the ASDO/SSDO as per the services requirement and in concurrence with CEMILAC.
- b. ASDO/SSDO shall take concurrence of Service HQrs if any significant deviations are there from the User requirements specified.
- c. The engine /sub system technical specification shall be confirming to the interface requirements of the associated systems.

Guidance Material

Prior to submitting for CEMILAC concurrence, the engine /subsystem technical specification to be reviewed by all other stake holders concerned.

21.B4.8. Finalisation of Type Certification Basis (TCB)

Regulation

The ASDO shall ensure that the TCB consists of the applicable Airworthiness codes established and it shall also specify the means of compliance. Finalisation of Type certification shall be based on the provisions specified in Engine/subsystem technical specification and acceptance criteria mutually agreed between ASDO/SSDO and CEMILAC.

Acceptable means of Compliance

- a. Upon scrutiny of the correctness and completeness, CEMILAC will freeze/approve the Type Certification Basis (TCB) which will be binding on the ASDO/SSDO.
- b. ASDO/SSDO shall comply with the TCB. If it desires to have an amendment to the Airworthiness requirements that are effective after finalisation of TCB, the ASDO/SSDO should approach CEMILAC for any amendment on the TCB.

Guidance Material

- a. If any concession is required to be provided for the TCB, which are not directly affecting the safety and reliability of the system, RMTC may be issued with mitigating provisions.
- b. The TCB will also include the Instructions for Sustaining Type Airworthiness (ISTA) when identified in the relevant Airworthiness code.

21.B4.9. Airworthiness Certification Plan (ACP)

Regulation

Airworthiness Certification plan shall be prepared by ASDO/SSDO in consultation with CEMILAC and shall clearly specify the verification/compliance matrix with means of compliance in accordance with the clauses and provisions of airworthiness codes and TCB agreed upon with CEMILAC

Acceptable means of Compliance

A documented Certification plan covering all the activities to comply with the TCB duly approved by CEMILAC shall be available before commencement of compliance demonstration and updated as necessary during the Certification process.

Guidance Material

The Certification plan will be owned and managed by the ASDO/SSDO/Main Contractor and agreed with the Certification Agencies, and will usually form part of the Integrated Test, Evaluation and Acceptance Plan (ITEAP).

21.B4.10. Quality Assurance Plan (QAP)

Regulation

The ASDO /SSDO shall propose a Quality Assurance Plan of the Aero Engines/Sub systems as per the prevailing norms of quality assurance provisions acceptable to DGAQA.

Acceptable Means of Compliance

- a. The agencies should be competent to ensure satisfactory Quality Assurance during development and manufacture in accordance with quality assurance plan to the satisfaction of DGAQA.
- b. The Quality Assurance Plan (QAP) that shall include the acceptable limits to demonstrate the quality and shall obtain the concurrence of DGAQA.

Guidance Material

- a. The ASDO/SSDO or their contractor firm would be primarily be responsible for instituting adequate quality assurance provisions for fulfilling the quality assurance requirements of the development projects / manufacture / repair / overhaul in conformance to the drawings / test schedules.
- b. ASDO/SSDO or their contractor firm will be responsible for veracity of the information supplied by it to the representatives of type certifying authority.
- c. The responsibility of the ASDO/SSDO or their contractor firm also includes the subcontracted portion of work, if any. Such sub-contracting arrangements are to be duly communicated to the DGAQA concerned.

21.B4.11. Design & Development of Aero Engine

Regulation

The main contractor shall have a design & development process that results in Aero Engine or its subsystems meeting the user requirements and the Type Certification Basis.

Acceptable means of Compliance

- a. CEMILAC shall ensure that the firm taking up activities which eventually requires issues of MTC, is capable of successful design and development of the aero engine / subsystems.
- b. The organization responsible for the design of the aero engine / subsystems can demonstrate its capability by holding an appropriate Design Organization Approval, or is in the process of applying for such an approval.
- c. ASDO/SSDO shall evolve inter alia System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP).

- d. The certification activity of the engine can be exercised concurrently with the Design and development process. In this approach, the designer shall involve CEMILAC & DGAQA in the development stage.

Guidance Material

- a. Application of Systems engineering approach reduces the risk of schedule and cost overruns and increases the likelihood that the implementation will meet the user's needs. In addition to providing this overall benefit, the Systems Engineering Process can provide improved stakeholder participation and shorter project cycles.
- b. For detailed guidelines on design and development of aero engines refer Annex A.21.B4. A : Aero Engine Development Process

21.B4.12. Configuration Control

Regulation

ASDO/SSDO/Main Contractor shall establish and implement a means by which the configuration of the aero engine /sub systems is managed over their entire product life cycle.

Acceptable means of Compliance

- a. The design of complex system like aero engine is normally specified by means of a large number of documents, such as performance specifications, drawings, design manuals, and testing procedures etc. As the design evolves these documents are subject to change, and configuration control provides an orderly scheme to manage and keep track of all the changes.
- b. A Configuration Control Board (CCB) shall address the changes in the configuration.
- c. Propulsion Systems have multiple failure modes and contain a significant number of critical parts whose failure could hazard the Air System and pose a Risk to Life. In order to assure the integrity of critical parts within a Propulsion System, the manufacture, identification, configuration and usage of such parts must be controlled and managed.
- d. Configuration control ensures that all changes to an aero engine design are performed in a disciplined way with the knowledge and consent of management. CEMILAC shall freeze the design SOP at certain point of design maturity based on the guidance of the designer.

Guidance Material

-Nil-

21.B4.13. Test Rigs /Test Facilities

Regulation

ASDO/SSDO or their partners or contractors shall have test equipments / test facilities/ engine test beds that are capable of performing the indented qualification /acceptance test and shall be capable of producing results that are meaningfully inferred as certain capability of engine and subsystems.

Acceptable means of Compliance

- a. Based on the approved Airworthiness Certification plan, ASDO/SSDO may prepare an implementation plan indicating the availability of test facilities for each of the tests planned in the Certification plan.
- b. Test rigs/facilities to be approved by the TAA for a given type of test.
- c. The test equipment / test facilities/ engine test beds shall have the approval of DGAQA and shall have its calibration validity up to date and periodically maintained.

Guidance Material

Refer Subpart T.

21.B4.14. Test and Evaluation

Regulation

The ASDO/SSDO or main contractor should agree with the TAA (CEMILAC and DGAQA) on the approved test organization and to determine the testing requirements. The level of involvement in reviewing test schedule / report or overseeing any activity shall be decided by the TAA.

Acceptable means of Compliance

- a. The tests shall be configured to demonstrate performance, safety and reliability of the aero engines and its sub systems.
- b. Test Schedules to be prepared in consultation with CEMILAC
- c. The main contractor should inform the testing plan to TAA (CEMILAC and DGAQA) and shall follow the testing requirements and the level of involvement as per the certification plan.

Guidance Material

- a. The major design houses all over the world designing gas turbine engines (turbojet and low bypass turbofan engines) for fighter aircraft and jet trainers (intermediate and

advanced) are now adopting engine structural integrity program (ENSIP) integrated to their design philosophy.

- b. For further guidelines refer Annex 21.B4.B : Aero Engine Testing and Evaluation

21.B4.15. Deviations (Non-conformance)

Regulation

ASDO/SSDO/Main/sub Contractor shall have a Non-conformance handling system as per the standard practices in aeronautical industry with an oversight surveillance of TAA

Acceptable means of Compliance

- a. Deviations are to be documented and disposed as per the standard practices in aeronautical industry with an oversight surveillance of TAA.
- b. The purpose of a non conformance procedure is to document non conformances, action on non conformances and to ideally stop similar non conformances from occurring in the future by identifying the root cause. The non conformance report (NCR) is a framework for following a good non conformance procedure.
- c. Any deviation from Airworthiness requirements shall be regulated through any of the various Boards as applicable.
 - i. Material Review Board (MRB)
 - ii. Salvage Board / Concession committee
 - iii. Production Permit Board
 - iv. Configuration Control Board (CCB)
 - v. Waiver Board

Guidance Material

Nil

21.B4.16. Flight Tests

Regulation

Flight tests may be carried out during Initial Flight Release (IFR) or Final Flight Release (FFR) stages of certification of aero engines.

Acceptable means of Compliance

- a. Prior to flight test, all safety related tests on aero engine and its systems, sub systems and accessories shall be completed.
- b. Flight test on intended platform shall be carried out to demonstrate engine operability such as;

- i. Windmill starts
- ii. Cross bleed starts
- iii. Control transients, primary & secondary
- iv. Supersonic and Super cruise operation if applicable based on platform
- v. 30-seconds inverted manoeuvre
- vi. Max AB performance if applicable
- vii. High 'g' and negative 'g' manoeuvre
- viii. Armament/weapon firing if applicable
- ix. Any other test to be decided based on platform requirement
- x. The following information shall be available prior to flight test:
 - xi. Analysis reports for various systems/equipment/LRU including stress analysis reports
 - xii. Aircraft/Platform integration procedure and integration test schedules
 - xiii. FMEA/FMECA and reliability estimates
 - xiv. Safety/hazard and risk analysis reports
 - xv. Investigation/Analysis of all the failures during ground testing and the rectification / improvements to the system
 - xvi. Build Standard of the prototype/Technology Demonstrator/SOP
 - xvii. Quality assurance procedures
 - xviii. Acceptance test procedures
 - xix. Flight test schedule

Guidance Material

In case of Ab-initio aero engine design and development of single engine aircraft application, experimental flights in flying test bed prior to flight test on the target platform is recommended based on safety considerations.

21.B4.17. Compliance with Type Certification Basis with available User Requirements

Regulation

The Main Contractor (ASDO/SSDO) shall provide to CEMILAC a compliance matrix prepared in-line with the provisions specified in User Requirement, Technical Specification, TCB and Certification Plan.

Acceptable means of Compliance

ASDO/SSDO shall prepare a compliance matrix along with the supporting evidences for the scrutiny and approval by TAA.

Guidance Material

Nil

21.B4.18. Application for RMTC/MTC along with Type Records

Regulation

The ASDO/SSDO/Main contractor shall apply to CEMILAC with the relevant test results and documentation for the issue of RMTC/ MTC.

Acceptable means of Compliance

- a. The application for RMTC/MTC shall be in the prescribed format including the necessary supporting documents.
- b. ASDO/SSDO/Main contractor can approach CEMILAC for RMTC/IOC even if complete certification requirements have not been fully completed covering the whole type design and the corresponding documentation, but the certification evidence has been demonstrated to the satisfaction of the User Service and CEMILAC for partial compliance of type design and all the safety of flight tests/analysis have been satisfactorily completed.
- c. The type record for aero engines and its critical components / systems shall include the following information / documents.
 - i. Technical specifications
 - ii. Design documents
 - iii. Drawings
 - iv. Bill of Materials
 - v. Certificate of Design
 - vi. Test schedule
 - vii. Test reports
 - viii. Photograph of the product
 - ix. Brief description of the product
 - x. Basis for approval
 - xi. Storage conditions and life
 - xii. Performance certificate/feedback from users
 - xiii. Provisional clearance and its validity
 - xiv. Compliance statements to the specifications/ Test schedule
 - xv. Duly filled type approval Proforma

Guidance Material

Nil

21.B4.19. Issue of Restricted Military Type Certificate (RMTC)/ IOC

Regulation

Initial Operational Clearance (IOC) is generally issued for the Flying Platform and not for Aero Engines and its accessories. However the engine designers/Development agencies may approach CEMILAC for IOC of platform along with the newly developed aero engine as a special case.

Acceptable Means of Compliance

- a. When an engine development process is complete and the prescribed qualifications tests are completed except evaluation of the effect of prolonged environmental exposure, and the TAA has assessed that there is no impact on Air Safety, a RMTC may be issued for a provisional period in order to initially exploit the benign envelope and progressively expanding the flight envelope, after concurrence by the User service.
- b. RMTC/IOC is typically required where the complete certification requirements have not been fully satisfied covering the whole type design and documentation, but the certification evidence has been assessed to the satisfaction of the User service and CEMILAC for partial compliance of type design and documentation and the safety of flight is not affected in any manner.
- c. In order to issue the RMTC/ IOC for aero engine, ASDO shall provide substantiating evidence that there is no impact on Air Safety.

Guidance Material

Nil

21.B4.20. Issue of Military Type Certificate (MTC)/FOC

Regulation

Final Operational Clearance (FOC) is generally issued for the Flying Platform and not for Aero Engines and its accessories. However, the engine designers/Development agencies may approach CEMILAC for FOC of platform along with the newly developed aero engine as a special case.

Acceptable Means of Compliance

- a. The Main Contractor (ASDO) shall be issued with a MTC when the TAA has accepted that the certification requirements have been fully satisfied and the Main Contractor has confirmed that his organization is appropriately placed in terms of resourcing, contractual position and access to design information to manage the MTC.

- b. The supporting evidence for having fulfilled the requirements for type certificate has to be provided to the satisfaction of CEMILAC.
- c. The CEMILAC shall conduct a detailed verification of the compliance status prior to issue of the MTC.
- d. Review of Certification Evidence and compliance statement leading to generation of Type Certification Report (TCR)

Guidance Material

- a. Type Record document include giving a description of the store, its functional and performance characteristics, summary of strength and other calculations along with reserve factors, environmental envelope of operation and storage of the store, results of all tests including environmental, functional and performance tests, weight data, list of applicable drawings and the Certificate of Design.
- b. The publications should be in convenient formats for users. Intermediate level documents are meant for users and Depot Level documents are required for maintenance/repair/overhaul agencies

21.B4.21. Issue of Release to Service Documents (RSD) along with Manuals

Regulation

ASDO/SSDO or main contractor shall prepare the Technical publications/Manuals for engine/ subsystem prior to RSD

Acceptable Means of Compliance

Before issue of RSD of platform to the user, aero engine / sub system designer shall prepare the Technical publications for engine support.

Guidance Material

The list of manuals is given in Annex 21.B4.C: List of Technical publications/Manuals for engine/ subsystem

21.B4.22. Production

Regulation

The ASDO/SSDO shall plan for production of the engine/sub systems as per the requirements projected by the Users or prepare to transfer the technology to a suitable production organization capable of producing the engines.

Acceptable Means of Compliance

- a. ASDO/SSDO shall plan for Issue of Transfer of Technology (TOT) agreement or production planning with the due approvals from the TAA wherever required.
- b. ASDO/SSDO shall plan for the supply chain management and development of vendors and their quality assurance systems with the due approvals from DGAQA..
- c. Aero engine designer shall prepare the Technical publications for engine production support by the time the qualification of the engine is completed and ready to commence production.

Guidance Material

- a. Identifying production partners in advance and strategic partnerships for Co-development and co-production agreements may be helpful in avoiding delays in regular production and supply to Armed Forces.
- b. For further details on materials approval refer 21.C3 of Subpart C
- c. For further details on production approval refer of Subpart F
- d. For further details on the organization approval refer 21.G1 and 21.G2 of Subpart G

21.B4.23. Changes Requiring a New Type Certificate for an Air System

Regulation

For Major changes in the type certified engines shall require to undergo re-certification programme in association with the TAA. For minor modification ASDO/SSDO shall produce the evidence that the new changes shall not jeopardise the safety and reliability of the Air System.

Acceptable means of Compliance

- a. The Designer shall submit details of the change incorporated to CEMILAC along with the criticality assessment
- b. For Major changes in the type certified engines shall require to undergo re-certification programme.
- c. For minor modifications, Designer shall provide the evidence/justification that these changes shall not jeopardise the safety and reliability of the Air System. Test / Analysis /substantiation etc can be used to justify the claim.

Guidance Material

- a. The following changes shall often require a new type certificate or amendment in type certificate;
 - i. Out line
 - ii. Weight
 - iii. Performance

- iv. Cooling configuration/bleed air etc.
- v. Safety features
- vi. Controls & software
- vii. Change of supply source
- viii. Any other changes deemed necessary

b. For details refer Subpart E on the modifications approval

21.B4.24. Responsibilities of the MTC Holder

Regulation

The Military Type Certificate holder should follow the condition & limitation mentioned in type certificate to maintain the airworthiness status of the engine / subsystems.

Acceptable means of Compliance

- a. All the condition & limitation mentioned in type certificate to be strictly adhered to.
- b. Type Approval can be withdrawn if the condition & limitation mentioned in it are violated.
- c. If TAA is not satisfied about the performance of the Aero Engine / Equipment or based on the feedback from User Services, the Type Approval earlier issued can be withdrawn.

Guidance Material

- a. Generally the type certificate is not transferable
- b. The process followed for development / qualification stage shall be followed for series production also. Changes if any shall be implemented only after proper concurrence from RCMA (Engines).
- c. Any deviation / deficiency / abnormalities faced at any stage during manufacturing of the components, performance of accessories / engine shall have to be intimated and investigated by concern authorities.
- d. Quality control requirements at production stage shall be followed as laid down by DGAQA.

21.B4.25. Transferability

Regulation

Type certificate issued to ASDO/SSDO for an Engine /sub system is non-transferable. However, CEMILAC may consider transfer of TC under very special circumstances.

Acceptable means of Compliance

- a. Generally, TA Holder cannot transfer the TA of the item issued to him to any other agency.
- b. If a MTC or RMTC is to be transferred, the transfer shall be made only to an ASDO/SSDO who will be able to fulfil the responsibilities of MTC holder as defined.
- c. The MTC shall not be transferred to a non-Indian entity.
- d. The MTC holder shall prepare MTC transfer plan in consultation with the Type Approval Authorities (TAA).

Guidance Material

Following are some special circumstances when CEMILAC may consider transfer of TC issued to ASDO/SSDO for an Engine /sub system

- i. The TA holder changing its name
- ii. Changes to the Registered Address or Relocating their facility (ie Works).
- iii. The acquisition of the TA holder by another company if the acquired company (i.e. TA Holder) continues to exist as the same legal entity to which the TA was issued, provided
- iv. The acquired company (TA Holder) continues to retain possession of the Design documents, Type Records and the responsibilities under the original TA

21.B4.26. Duration and Continued Validity

Regulation

The MTC holder shall apply to CEMILAC to renew the MTC on its expiry.

Acceptable means of Compliance

- a. The validity of the Type Certificate is generally 5 years from the date of issue of the certificate or as specified by CEMILAC from time to time.
- b. The MTC holder shall apply to CEMILAC in prescribed Proforma for the renewal six months prior to expiry of the certificate.
- c. The information / reports required in the renewal format shall be provided by the certificate holder to CEMILAC for renewal of the Type Certificate based on the information provided

Guidance Material

Nil

21.B4.27. Record Keeping

Regulation

The MTC holder shall ensure proper record keeping of all relevant design information inter-alia documents, drawings, QA records, test procedures, reports, for the identified engine /sub system and are securely held by the appropriate ASDO/SSDO.

Acceptable means of Compliance

- a. The ASDO/SSDO shall have a Record Keeping Plan Document concurred by TAA. The record keeping shall be for a period not less than 5 years after the decommission of the aircraft from services.
- b. All revision to be properly updated and traceability to be maintained.
- c. The designer / Holder of the Type certificate shall follow the documentation requirements as specified in various sections IMAR to sustain Type airworthiness of the Aero engines / subsystems.

Guidance Material

Nil

21.B4.28. Instructions for Sustaining Type Airworthiness (ISTA)

Regulation

ASDO/SSDO/ Main contractor shall ensure that complete set of Instructions for Sustaining Type Airworthiness (ISTA) are provided.

Acceptable Means of Compliance

- a. A programme showing how changes to the ISTA are promulgated should be submitted to the main contractor by the ASDO/SSDO.
- b. ASDO/SSDO /Main contractor should provide all the relevant ISTA to the User to keep the engine and its sub systems in Airworthy condition.
- c. Variations to the ISTA should be made available by the ASDO/SSDO to the main contractor at the earliest opportunity.

Guidance Material

The availability of some manuals or portions of variations to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into service, but should be available before any of the products reaches the relevant age or flight hours/cycles, by which time this information is required to sustain type Airworthiness.

Annex A.21.B4. A : Guidance Material on Aero Engine Development Process

- A.21.B4.A.1. Design Analysis & Verification: This is the first major verification activity after the technical specification is frozen and the design is accomplished. This includes verification and scrutiny of the design analysis for its adequacy against the laid down requirements. In concurrent certification approach, airworthiness agency is involved from this stage onwards.
- A.21.B4.A.2. Mechanical / Structural Design Analysis: The objective of the structural design as well as the factors to be considered are as given under:
- A.21.B4.A.3. Component level design analysis: A Static and Dynamic design Analysis to be carried out by the designer to establish the following against the specification requirements:
- Fatigue Life [HCF & LCF, Creep]
 - Static Strength Margin
 - Vibration Analysis (No danger of flexural & tensional vibration for rotating components should be present)
 - Establishing critical speeds
 - Safety Margin / Design Margin
- A.21.B4.A.4. Factors to be Considered during analysis:
- Static/Dynamic Mechanical loads(on ground & flight)
 - Vibrating environment (HCF Cycling)
 - Max. temperature/Thermal loads
 - Corrosive environment
 - Manoeuvre loads (g-loads)
- A.21.B4.A.5. Aerospace standard material should be considered for designing and Manufacturing of the Engine. Suitability & durability of materials to be established on the basis of experience & tests.
- Establish the safety margins for critical components in respect of LCF /HCF and Creep. Also to establish by analysis the safety margins in case of undesirable/ over speed/ over temperature conditions.
- A.21.B4.A.6. Dynamic Analysis: Analysis of dynamic systems such as bearing selection, location of the bearing, bearing loads etc., throughout the operating speed & power range of shafts to be made to arrive at critical speed, order, frequency etc.
- A.21.B4.A.7. Aero thermodynamic Design Analysis & Verification: The aerothermodynamics design should include the cycle calculations as well as the following analysis using CFD in case of critical components.
- A.21.B4.A.8. Cycle calculation & Analysis to establish the cycle parameters
- A.21.B4.A.9. Cycle efficiency at design and off-design conditions
- A.21.B4.A.10. Pressure, Temperature & Flow distribution

A.21.B4.A.11. Pressure losses if any

Note: Pressure & temperature covering the entire flight envelope including corner points and hot day, cold & standard day conditions.

A.21.B4.A.12. System Level Design Verification through Analysis: The detail system level design verification of major engine systems and accessories (Mechanical / Aero) should be based on specifications already laid down.

A.21.B4.A.13. Design Analysis Tools

A.21.B4.A.14. After design is accomplished following design analysis tools may be used for establishing the criticality of undesirable events and action needed on part of ground crew

A.21.B4.A.15. FMECA

A.21.B4.A.16. Safety & Hazard Analysis

A.21.B4.A.17. Design Reviews

The designer has to perform Design reviews after which design is considered to be frozen for the engineering drawings and component manufacturing.

A.21.B4.A.18. Preliminary Design Review (PDR)

A.21.B4.A.19. Detail Design Review (DDR) on requirement basis

A.21.B4.A.20. Critical Design Review (CDR)

A.21.B4.A.21. Documents for submission

The designer has to submit the following documents after the design is frozen;

- Preliminary Design Review (PDR) Report
- Critical Design Review (CDR) Report
- Design Document of all the modules/components, systems, sub-systems, LRUs, control systems, etc.
- Standard of Preparation (Illustrated Part List)
- A set of Engineering Drawings
- Performance Cycle Deck (PCD) for the engine

Annex 21.B4.B : Guidance Material Aero Engine Test and Evaluation

Guidance Material on the Certification of Military Turbojet/ Turbofan Engine is given below.

This approach outlines a qualification process with the following milestones:

- Preliminary Flight Rating (PFR) Tests
- Initial Flight Release (IFR)
- Final Flight Release (FFR)
- Initial Service Release (ISR)
- Operational Capability Release (OCR)

The designer may adopt Production Release (PR) tests after completing PFR tests instead of IFR, FFR, ISR, OCR for engines intended for unmanned air vehicles.

a) Preliminary Flight Rating (PFR) of Engine

- i. The Preliminary Flight Rating (PFR) provides an engine configuration that has demonstrated sufficient flight safety for limited use in experimental flight tests. The PFR is achieved when the tests, demonstrations and analyses of Tables B1 & B2 have been successfully completed and approved by the Using Service.
- ii. The designer shall plan and sequence the tests on components/systems/engine in concurrence of RCMA (Engines) and DGAQA.
- iii. Tests shall be carried out on components/systems/engine duly inspected and cleared by DGAQA.
- iv. Each test shall be carried out as per Test schedule approved by RCMA (Engines).
- v. Tests shall be carried out at Test benches/facilities/Rigs approved by DGAQA.
- vi. Designer should plan for sufficient number of components/systems/engine for timely completion of the tests.
- vii. Pre-PFR Analyses

It is recommended practice that the following analyses/study/ substantiation (Table-B1) shall be completed and reports may be submitted to the CEMILAC prior to the initiation of PFR tests on engine.

Table-B1 - List of Typical Analysis / Documentation to be done Prior to PFR

Sl. No.	Analysis / Documentation Requirements
1.	Externally applied forces
2.	Heat Rejection and Cooling test
3.	Engine radar cross section (RCS) shall be calculated to provide data by taking radar reflectivity measurements of a full-scale model of the engine inlet and

	exhaust systems. The radar reflectivity determinations shall be conducted at an outdoor test site.
4.	Engine performance verification
5.	Engine temperature Limits
6.	Vibration Limits
7.	Weight of residual fluids
8.	Reliability Analysis
9.	Engine noise signature at near and far field
10.	Materials and processes used
11.	List of adhesives and sealants used
12.	List of all protective treatments for corrosion protection
13.	EMI control plan and EMI test plan
14.	Inter-changeability: Matched and selected fit parts shall be identified and a proposed listing shall be provided.
15.	<p>Engine Life:</p> <p>List of predicted structural lives, without repair or replacement, of all major life limiting engine components by engine module.</p> <ul style="list-style-type: none"> • Hot parts life • Cold parts life • Critical parts life • HCF life • LCF life <p>(a) Demonstrate a safe life in service at which parts should be retired, or</p> <p>(b) Demonstrate that the item has a life significantly longer than the design target life.</p> <p>(c) Demonstrate and make recommendations to the Approval Authority on the extent of inspections and/or tests on the part(s) that may be required in service to maintain safe operation.</p>
16.	Engine pressure balance analysis
17.	<p>Strength and life analysis shall be performed and a report submitted prior to initiation of the PFR and revised and resubmitted prior to initiation of the FFR. Stress analysis shall include such items as engine cases, discs, vanes, blades, mounts, combustion liners, bearing supports, gears, brackets and tubing. The report shall contain an analysis to define:</p> <p>(1) LCF duty cycle for the critical parts individual component tests (spin pit) and any full scale engine LCF testing</p> <p>(2) Cool down time between cycles, and</p> <p>(3) Total number of cycles to demonstrate the equivalent of the LCF design life requirement for critical parts. The LCF lives of all the engine parts and the</p>

	mission hours equivalency shall also be defined.
18.	Vibration and stress analysis
19.	Wear rate analysis
20.	List of all potting compounds
21.	Infrared radiation (IR) signature analysis
22.	Details of Engine Wash System.
23.	Test article configuration
24.	Pre-test data and detailed test procedure

Notes:

(a) Quality Conformance Inspections: Engines, components and test apparatus shall be subject to inspection by authorized Inspectors from DGAQA who will be given the necessary information and facilities to determine conformance with this specification.

(b) Test Surveillance: Each test and demonstration described herein shall be subject to witnessing by authorized certification authorities at convenient times prior to the tests, during the tests and during teardown inspections. The engine and components shall be examined to determine if they conform to all requirements of the contract and specifications under which they were built.

(c) At no time shall any part of the engine or component be disassembled, adjusted, cleaned, replaced or removed without prior approval of the certification authorities.

(d) The demonstrations and analyses required for PFR shall be based on the proposed SOP of PFR engine and shall be updated, as required, by changes incorporating in engine parts list/configuration approved by the User Service. The mixing of parts of the same or different design, such as blades in a disc, or the mixing of different vendor's components and parts in a multiple assembly, such as a segmented stator assembly, is not allowable during PFR tests. All parts shall be considered as having zero time at the start of the test. While all parts do not have to be new, any part which fails during the test shall be cause for rejection of that test article.

(e) Test Stand Dynamic Characteristics: Vibratory velocity and acceleration shall be measured with the engine operating on a test stand which has the following dynamic characteristics: the natural frequencies of the test stand with the engine installed shall not be higher than 80 percent of the idle rotor speed in all modes of motion which can be excited by residual rotor unbalances.

Typical PFR Tests – (For General Guidelines)

The following demonstrations/tests (Table B2) are recommended to be carried out to meet the PFR requirements;

Table-B2 Typical PFR Tests

	Requirements	Demo	Test
1.	Engine dry weight	X	
2.	Power Lever Torque loads by measurement	X	
3.	Temperature Sensing System Calibration		X
4.	Engine Control System Calibration		X
5.	Engine Calibration. The procedure during the engine calibration shall be such as to establish the performance characteristics complete engine at all inlet air temperature ratings. Prior to the beginning of the calibration the engine shall be cleaned using the wash procedure and all engine controls shall be adjusted and shall not be readjusted throughout the calibration. Calibrations shall be made initially with no customer accessory power extraction and no bleed air extraction other than that required for continuous engine operation.		X
6.	Customer Bleed Air Analysis		X
7.	Endurance Test: a. Initial Stair-Step/Bodie Test(5 hours) b. Mission Oriented Schedule (at least 60 hours) c. Final Stair-Step/Bodie Test (5-hour)		X
8.	Engine inspection, maintenance and calibration after endurance test		X
9.	Engine Recalibration		X
10.	Engine disassembly and inspection	X	
11.	Engine Component Tests shall be conducted on components conforming to the same parts list and configuration used on the PFR endurance test.		X
12.	Explosion proof test of all electrical components, including electrical connectors, not hermetically sealed shall be carried out		X
13.	Fuel pump altitude test		X
14.	Oil reservoir pressure test		X
15.	Fire test of Lines, fittings and components, including enginefurnished oil tank, which convey flammable fluids		X
16.	Altitude test of the engine, conforming to the same parts list and configuration as the endurance test engine, shall be carried out, which shall consist of operation and air starting checks at several		X

	selected conditions within the flight envelope specified for the engine and at least those specified in the engine specification. The test points shall include the effects of power extraction, inlet recovery; bleed air extraction, inlet distortion and windmilling on engine performance and stability. Control system adjustments shall not be made without approval of Certification Authority.		
17.	Structural tests: <ul style="list-style-type: none"> • Engine Pressure Vessel/Case Verification. 		X
18.	Rotor Integrity tests <ul style="list-style-type: none"> • Over-speed test • Over-temperature test • Disk burst test 		X
19.	Engine static load test		X
20.	Engine attitude test		X
21.	Engine pressure balance verification		X
22.	Heat Rejection and oil Cooling test	X	
23.	Engine electrical power failure tests		X
24.	Engine Vibration Survey	X	
25.	Bleed air system test		X
26.	Oil flow interruption Test		X
27.	Verification of starting torque and speed requirements		X
28.	Electromagnetic Interference and susceptibility test		X
29.	Electromagnetic Pulse test		X
30.	Lightning Test		X
31.	Induced transients tests shall be made on all electrical and electronic systems and components.		X

Completion of PFR

Completion of PFR is achieved when the tests, demonstrations and analyses of Table-1 and Table-2 have been successfully completed and approved by the Certification Authority, when the following conditions are satisfied:

- a) The engine and engine components meet the service limits.
- b) There are no part failure/ impending failure which might compromise safety of flight.
- c) All failures and problems encountered during the test and any additional engine developmental testing have been documented, analyzed and resolved to the satisfaction of the User Service.
- d) Performance during the engine recalibration; SFC is within 105% and thrust is at least 95% of the initial calibration values.

e) Flying Test Bed (FTB) trials can also be carried out in addition to the tests/analyses specified in this section.

Guidelines on the Documents to be submitted at PFR

- Reports of all analyses specified in Table-1 shall be submitted to RCMA(Engines) prior to the initiation of PFR tests on engine.
- Reports of all the Tests in Table-2 duly authenticated by DGAQA shall be submitted to RCMA(Engines)
- Reports of additional tests/analyses if any
- Reports of all failures and problems encountered during the test
- Reports of all inspections carried out prior, during and post-PFR
Guidance Material on Initial Flight Release (IFR)

This phase of qualification is intended to clear the engine for safety of flight release. IFR configuration of the engine shall incorporate changes identified during PFR phase.

Note:

(1) Pre-PFR Analyses and component/system tests carried out to meet PFR requirements need not be repeated unless there is a change in the component/system configuration from that of PFR.

(2) Additional analyses, demonstrations and tests required for IFR are only presented in this section.

Altitude Tests

Following altitude tests if not carried out during PFR. Additional altitude tests if it is called for based on configuration changes.

- Altitude rating points
- Transient operation
- Functional Tests
- Inlet distortion tests
- Starts & restarts
- Altitude windmilling test

Guiding Material on Additional tests based on configuration upgradation

Accelerated Mission Test (AMT) (as applicable)

An AMT (as applicable) will be performed on the IFR engine configuration. The recommended minimum test duration will be two times (2X) the initial flight test usage. This test will be completed prior to first flight.

LCF Test (as applicable)

LCF test time must be at least twice the proposed/actual flight test time.

Gearbox Tests (as applicable)

- Static Torque Test
- Attitude Test
- Endurance Test
- Oil Interruption Test

Flying Test Bed (FTB) trials can also be carried out in IFR.

Guidance Material on Full Flight Release (FFR)

FFR clears the engine for initial low rate production. FFR configuration incorporates changes suggested during IFR.

Full altitude Qualification Test

Full altitude qualification is conducted during FFR covering

- Steady state & transient performance
- Air starts and relights
- Alternate fuels
- Compressor stability
- Secondary flow, thermal mapping etc.
- Hot and cold day tests
- Effect of power extraction

Accelerated Mission Test (AMT)

An AMT shall be performed on the FFR engine configuration. The minimum test durations shall be one-half the design service life at full flight release (FFR).

LCF Test: For FFR, the LCF test time must be at least twice the proposed/actual flight test time.

Guidance Material on Additional tests based on engine configuration changes.

Simulated operational Component Tests (as applicable)

Simulated operational Component Tests shall be carried out on the following systems as applicable:

- a) Ignition system
- b) Fuel system
- c) Anti-icing system
- d) Hydraulic system
- e) Engine control system
- f) Temperature sensing system
- g) Actuation components

The component simulated mission test program shall consist of three endurance tests:

- 300 hours at high temperature
- 400 hours at room temperature

- 300hours at low temperature

Environmental Component Test (as applicable)

- Humidity
- Fungus
- Explosion-Proof
- Sand and Dust
- Sustained Acceleration
- Impact
- Vibration
- Ignition System Fouling
- Carbon Fouling
- Water Fouling

Individual Component Testing (as applicable)

- Oil Reservoir: cyclic fatigue test, proof pressure test, valve tests
- Accessory Drive and power Takeoff
- Generator/Alternator: Over speed, load test, containment test
- Heat Exchangers
- Fire Test
- Hydraulic System

Engine Environmental and Ingestion Tests: (as applicable)

- Sea Level High and low Temperature Tests
- Starting and Acceleration Tests
- Water Saturated Fuel Test
- Environmental Icing Test
- Corrosion Susceptibility
- Bird Ingestion Test
- Foreign Object Damage Test
- Ice Ingestion Test
- Sand and Dust Ingestion
- Atmospheric Water Ingestion
- Armament Gas Ingestion
- Noise Survey
- Exhaust Gas Emission
- Exhaust Smoke Emission
- Invisible Exhaust Mass Emissions
- Survivability and Vulnerability test or analyses of the engine to determine its capability in hostile environments as specified by the user

Engine characteristics and Fuel Test (as applicable)

Alternate Fuel Test: Endurance test using the alternate fuel if specified in the engine specification.

Emergency Fuel Test: Test of at least six hours duration using the emergency fuel if specified in engine specification.

Structural Tests: (if not covered during IFR)

- Pressure vessels & case
- Containment Test
- Rotor Structural Integrity
- Vibration and stress test
- Gyroscopic test
- Engine over-temperature control system test
- Maintainability/maintenance demonstration

Guidance Material on Initial Service Release (ISR)

ISR clears the engine for full rate production. ISR configuration incorporates changes suggested during FFR

Altitude qualification, if any required

Accelerated Mission Test (AMT)

An AMT shall be performed on the full-scale development engine configuration. The minimum test durations will be one times (1X) the design service life at initial service release (ISR).

LCF Test

For ISR, the length of the LCF engine test will be equivalent to 1/2 of the cold section life, or 1/2 of LCF life, or 4000 cycles, whichever is longer.

Additional qualification tests based on engine configuration changes.

Component and Engine Environmental Tests if not completed earlier or if re-qualification is required, to be carried out as per certification agency requirements.

Guidance Material on Operational Capability Release (OCR):

OCR Clears the engine for release to service.

Accelerated Mission Test (AMT)

Accelerated Mission Test will be performed on a production-tooled engine configuration.

The minimum test duration will be one times (1X) the design service life at operational capability release (OCR). AMT of any proposed design changes will be conducted to a duration of one times (1X) the design service life at OCR.

LCF Test: For OCR, the length of the LCF engine test will be equivalent to 1/2 of the cold section life, or 1/2 of LCF life, or 4000 cycles, whichever is longer.

Guidance Material on Test requirements for ab-initio Design, Development and/or
Derivative Piston/Wankel Rotary Engines

Qualification Tests for Piston Engines:

Ab-initio Design & Development Diesel Engines and/or Diesel Engines developed from automotive engines shall have to undergo certification & qualification tests which include material level, system/sub-system level and engine level before fitment of engine on Unmanned Air Vehicles for flight trials. List of engine & system level tests are as given below:

Engine Level Tests:

- Engine Performance / Ratings & correction
 - Full & Part Throttle Performance tests
- Starting Tests
 - Start / Stop
 - Low temperature starting
- Acceleration / Deceleration Tests
- Calibration tests
- Thermal Shock test
- Thermal Cycle tests
- Over speed
- Over temperature
- AMT / Endurance / Mission Cycle Tests / TBO Validation Tests
- Engine - Propeller System Tests
- Vibration tests
- Attitude Tests
- Altitude Tests
- Environmental tests
- Any other tests as deemed necessary by Certification Authority.

System Level Tests:

Turbo Charger (TC) Tests:

- TC performance on engine - On engine dynamometer
- Temperature Survey Test - On engine dynamometer
- Oil supply test - On engine dynamometer
- Oil sealing capability test -- On engine dynamometer
- TC : Vibration Tests -- On engine dynamometer
- Burst test - TC Test Stand
- Containment test - TC Test Stand
- High Altitude trials- High altitude test set up
- Endurance & cyclic durability - On engine dynamometer

- Any other tests as deemed necessary by Certification Authority.

Propeller & Propeller Functioning Tests:

- Propeller Functioning
- Propeller Pitch Control
- Feather & Un-feather
- Reverse
- Engine-Propeller Vibration tests
- Any other tests as deemed necessary by Certification Authority.

FADEC:

- Theoretical analysis of Control Law & Algorithm and demonstration by engine tests
- Software IV & V
- HILS testing
- Any other tests as deemed necessary by Certification Authority.

Annex 21.B4.C: Guidance material / List of Technical publications/Manuals for engine/ subsystem

MANUAL TYPE	DESCRIPTION
General	Illustrated Parts List
	Engine Critical Alloys
	NDI Manual
Intermediate Level	Operation& Service Instruction
	General Information of the engine
	Support Equipment
	Accessory Removal Procedure
	Module Removal Procedure
	Module Dis-assembly Procedure
	Cleaning Procedure
	Inspection Manual
	Repair Manual
	Module Assembly Procedure
	Module Installation Manual
	Accessory Installation Manual
	A/B installation& inspection etc
	Test Cell Requirements/specification
Depot Level	Operation& Service Instruction
	General Information
	Support Equipment
	Accessory Removal
	Module Removal
	Module Disassembly
	Cleaning Procedure
	Inspection Manual
	Repair Manual
	Module Assembly Procedure
	Module Installation Procedure
	Accessory Installation Procedure
	A/B description, operation procedure, Inspection etc
	Test Cell parameters/test procedure

SUBPART C - AB-INITIO DEVELOPMENT OF AIRBORNE STORES LEADING TO TA / LOA / IMTSOA

Rationale

Airborne stores include all Parts & Appliances, Airborne General Stores, Aero Materials, Armaments, Flying Clothing, Fuel Oil Lubricants (FOL) etc, used in an Air System. Project for development of Airborne stores could be initiated on specific requirements by the user services. In addition, Design authority in Government, Public or Private Sector on their own may also initiate development activities considering the applicability of the same to the user services or export options. All Airborne Stores intended to be used in Air Systems shall be subjected to a certification and quality assurance process as agreed by the Technical Airworthiness Agencies (TAA), to ensure the Airworthiness for such stores.

On completion of design, development and evaluation of airborne stores including its associated software, and upon showing compliance with the Type Approval Basis, CEMILAC shall issue Type Approval/ IMTSOA/ LoA for Airborne Stores to the Design Organisation.

Applicability

- a. This subpart is applicable for the following types of development of Airborne Stores:
 - i. Ab-initio design and development of Airborne Stores, which includes Parts and appliances, LRUs, Accessories etc. leading to the issue of Type Approval. The regulations for such stores are covered under 21.C1.
 - ii. Ab-initio development of Air Armament Stores and Air Launched Weapons(excluding Air Launched Missiles) leading to the issue Type Approval. The regulations for such stores are covered under 21.C2.
 - iii. Ab-initio development of Airborne Stores, which includes materials, structural components, finished parts, electronic modules, software and firmware components, fuel, oil, lubricants etc leading to the issue of LoA. The regulations for such stores are covered under 21.C3& 21.C4
 - iv. Ab-initio development of Airborne Stores for which an IMTSO exists. The regulations for such stores are covered under 21.C5.
 - v. Design, Development and Evaluation of Software&Complex Electronic Hardware (CEH) as a part of Airborne Avionic Systems. The regulations are covered under 21.C6.
 - vi. Design, Development and Evaluation of re-usable / independent Software components and Complex Electronic Hardware (CEH) components. The regulations are covered under 21.C6.

- b. Airborne Stores for which specific user requirements does not exist, but are developed as technology demonstrators which will have potential applications with Indian Military Services, the development shall be as per Subpart I.
- c. Aircraft General Standard (AGS) parts need not be subjected to the certification process as explained in this subpart. Suitability of such components in respective applications shall be ensured by the design and development agency.

Contents

- i. 21.C1 - Ab-initio development of Airborne Stores leading to Type Approval
- ii. 21.C2 - Ab-initio development of Air Launched Weapons leading to Type Approval
- iii. 21.C3 - Ab-initio development of Materials leading to LOA
- iv. 21.C4 – Ab-initio development of Airborne Stores leading to LoA
- v. 21.C5 - Ab-initio development of Airborne Stores leading to IMTSOA
- vi. 21.C6 – Airborne /Ground System Software and Complex Electronic Hardware (CEH)

21.C1 - AB-INITIO DESIGN & DEVELOPMENT OF AIRBORNE STORES LEADING TO ISSUE OF TYPE APPROVAL

Rationale

All line replaceable stores shall have necessary approvals prior to its installation on the Airsystem. The design approval process certifies that the store complies with the airworthiness standards applicable for the intended Airsystem. The applicant shall show this compliance through analysis, reviews, tests and computations unless the article is identical to an already approved store.

Type Approval (TA) certifies that the store complies with the applicable Airworthiness Certification Criteria finalised for a specific Type of Airsystem. However, the use of the Airborne Store on a particular Airsystem is based on the inclusion of such store in the Build Standard of that Airsystem with the approval of CEMILAC.

Contents

- 21.C1.1 Applicability**
- 21.C1.2 User Requirements**
- 21.C1.3 Certification of Ab-initio Design and Developed Airborne Stores**
- 21.C1.4 Application for Airworthiness Assessment Coverage of Airborne Store**
- 21.C1.5 Demonstration of Design Organisation (DO) Capability**
- 21.C1.6 Airworthiness Certification Criteria**
- 21.C1.7 Type Approval Basis**
- 21.C1.8 Identification**
- 21.C1.9 Technical Specifications**
- 21.C1.10 Airworthiness Certification Plan (ACP)**
- 21.C1.11 Quality Assurance Plan**
- 21.C1.12 Configuration Control**
- 21.C1.13 Design and Development**
- 21.C1.14 Software & CEH Development**
- 21.C1.15 Test Rigs and Test Equipment**
- 21.C1.16 Test and Evaluation**
- 21.C1.17 Deviations**
- 21.C1.18 Defects During Development**
- 21.C1.19 Modification**
- 21.C1.20 Certificate of Airworthiness (CoA)**
- 21.C1.21 Flight Testing**
- 21.C1.22 Issue of Provisional Clearance**
- 21.C1.23 Compliance to Type Approval Basis**
- 21.C1.24 Application for TA along with Type Record**
- 21.C1.25 Issue of Type Approval**
- 21.C1.26 Transferability**

- 21.C1.27 Production of Airborne Store**
- 21.C1.28 Duration and Continued Validity**
- 21.C1.29 Record Keeping**

21.C1.1 Applicability

Regulation

The regulations contained in this subpart are applicable to Airborne Stores which are considered as Line Replaceable Units (LRUs)/accessories.

Acceptable Means of Compliance

- a. This subpart is applicable for Airborne stores which are considered as Line Replaceable Units (LRUs)/accessories for which a Technical Specification is approved by CEMILAC and are identified in accordance with Subpart Q of IMTAR.
- b. This Subpart may also be applied for Sub-Systems, which are a combination of LRUs/accessories and are intended to perform a specific function.
- c. LRUs and Sub-systems designed and developed by foreign firms on contract placed by Indian agencies and are meant for use by Indian Defence Services shall also be approved as per this subpart. However, the clearance shall be issued in the form of LoA.

Guidance Material

Nil

21.C1.2 User Requirements

Regulation

Requirement for the Airborne Store shall be resulting from a Service Qualitative Requirement (SQR) or from an Airsystem development process, which has potential application with Indian Military Services.

Acceptable Means of Compliance

- a. The requirement for the Airborne Store should be derived based on a Service Qualitative Requirement (SQR) from the user services.
- b. The requirement may also be derived from an Airsystem design & development or upgradation process or from an indigenous substitution process for Airborne Stores.
- c. A concept of Operation (CONOPS) for the Airborne Store should be arrived at based on the CONOPS of the intended Airsystem. The CONOPS should also be the basis for selection of the Applicable Airworthiness Codes and Criticality Level.

- d. The Criticality Level of the Airborne Store should be arrived at based on a System Safety Assessment (SSA) process.

Guidance Material

- a. A feasibility study may be undertaken by the DO to establish whether it is practicable to meet the requirements and also to identify the scientific and technical issues as well as to acquire an appreciation of the cost and time to complete the project.
- b. Based on the feasibility studies more precise Requirements may be evolved if considered necessary.

21.C1.3 Certification of Ab-initio Designed and Developed Airborne Stores

Regulation

- a. Ab-initio designed and developed Line Replaceable Units (LRUs)/accessories and Sub-systems that are intended to be operated on Indian Military Airsystems shall be Airworthiness Certified by CEMILAC.
- b. Such Airborne stores shall hold a valid Provisional Clearance (PC) or Type Approval (TA) prior to the Clearance for Service Use (CSU).

Acceptable Means of Compliance

- a. The approach to Certification and through life Airworthiness Certification Plan shall be in accordance with the regulations provided in this Subpart in the subsequent sections.
- b. CEMILAC shall be responsible for the Airworthiness Certification of the Airborne Store and DGAQA shall be responsible for the Quality Assurance during design & development as well as production.
- c. DGAQA is also responsible for the QA coverage of the stores during any maintenance activities carried out by organisations other than the user agencies.

Guidance Material

- a. The certification process comprises the following 07 major phases:
 - i. Phase 1– Establish and agree the Type Approval Basis (TAB).
 - ii. Phase 2 – Agree the Airworthiness Certification Plan (ACP)
 - iii. Phase 3 – Agree the Quality Assurance Plan
 - iv. Phase 4 – Demonstrate compliance with the TAB.
 - v. Phase 5–Review of Certification Evidence.
 - vi. Phase 6- Issue of Provisional Clearance / Type Approval
 - vii. Post Certification Activities

- b. The Type Approval Data Sheet(TADS) of the Airborne Stores shall be an input in framing the Clearance for Service Use(CSU) of the Airborne store. The Type Approval **should not** be issued until the Airborne Store is flight tested by the user and a feedback is provided thereof.
- c. Successful completion of the certification process for a new Airborne Store will result in CEMILAC issuing a Provisional Clearance or Type Approval to the Design Organisation.
- d. A PC or TA will certify that the Airborne Store:
 - i. Has been designed and developed by an approved organization(s).
 - ii. Meets the approved TAB, or that any Airworthiness provisions not complied with, are compensated for by controls, factors, or mitigations that provide an equivalent level of safety.
 - iii. Is supported by appropriate Technical Information and Maintenance manuals of the Store along with Type Record.
 - iv. Programmes for new Airborne Stores, for which CEMILAC/DGAQA have previously agreed with a certification plan, will result in the issue of PC/TA as per DDPMAS 2002. However, if the CEMILAC's Certification assurance activities conclude that the requirements of these regulations have been met in full, a PC or TA may be issued based on this Regulation.

21.C1.4 Application for Airworthiness Assessment Coverage of Airborne Store

Regulation

An application for certification and QA coverage to CEMILAC & DGAQA shall be made by the main contractor in a form and manner established by them respectively.

Acceptable Means of Compliance

- a. Main contractor shall apply to CEMILAC for airworthiness certification coverage.
- b. Main contractor shall apply to DGAQA for Quality assurance coverage.

Guidance Material

- a. The application shall include:
 - i. A description of the firm and its approval status
 - ii. A description of the store being developed
 - iii. Intended end use platform
 - iv. Timelines of the program
 - v. Scope of the program
 - vi. Any special conditions

21.C1.5 Demonstration of Design Organisation (DO) capability

Regulation

The organization responsible for the design and development of the Airborne Stores shall demonstrate its capability to TAA by demonstrating its approved Quality Management System (QMS) and by holding a Design Organisation Approval (DOA).

Acceptable Means of Compliance

- a. The Design Organisation (DO) (referred as the Main Contractor for the Airborne Store Design & Development) should have a Design Organization Approval(DOA) as per Subpart G, or should be in the process of obtaining such approval.
- b. The Main Contractor, shall apply to CEMILAC for DOA under the Design Approved Organization Scheme (DAOS) for the scope of design activities in accordance with Subpart G.
- c. The design organisation shall also hold an approval for its Quality Management System (QMS) from DGAQA or should be in the process of obtaining such approval.

Guidance Material

- a. Each applicant for, must allow DGAQA& CEMILAC or its authorised representatives to inspect its quality system, facilities, technical data, and any manufactured products or articles and witness any tests, including any inspections or tests at a supplier facility, necessary to determine compliance with this Subpart.
- b. Design Approved Organization Scheme (DAOS) - Subpart G
- c. QMS approval as per DGAQAQ guidelines

21.C1.6 Airworthiness Certification Criteria

Regulation

CEMILAC & DGAQA shall ensure that the Airborne Stores are approved against acceptable Airworthiness codes/standards.

Acceptable Means of Compliance

- a. The Airworthiness Codes shall be selected in accordance with the user requirements (PIDS/ASQR/JSQR/NSQR/TRD) or Minimum Operational Performance Specification and platform characteristics.
- b. Software and Firmware shall be developed in accordance with established Development Life Cycle standards.

- c. Formal approval shall be sought from the TAA for the use of alternative and appropriate specifications or Airworthiness codes.
- d. Special Conditions if any, for an Airborne store, **should** be approved by the CEMILAC if the related Airworthiness codes do not contain adequate or appropriate standards for the stores or for an element of its design.

Guidance Material

- a. TAB shall be derived from the Certification Criteria released by the Airworthiness authorities.
- b. TAB may also be derived from internationally available certification criteria documents.
- c. The Special Conditions may contain such standards that the CEMILAC/DGAQA finds necessary to establish a level of safety and performance equivalent to that established in the applicable Airworthiness codes. Special conditions may be arrived at in any of the following circumstances:
 - i. The Air System/Airborne Store has or may have novel or unusual design features relative to the design practices on which the applicable Airworthiness codes are based.
 - ii. The Airborne Store design usage assumptions do not match the intended military usage.
 - iii. Experience from other similar Air Systems/Airborne in service or having similar design features, has shown that 'unsafe conditions' may develop.
 - iv. Suitable Airworthiness codes do not exist for the concerned store or specific design feature.

21.C1.7 Type Approval Basis

Regulation

Main contractor and CEMILAC shall have a mutually agreed Type Approval Basis (TAB).

Acceptable Means of Compliance

- a. TAB should be prepared by main contractor and approved by CEMILAC. Any amendments to the TAB also should be approved by CEMILAC.
- b. TAB shall be effective for a period of 5 years from the date of approval. If PCC/TA is not achieved within that timeframe, a review of the changes to the Airworthiness criteria / codes / standards that defined the TAB will be required to assess any shortfall of agreed TAB against contemporary requirements.

Guidance Material

- a. TAB should be arrived at based on the applicable Airworthiness Certification Criteria (21.C1.6) and Airborne Stores Technical Specification (21.C1.9).
- b. Main contractor should also specify the way of compliance to every requirement listed in the TAB. The description on how compliance will be demonstrated, with proposed means of compliance and any selected guidance material. The description of the means of compliance should be sufficient to determine that all necessary data will be collected and compliance can be demonstrated.
- c. Main contractor may form committees with stake holders to look in to the adequacy of the proposed TAB.
- d. Compliance to TAB forms one of the basis for the issuance of TA and Clearance for Service Use.

21.C1.8 Identification

Regulation

All Airborne Stores shall be properly and uniquely identified prior to the installation on Airsystems and delivery to the user services.

Acceptable Means of Compliance

Airborne Stores shall have identification as per Subpart Q.

Guidance Material

Nil

21.C1.9 Technical Specifications

Regulation

The Main Contractor shall bring out a detailed Technical Specification for the Airborne Store that shall comply with the User requirements.

Acceptable Means of Compliance

- a. A Technical Specification Document to be prepared by the Main Contractor and approved by CEMILAC.
- b. The document shall take into account the User requirements and shall address the system level requirements and its dependency on the other systems.

Guidance Material

- a. User Requirement document as an input document.
- b. Main Contractor's preliminary investigations /studies defining the project.
- c. The Technical Specification document to specify the system architecture and top level specifications and interfaces that shall comply with the user requirements. Details referred at Annexure A shall also be considered as an input.
- d. There may also arise a need to revise the Technical specification as the development activities progress because of various reasons such as inability to implement the initial concepts or changes in the user's requirements. Such changes in the Technical Specification are regularised by issuing amendments to the Technical Specification through an established configuration control procedure (21.C1.18).

21.C1.10 Airworthiness Certification Plan (ACP)

Regulation

The Main Contractor **shall** propose to the CEMILAC an Airworthiness Certification Plan (ACP) that **shall** define the engagement with CEMILAC and the means to demonstrate compliance with the Type Approval Basis.

Acceptable Means of Compliance

- a. For a particular project as part of the engagement plan with Airworthiness Certification Authorities, the applicant shall prepare a Airworthiness Certification Plan (ACP).
- b. The certification plan can be developed step by step, when the information needed is not available at the beginning of the project.
- c. The ACP should be approved by the CEMILAC before compliance demonstration commences and updated as necessary during the Certification process
- d. If the store is already operationalised / flight tested in another program, the compliance checklist shall specifically identify the delta requirements to be demonstrated, if any.

Guidance Material

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a certification plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable Airworthiness codes/standards

- iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
- iv. Identification of relevant personnel making decisions affecting airworthiness and environmental protection interfacing with the Authority, unless otherwise identified to the authority.
- v. Major Project milestones and review stages with timelines.
- vi. Artefacts/documents generated at each stage
- vii. Software/Firmware considerations wherever applicable
- viii. Test equipment and Rigs
- ix. Route to Flight Testing – Safety of Flight (SOF) / Limited Qualification / Qualification Tests / Screening requirements
- x. Scope of Flight Test and details of Flight Test Agencies

21.C1.11 Quality Assurance Plan

Regulation

The Main Contractor **shall** propose to the DGAQA a Quality Assurance Plan that **shall** include the QA milestones and activities.

Acceptable Means of Compliance

The QAP should be approved by the DGAQA before compliance demonstration commences and updated as necessary during the Design, Development and Acceptance process

Guidance Material

- a. For a particular project and as part of the finalisation of QA milestones, the applicant shall prepare a QA Plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable inspection, process and acceptance standards
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Process flow & Stage wise inspection plan starting from raw material stage to finished product.

- vii. Involvement of internal & external agencies at various stages.
 - viii. Documents generated at each stage
 - ix. Clearance procedures at each stages
 - x. Handling and storage conditions.
- b. The description on how compliance with QA points will be demonstrated, with proposed means of compliance, and any selected guidance material.

21.C1.12 Configuration Control

Regulation

The Design Organisation shall have a proper configuration control mechanism to address the changes in baseline configuration of the stores as well as documents during Design and Development phase.

Acceptable Means of Compliance

- a. Configuration items should be uniquely identified, documented and controlled. This may include, but is not limited to, hardware, software, design representations of hardware and software, tools or other data items used for certification credit and baselines.
- b. A configuration management plan to be prepared at the beginning of the program. The plan shall describe the through life configuration management of all the identified configuration items.
- c. Change control and traceability of changes shall be maintained. This requires that life cycle data identified in the plans shall be secured and retrievable.
- d. Baselines for the configuration items to be established at appropriate intervals. Once the baseline configuration is established, changes shall be managed through Change Notes till the next release of configuration items.
- e. Problems should be uniquely identified, tracked and reported.
- f. Configuration Control Boards shall be constituted to address the changes proposed.
- g. Any change in requirements or incorporation of additional requirements shall be referred to CCBs.
- h. Changes resulting from Defect Investigation shall be referred to CCBs only when it calls for a requirement change or incorporation of additional requirements.
- i. Configuration Control Board to be chaired by Head of DO or by the Design Head of the project depending on the scope/level.
- j. The Configuration Control Board should also include the following members:
 - i. Rep Main Contractor responsible for design and development

- ii. Rep. Main Contractor responsible for Quality Assurance
- iii. Rep. Main Contractor responsible for manufacturing
- iv. Rep CEMILAC
- v. Rep DGAQA
- vi. Any external experts if required

Guidance Material

- a. Main Contractor to make a configuration management plan to full fill the objectives of configuration management through Configuration Control Boards during Design and development phase.
- b. Engineering Change Note (ECN) and Software Change Note (SCN) may be prepared by the Main Contractor to document the changes in baseline configuration. Change notes to be approved by CEMILAC.
- c. Baseline configuration items along with approved Change Notes (ECN& SCN) should be treated as the revised approved configuration.
- d. There shall at least two levels of CCBs. A Central Configuration Control Board (CCCB) shall address the changes in configuration which may affect multiple sub-systems or major performance enhancements. A Local Configuration Control Board (LCCB) shall address the changes in configuration which are confined to the Airborne Store/System.
- e. If found appropriate, CCBs at different levels also may be created.
- f. Configuration management plan shall clearly differentiate the roles of each level CCBs in each program.

21.C1.13 Design and Development

Regulation

- a. The main contractor shall have a design & development process that results in the Airborne Store meeting the user requirements and the Type Approval Basis.
- b. TAA and user agencies should be involved from conceptual stage of the project in various reviews and evaluation.

Acceptable Means of Compliance

- a. The design and development activities shall follow a System Engineering Life Cycle Process. A System Engineering Plan Document shall be prepared and the documents shall elaborate the design and development life cycle activities, responsibilities and milestones.

- b. Requirement Review, PDR and CDR shall be conducted for the stores/systems at appropriate stages.
- c. Certified tools only should be used to augment the Design process. The same should be ensured by the Main Contractor.
- d. Finalized Build Standard shall be approved by CEMILAC.
- e. The prototype unit shall be realized as per the build standard approved by CEMILAC in accordance with a QA process approved by DGAQA.
- f. Test and evaluation as per the applicable regulations.

Guidance Material

- a. The various activities in Design and Development process, leading to finalisation of the baseline configuration of the store to be subjected to test and evaluation, is elaborated in Annexure A to this Subpart 21.C1.
- b. For systems that have already been qualified for other platforms, TAB requirements shall be tailored accordingly while finalising the ACP

21.C1.14 Software and CEH Development

Regulation

Software and Complex Electronic Hardware (CEH) used in Airborne Stores shall comply with the applicable airworthiness regulations for the software and CEH aspects of airborne systems and equipment certification.

Acceptable Means of Compliance

- a. Developers of Airborne stores containing Software & CEH components shall demonstrate the means of compliance with Type Approval Basis for the Software & CEH aspects.
- b. Software & CEH shall be developed and tested in accordance with an established Development Life Cycle Process.
- c. The criticality level of the software & CEH shall be arrived at through a System Safety Assessment Process.
- d. The objectives of each stage of the Development Life Cycle shall be identified and Means of Compliance shall be arrived at.

Guidance Material

- a. Development and airworthiness evaluation of Software & CEH components shall follow the guidelines listed at Subpart C6.

21.C1.15 Test Rigs and Test equipment

Regulation

Test Rigs and Test equipment used to demonstrate the compliance to Applicable Airworthiness codes shall have necessary approvals from CEMILAC & DGAQA.

Acceptable Means of Compliance

- a. Test Rigs, Simulators, Test equipment etc with its associated software shall have necessary approvals prior to using for compliance demonstration in accordance with Subpart T
- b. Test Rig Software/Firmware shall be certified as per relevant certification criteria and in accordance with Subpart C6.

Guidance Material

- a. Test Rigs and Equipment shall be classified into the following categories as per Sub Part T:
 - i. Used only during Design and Development
 - ii. Used during Production
 - iii. Delivered to user services
- b. DGAQA directives on Qualification and acceptance of ground systems.

21.C1.16 Test and Evaluation

Regulation

The Airborne Store shall be subjected to necessary tests to ensure compliance with applicable Airworthiness codes and performance requirements as defined in the TAB & ACP prior to installation on Airsystem and flight testing.

Acceptable Means of Compliance

- a. The Airborne Store shall be subjected to necessary tests to ensure compliance with applicable Airworthiness codes and performance requirements as defined in the TAB & ACP prior to installation on Airsystem and flight testing.
- b. Test Rig specification, SOFTP/QTP and Functional Test Procedure shall be prepared by the Design agency and approved by CEMILAC before commencement of tests.
- c. Electrical and Bus ICD, Hardware Design Document and installation drawings shall be provided by the design agency to CEMILAC for reference.

- d. Design changes, if necessary during the evaluation process shall be only with the concurrence of CEMILAC.
- e. Software certification shall be carried out for all the software components in the system.
- f. The test results and compliance chart, both endorsed by DGAQA shall be analysed by CEMILAC for clearance.

Guidance Material

- a. A detailed description of Test and Evaluation process is provided as Annexure B to this Subpart 21.C1.
- b. Safety of Flight Test (SOFT) approach may be followed for ensuring the Airworthiness aspects of the Airborne Store prior to installation on the Aircraft as much as possible. Qualification tests may be carried out only after achieving considerable level of confidence on performance on the store.
- c. When reviewing any test report or activity, the independent checking function of the Design Organization is made to ensure:
 - i. That materials and processes adequately conform to the specifications for the proposed Type Design.
 - ii. Those parts of the Airborne store adequately conform to the drawings in the proposed Type Design.
 - iii. That the manufacturing processes, construction and assembly adequately conform to those specified in the proposed Type Design.
 - iv. That the test equipment and all measuring equipment used for tests are adequate for the test and are appropriately calibrated.

21.C1.17 Deviations

Regulation

A Non-Conformance Review Process shall be established to address the deviations observed in specifications, performance or manufacturing with respect to the baseline configuration during the design and development phase.

Acceptable Means of Compliance (AMC):

- a. Any Deviations observed during manufacturing, assembly and performance evaluation of Qualification Prototypes and Prototype Deliverables, whether it is temporary or permanent in nature, shall be referred to CEMILAC for its disposition considering the scope of development activities.

- b. A Non-Conformance Review Board (NCRB) shall be constituted by the Main Contractor for the disposition of those deviations which are permanent in nature, or which cannot be resolved in subsequent phases of development.
- c. NCRB shall be chaired by the Design Head of the Main Contractor responsible for design & development activities. The board may co-opt members from other agencies in the respective domain.
- d. Non-Conformance Review Board shall comprise members from:
 - i. Main Contractor responsible for design & development activities
 - ii. CEMILAC
 - iii. DGAQA
 - iv. User agencies (if part of the project team)
 - v. Quality department of Main Contractor responsible for design & development activities
- e. The board may recommend additional analysis/testing to assess the implications of the deviation. The same shall be carried out by the Main Contractor and submitted to the Board.

Guidance Material

- a. Deviations observed during manufacturing/assembly of qualification prototypes and prototype deliverables may be analyzed thoroughly by the Main Contractor and referred to CEMILAC for disposition.
- b. CEMILAC may refer those deviations which may become permanent across units or which may have implications on Qualification / Performance of the unit to the NCRB for disposition.
- c. The NCRB may study the implications of the reported deviation on the aspects viz. Function, Strength, Safety, Life, Interchangeability and Maintenance of the store etc. A decision on acceptance of the deviation with or without any limitations/restrictions or rejection of the part/ unit may be taken accordingly.
- d. The board may also scrutinize the possible causes for occurrence of the deviation and suggest suitable remedial measures to avoid such recurrences to the agencies concerned.

21.C1.18 Defects/Failure Reporting

Regulation

The defects/ failures in Airborne Stores observed during design and development phase shall be properly investigated and remedial measures shall be incorporated.

Acceptable Means of Compliance:

- a. A Defect Investigation Committee (DIC) shall be constituted for each development project with members from Designer, QA, CEMILAC, DGAQA and user services (wherever applicable). The QA head shall chair the DIC.
- b. DIC may co-opt expert members from external agencies if required.
- c. Defect Investigation committee shall analyze the failure / defect and identify the reasons there off and suggest remedial measures. These details should be endorsed in the defect investigation report and signatories to this report are members of the DIC.
- d. If the Defect Investigation results in the incorporation of any new requirements, same shall be referred to Configuration Control Boards (CCBs).

Guidance Material

- a. The defects / failures shall be reported by the main contractor in appropriate formats.
- b. The DIC may be chaired by a domain expert, not part of organization responsible for design and development activities.
- c. Main contractor should forward a modification proposal to CEMILAC based on the remedial measures suggested by the DIC as a Change Note.
- d. Main Contractor along with CEMILAC will finalise the required modifications and evolve the evaluation mechanism for improvements to be implemented.
- e. The main contractor has to compile failures / defects, their analysis and corrective action taken and forward to CEMILAC and DGAQA at regular intervals.

21.C1.19 Modification

Regulation

Modifications to the baseline configuration of the Airborne Stores during the design and development stages are to be properly accounted for.

Acceptable Means of Compliance

- a. Any deviations from functional / performance requirements or failures during qualification/ground / flight testing of the Airborne Stores during the design and development phase may leads to some modifications in the baseline configuration (Ref 21.C1.16)
- b. Modification may also arise due to incorporation of new requirements, improvement in functionality, reliability, maintainability, testability etc. (Ref 21.C1.19)

- c. Modifications cleared by the DIC or CCBs (21.C1.17& 21.C1.18) shall be documented by main contractor in the form of ECNs & SCNs.
- d. Approved ECNs & SCNs by CEMILC shall be the basis for incorporating Modifications.
- e. Implementation of modification will be carried out by main contractor.

Guidance Material

Any modification to the baseline configuration shall be carried out in accordance with 21.C1.18.

21.C1.20 Certificate of Airworthiness (CoA)

Regulation

Airborne Stores shall hold a valid Certificate of Airworthiness prior to installation on an Airsystem.

Acceptable Means of Compliance

- a. Airborne Stores shall be issued with a CoA as per Subpart H prior to flight testing.
- b. The acceptability of Design and Build Standard of the prototype deliverables for installation & integration on Military Air Systems shall be approved by CEMILAC through an instrument named "Clearance for Aircraft/ Airsystem Integration".
- c. Compliance Statement to mutually agreed requirements for issue of clearance for prototype deliverables duly signed by Main Contractor and DGAQA
- d. Clearance for Installation & Integration of the accessory bearing a unique clearance number issued by CEMILAC.
- e. CoA shall be issued by DGAQA for flight trials based on the availability of Clearance for Aircraft/Airsystem Integration from CEMILAC.
- f. On completion of Airsystem Integration checks, CEMILAC shall issue a Flight Clearance (FC) for the Airborne Store, which shall subsequently form the basis for the Flight Testing of Airsystem.

Guidance Material

- a. After successful completion of analysis, simulation and testing on qualification prototypes deemed necessary and sufficient for permitting installation & integration of the accessory on Military Air Systems, the Main Contractor can approach CEMILAC for issue of "Clearance for Integration on Airsystem".

- b. The extent of analysis, simulation & testing required for issue of this clearance shall be based on Type Approval Basis (TAB) and compliance to which should be demonstrated by the Main Contractor prior to requesting for issue of clearance for prototype deliverables.
- c. The scope of clearance for prototype deliverables shall be limited only to installation & integration of the accessory on Military Air Systems and not its flight trials. Clearance for flight trials of the accessory shall be issued by CEMILAC.
- d. The Clearance for Aircraft/Airsystem Integration may contain the following but not limited to:
 - i. Reference to the letter of Main Contractor requesting for issue of clearance
 - ii. Brief Introduction of the store
 - iii. Clearance (Scope of the clearance)
 - iv. Validity of the Clearance
 - v. Performance Feedback requirement
 - vi. Basis of Clearance and List of Applicable Documents and Drawings including the technical specification, test documents, test reports, SOP, compliance matrices and minutes of meetings etc
 - vii. Limitations of the Clearance, if any
 - viii. Conditions of Clearance
 - ix. Significant Technical Parameters
 - x. Any other information deemed necessary

21.C1.21 Flight Testing

Regulation

Flight testing of Airborne store **shall** be carried out for the purpose of evaluating performance in accordance with the Means of Compliance finalized with the Type Approval Basis.

Acceptable means of Compliance

- a. Flight testing shall be carried out in accordance to Regulations of Subpart P.
- b. The Airborne Store shall hold a Flight Clearance (FC) from CEMILAC prior to the clearance of Airsystem for flight testing.
- c. The Airsystem shall hold a valid CoA prior to Flight Testing.

Guidance Material

- a. Necessary Clearances for integration of the store on the platform shall be issued by TAA.

- b. Ground Testing of Airborne store installed on Aircraft as per Means of Compliance finalised in TAB shall be completed.
- c. A Flight Test Plan shall be prepared by Airsystem Integrator in coordination with the Main Contractor and flight test agencies.
- d. Flight Test Plan approved by CEMILAC should be the basis for flight testing.
- e. For ab-initio developed or upgraded Airsystem for which DGAQA gives QA coverage, CoA shall be issued by DGAQA on the form of Form 1090.
- f. For flight testing of Airborne Store on certain service Airsystem for which DGAQA doesn't provide QA coverage, updated and approved Form 700 or equivalent document shall serve the purpose of CoA. Form 700 amendment shall be based on the Flight Clearance issued by CEMILAC.

21.C1.22 Issue of Provisional Clearance

Regulation

A Limited Series Production of the Airborne Store shall be taken up on the completion of development flight trials of the store to an acceptable level mutually agreed among the Airsystem integrator, main contractor and CEMILAC.

Acceptable Means of Compliance

- a. The DO **shall** be issued with a Provisional Clearance when CEMILAC has accepted that the requirements of TAB have been met to an acceptable level.
- b. Provisional Clearance (PC) shall be the basis for DGAQA to carry out acceptance of Limited/Series Production stores.
- c. PC shall be valid for a period of two years. PC shall be extended a maximum of two times, prior to the issue of Type Approval.
- d. In cases of LRUs where hardware is developed by third party suppliers and software by main contractor, if any limited/series production requirements of the hardware is envisaged prior to flight trial completion, a Letter of Acceptance (LoA) as explained in Subpart C2 may be issued for the hardware part on completion of satisfactory performance evaluation.

Guidance Material

- a. The evaluation as per ACP should be completed. Compliance report along with application for PC should be submitted by DO.

- b. In cases the application software development is being continued for longer durations and the hardware performance has been established to satisfactory levels, PC shall be issued with such limitations.
- c. The Main contractor can approach CEMILAC for PCC even if complete certification requirements have not been fully completed covering the whole type design and the corresponding documentation, but the certification evidence has been demonstrated to the satisfaction of the User Service and CEMILAC for partial compliance of type design and all the safety of flight tests/analysis have been satisfactorily completed.

21.C1.23 Compliance to Type Approval Basis

Regulation

After successful completion of design, development and evaluation phases, the Main Contractor shall prepare compliance to requirements listed in TAB in the form of Type Approval Data Sheet (TADS).

Acceptable Means of Compliance

- a. The Main Contractor should prepare TADS along with the supporting evidences for submission to CEMILAC along with the application for issue of TA.
- b. All the supporting evidences towards the configuration management process followed during development also should be included.

Guidance Material

- a. Non-compliances to TAB requirements, if any should be clearly brought out with proper analysis reports bringing out their impact on type certification.
- b. Limitations arising at any phase of the store development should be clearly brought out in TADS with proper justification for their temporary / permanent acceptance.

21.C1.24 Application for TA along with Type Record

Regulation

An application for a TA **shall** be made by the Main contractor as per the prescribed forms and formats given by CEMILAC along with supporting documents.

Acceptable Means of Compliance

The application for TA shall be in the prescribed format including the necessary supporting documents.

Guidance Material

- a. The application **should** be accompanied by Design Data of the Airborne store including the operating characteristics and limitations.
- b. CEMILAC Directive on Type Approval should be followed while forwarding the TADS to CEMILAC.
- c. The data required for TADS for the stores / systems may include, but not limited to, the following information / documents.
 - i. Technical specifications
 - ii. Design documents
 - iii. Drawings
 - iv. Certificate of Design
 - v. Test schedule
 - vi. Test reports
 - vii. Photograph of the product
 - viii. Brief description of the product
 - ix. Basis for approval
 - x. Storage conditions and life
 - xi. Performance certificate/feedback from users
 - xii. Provisional clearance and its validity
 - xiii. Compliance statements to the specifications/ Test schedule
 - xiv. Duly filled type approval Performa
- d. Wherever applicable, the supporting evidences to be approved by authorities responsible for the same.

21.C1.25 Issue of Type Approval

Regulation

CEMILAC shall issue the Type Approval for the store when the compliance with TAB is established and the feedback from the user services are satisfactory

Acceptable Means of Compliance

- a. The main contractor **shall** be issued with a Type Approval when CEMILAC has accepted that the requirements of TAB have been fully satisfied and confirmed that the main contractor is appropriately placed in terms of resourcing, contractual position and access to design information to manage the TA and production if any.
- b. TA shall enable the Main Contractor to initiate the series production of the store if a Production Organisation Approval as per Subpart G is established with.

Guidance Material

Nil

21.C1.26 Transferability

Regulation

- a. If a TA is to be transferred, the transfer shall be made only to a Design Organisation who will be able to fulfil the responsibilities of MTC holder as defined.
- b. The TA shall not be transferred to a non-Indian entity.

Acceptable Means of Compliance

- a. The TA transfer should be made with the agreement of CEMILAC.
- b. TA transfer should not be made when the same TA is suspended or withdrawn by CEMILAC.
- c. The TA issued assumes usage in the Indian Environment only and needs to be redefined in scope for further transferability.

GuidanceMaterial

Nil

21.C1.27 Production of Airborne stores

Regulation

Limited Series or Series Production of the Airborne store may be taken up by a Production Organisation on Receipt of PC or TA for the respective Store.

Acceptable Means of Compliance

- a. PC/TA holder may take up limited/series production of the Airborne Store.
- b. If the PC/TA holder and Production Organisation are different, necessary Transfer of Technology shall be carried out.
- c. For production of Airborne Store, Provisions in Subpart F shall be followed.

Guidance Material

- a. Production of Airborne Store shall be carried out as per provisions provided in Subpart F.
- b. Broad guidelines for ToT in case the PO is different than DO, is given at Annexure C.

- c. TA is a design-cum-production certificate. Hence TA holder can take up production of Airborne Store after obtaining production organization approval.

21.C1.28 Duration and Continued Validity

Regulation

TA shall remain valid for life subject to the conditions specified, Design Organization remaining in compliance with and providing that the Approval has not been suspended or revoked.

Acceptable Means of Compliance

- a. Upon notification of suspension or revocation, the TA should be surrendered to the CEMILAC and the users to be informed.
- b. The DO should inform the CEMILAC and users as soon as practicable when he is no longer able to meet the Type Certificate Holder responsibilities.
- c. It should be the responsibility of the main contractor to obtain feedback from services periodically and submit the same to TAA along with failure data.
- d. Any re-qualification based on study of failure data shall be projected by the TAA and the same shall be carried out by the main contractor.

Guidance material

- a. If the TA Certificate has been suspended, then it should be revoked before it could be considered for TA Renewal after satisfying the conditions that has resulted in the suspension of TA.
- b. The Main Contractor should update all the TA documents with the latest hardware and software modifications/updates which are approved in accordance with Subpart E.
- c. The Main Contractor should prepare the updated TA documents absorbing all such modifications/updates and forward along with feedback from user services to CEMILAC every five years or during any renewal of TA by the CEMILAC.
- d. TA renewal should be applied in the appropriate format with the supporting documents as stipulated. However, renewal is mandatory only during the revoking of a suspended TA.

21.C1.29 Record Keeping

Regulation

- a. The main contractor shall ensure that all relevant design information inter-alia documents, drawings, QA records, test procedures, reports, for the identified Airborne Store are held by the appropriate DO.
- b. The TAA shall ensure that all relevant Specifications, baseline build standard details, test reports and inspection records of the Airborne stores are held by the appropriate AHSP.

Acceptable means of compliance

Documentation should be held in order to provide the information necessary to ensure the Type Airworthiness and Continued Airworthiness of the Airborne stores and should be retained for a minimum of 5 years beyond the aircraft Out-of-Service date.

Guidance Material

- a. The Main Contractor in consultation with TAAs shall identify all the records that needs to be archived and details like the mode of archival, the periodicity of accounting audit.
- b. All master copies of production documents of Airborne stores which are delivered to user services are held with Authority Holding Sealed Particulars (AHSP) i.e. DGAQA HQ, New Delhi. Any changes to these documents are affected with the approval of CEMILAC after recommendation of DO.

ANNEXURE A

Design and Development

The different stages of development of the store leading to the finalisation of baseline build standard to proceed with test and evaluation are explained here.

a. Finalization of Technical Specification

- i. The detailed Technical Specifications shall be finalised prior to the start of the design and development activities. The document shall, but not limited to include:
 - Functional and performance requirements
 - Safety requirements
 - Environmental requirements
 - Applicable specifications and standards followed
 - Interface and Integration requirements
 - Maintainability requirements
 - Reliability Requirements
 - Lifting requirements
- ii. The requirements may be for an ongoing Air System program under development Stage or for an already existing platform in service use.
- iii. The requirement specification need to be approved by CEMILAC prior to the initiation of design activities. If the Air System integrator is outsourcing the development activities to a third party developer, approved requirement specification shall be a part of contract document.
- iv. Results and analysis generated during feasibility study may be taken as input for finalization of Requirement specification.
- v. Requirement Specification shall be reviewed by a Requirement Specification Review Committee consisting of members from”
 - Organization originating requirements
 - User Services
 - CEMILAC Rep
 - DGAQA Rep
 - Contractor responsible for design and development
 - Domain Expert
- vi. The committee is to be constituted by Air System Integrator / main contractor and shall be chaired by a domain expert not part of organization responsible for design and development activities.

b. Preliminary Design Review

- i. PDR shall be a formal technical review and the objective of PDR is:
 - To have clear understanding of all the parameters of technical specification
 - To evolve the approach for implementation of design architecture to meet the entire technical specification.
 - To ensure complete testability of the accessory.
- ii. Following documents are required before PDR:
 - Approved Technical specification of accessories
 - Broad approach for implementation of design architecture / details prepared by contractor.
 - Test plans
- iii. After completion of PDR, the Minutes of Meeting bringing out the required changes in documents and broad approach to design implementation is to be released.
- iv. The necessary changes suggested by committee in the documents and preliminary design are to be implemented by contractor.
- v. All the documents necessary for the review shall be given to each member at least 15 days prior to the date of the PDR meeting.
- vi. Preliminary design documents may include following but not restricting to:
 - Preliminary design approach of accessory
 - Design study reports / results.
 - Functional flow diagram
 - Requirement allocation
 - Safety & security engineering considerations
 - Preliminary list of materials / parts and processes
 - Preliminary reliability / maintainability / availability data
 - Testing limitations and test facility availability
 - Weight & structure analysis
 - Thermal design aspects

c. Constitution of Preliminary Design Review Committee

- i. PDR committee should be made by contractor responsible for design and development activities. The PDR Committee consisting of members from:
 - Contractor responsible for design and development
 - CEMILAC Rep
 - DGAQA Rep
 - Domain Expert
 - Organization originating requirements
- ii. The committee is to be chaired by domain expert not part of organization responsible for design and development activities.

d. Critical Design Review

- i. The critical design review shall be conducted to ensure that the detail design solution and engineering drawings satisfy the technical requirements of the technical specification
- ii. CDR shall be a detail technical review and the objective of CDR is:
- iii. To ensure adequacy of detail design for meeting the technical requirement as per specification
 - To establish baseline Standard of Preparation for facilitating fabrication of accessories.
- iv. Followings documents are required before PDR:
 - Approved Technical specification of accessories
 - Deatil approach for implementation of design architecture / details prepared by contactor.
 - Test plans
- v. After completion of CDR, the Minutes of Meeting bringing out the required changes in documents and detail approach to design implementation is to be released.
- vi. The necessary changes suggested by committee in the documents and in design are to be implemented by contactor.
- vii. All the documents necessary for the review shall be given to each member at least 15 days prior to the date of the CDR meeting.
- viii. Testing must be considered at the earliest formulate stage of the aircraft stores and at the design stage of the individual store. Attempting to impose a testing system onto equipment already developed is seldom successful.
- ix. Detail design documents may include following but not restricting to:
 - Design analysis / study reports / results.
 - Functional flow diagram
 - Design details
 - Safety & security engineering considerations
 - List of materials / parts and processes
 - Reliability / maintainability / availability data
 - Testing limitations and test facility details
 - Test rig and test procedure details
 - Component Build standard
 - Thermal design analysis & results
 - Prototype test results
 - Safety analysis
 - Any limitations

e. Constitution of Critical Design Review Committee

- i. CDR committee should be made by contractor responsible for design and development activities. The CDR Committee consisting of members from:
 - Contractor responsible for design and development
 - CEMILAC Rep
 - DGAQA Rep
 - Domain Expert
 - Organization originating requirements
- ii. The committee is to be chaired by domain expert not part of organization responsible for design and development activities

f. Approval of Standard of Preparation

- i. Standard of Preparation (SOP) defines the build standard of the Airborne Store. The initial base line SOP document shall be finalized after completion of CDR activities.
- ii. Standard of Preparation encompass information on assembly, subassembly, components, details of engineering drawings, materials, processes which can be applied consistently for manufacturing of accessories.
- iii. Standard of Preparation shall be evolved by main contractor and approved by CEMILAC. Standard of Preparation shall be finalized after completion of CDR activities.
- iv. SOP should be in accordance with organizational practice capable of managing base-lining and change control.
- v. Any changes to the SOP subsequent to baseline document shall be made in accordance with a Configuration Management

Annexure B

Test and Evaluation

1. Testing of Prototype Store

- a. The Airborne Store need to be evaluated in for its functionality, performance and suitability to be operated in the intended Air Systems. An Airborne Store, prior to clearance for integration on Air Systems, shall be tested and evaluated for its performance and safety under intended operational conditions.
- b. The optimum mixture of on-board, built-in, flight line, depot level testing is likely to depend upon a particular Air System and its mission. In general, the minimum of on-board testing is desirable
- c. Mathematical modelling techniques are available for determining the cost effectiveness of alternative testing methods - and are essential when dealing with complex systems.
- d. A Means of Compliance matrix shall be arrived at to demonstrate the functional, performance and qualification requirements of the store against the requirement specification and shall be included in Technical Specification of the Store.
- e. An Airborne Store may be subjected to one of the following evaluation method prior to installation on the Air System
 - i. Safety of Flight Test
 - ii. Limited Qualification Test
 - iii. Full Qualification tests
- f. The Certification plan shall clearly specify the steps to be followed prior to installation on Air Systems. Wherever possible Safety of Flight Test approach shall be followed prior to flight trials for development evaluation.
- g. Qualification tests on the unit to be carried out only after achieving adequate level of safety and performance. However depending on the criticality of the store, the TAA shall decide on the tests and the same shall be included in the Certification Plan.
- h. Functional / Safety of Flight / Qualification Test procedure document shall be prepared by the Designer and approved by CEMILAC.
- i. A Test Adequacy Review Board (TARB) shall be constituted to check for the completeness of the test requirement.
- j. Prototypes built as per the approved Standard of Preparation shall be subjected to detailed qualification testing as per the test document approved by CEMILAC.
- k. Test reports for each test duly coordinated by ORDAQA/DGAQA

- l. Compliance statement to the approved test document duly signed by Main Contractor and CEMILAC
- m. The test document for testing of qualification prototypes shall be evolved by the Main Contractor in accordance with the existing Organizational Practices. It may be named as Qualification Test Schedule/Qualification Test Procedure/ Type Test Schedule.
- n. The test document shall be prepared by the Main Contractor and approved by CEMILAC. Various agencies of the Main Contractor viz. Design Department, Airworthiness Group, Quality Control/Assurance Department and Ground Test Department etc. may be the signatories for the Schedule.
- o. The draft test document shall be submitted to ORDAQA/DGAQA and their opinion on the same from the point of view of conduct of test and inspection/measurement of parameters shall be sought. However, final decision on inclusion of ORDAQA/DGAQA inputs shall be taken in consultation with CEMILAC.
- p. The test document for qualification prototypes shall be prepared in such a way as to test, demonstrate and establish compliance to all relevant technical requirements of the approved technical specification. The test document may contain the following but not limited to:-
 - ✓ Details of unit to be tested
 - ✓ Standard of Preparation of test unit
 - ✓ Objective of the tests
 - ✓ Applicable guiding standards for conduct of tests
 - ✓ Functional and performance tests
 - ✓ Environmental tests
 - ✓ Tests for extreme operating conditions
 - ✓ Strength and life building tests
 - ✓ Special tests required for the unit
 - ✓ Number of samples to be tested, distribution of test for each sample and sequence of tests if required
 - ✓ Test conditions and limitations
 - ✓ Procedures for each of the tests
 - ✓ Parameters required to be measured during testing
 - ✓ Instrumentation required for testing
 - ✓ Pass-Fail criteria for each of the tests
 - ✓ Schematics of test rigs and special equipment etc
- q. Tests shall be conducted only after approval of the test document by CEMILAC. All the stakeholders shall be intimated well in advance prior to start of tests for participation and witnessing the test. Rep of CEMILAC may witness the tests if so

decided by them. However, it is not mandatory for CEMILAC rep to be present during testing.

- r. All the test reports shall be duly coordinated by ORDAQA/DGAQA.

2. Testing of Prototype Deliverables:

- a. Prototype deliverables built as per the approved Standard of Preparation and earmarked for installation, integration and flight evaluation on Platform shall be subjected to acceptance testing as per the test document approved by CEMILAC prior to their release for use.
- b. Test document for prototype deliverables to validate quality of manufacturing and assembly through functional and performance tests to be approved by CEMILAC.
- c. Test reports for each test to be duly coordinated by ORDAQA/DGAQA.
- d. Clearance of the accessory by ORDAQA/DGAQA indicating satisfactory compliance to the approved test document.
- e. The test document for testing of prototype deliverables shall be evolved by the Main Contractor in accordance with the existing Organizational Practices. It may be named as Acceptance Test Schedule/Acceptance Test Procedure.
- f. The test document shall be prepared by the Main Contractor and approved by CEMILAC. Various agencies of the Main Contractor viz. Design Department, Airworthiness Group, Quality Control/Assurance Department and Ground Test Department etc. may be the signatories for the Schedule.
- g. The test document for prototype deliverables is a sub-set of the test document for qualification prototypes. The aim of test document for prototype deliverables is to define the tests necessary and sufficient to establish quality of manufacturing & assembly through functional & performance testing of each of the deliverables. The tests to be included in this document shall be chosen accordingly. The test document for prototype deliverables may contain the following but not limited to:-
 - ✓ Details of unit to be tested
 - ✓ Standard of Preparation of test unit
 - ✓ Objective of the tests
 - ✓ Applicable guiding standards for conduct of tests
 - ✓ Functional and performance tests
 - ✓ Tests for extreme operating conditions, if required
 - ✓ Test conditions and limitations
 - ✓ Procedures for each of the tests
 - ✓ Parameters required to be measured during testing
 - ✓ Instrumentation required for testing

- ✓ Pass-Fail criteria for each of the tests
 - ✓ Schematics of test rigs and special equipment etc
- h. Tests shall be conducted only after approval of test document by CEMILAC. Tests on prototype deliverables shall be witnessed by ORDAQA/DGAQA and reports thereof shall be duly coordinated by them.

3. Test Readiness Review:

- a. Preparedness for conduct of qualification testing of the accessory as per the approved test document shall be reviewed by the Test Readiness Review Committee (TRRC) in order to ensure smooth conduct of qualification testing.
- b. Go-ahead for conduct of testing by the Test Readiness Review Committee after closure of all action points.
- c. Preparedness for smooth conduct of qualification testing of the accessory i.e. availability of approved test document, qualification prototypes and the test rigs/measuring equipment/infrastructure adequate for conduct of test etc shall be reviewed by the test readiness review committee.
- d. Shortcomings/deficiencies, if any, hampering smooth conduct of tests shall be indicated to the Main Contractor by the test readiness review committee for necessary action.

4. Constitution of Test Readiness Review Committee:

- a. A Test Readiness Review Committee (TRRC) shall be constituted by the Main Contractor with the participation of all stakeholders to review preparedness for smooth conduct of qualification testing of accessory under design & development.
- b. Letter from the Main Contractor constituting the Test Readiness Review Committee (TRRC).
- c. Test Readiness Review Committee (TRRC) formed by the Main Contractor shall have members from the Design, Quality, Shop, & Testing Departments of Main Contractor, CEMILAC and ORDAQA. The committee may co-opt external experts also if required.
- d. Rep of Design Department of Main Contractor shall convene the meetings of TRRC and chair the meetings.

ANNEXURE C

1. Procedure for Transfer of Technology Airborne Store

- a. Airborne Stores after its acceptance by users services and issue of PC/TA, has to be produced in required numbers. Many times Design & Development Agency (Design Organisation(DO)) and Production Agency (Production Organisation (PO)) may not be the same. This section gives procedures and requirements to be followed and met during the production TOT in such cases.

2. Identification of production agency

DO will identify the production agency by following the process as given below:

e. Assessment of production agency

DO will assess the organization and infrastructure of the PO in respect of the following by forming a team for the purpose. Suggested team composition is given below:

- i. DO (Project officer): Team leader
- ii. QA representative of design agency
- iii. Certification agency
- iv. Quality Assurance Agency
- v. User Representative

f. Team should assess the production agency in respect of the following:

- i. Commitment of management to acquire technology and know how
- ii. Well defined organization and track record
- iii. Adequacy of specified plant, machinery for production and scope of expansion
- iv. Adequacy of suitable testing facilities
- v. Adequacy of qualified personnel
- vi. Procedure for document and data control
- vii. Any other points

3. Business Agreement

Once firm (PO) is assessed and recommended for TOT, a business agreement may be made between the DO & PO.

4. TOT Documents

The set of documents (not limited to) to be handed over by DO to the PO are listed below. The DO may identify and handover the relevant documents needed for production.

- i. Standard of preparation (SOP)
- ii. Standard of Equipment(SOE)
- iii. Description manual
- iv. List of raw materials (from approved source)
- v. Technical specification
- vi. Configuration document
- vii. Approved Drawings and master drawing index
- viii. Bill of materials
- ix. Method and process documents/Instruction sheets
- x. Manufacturing and assembly process, associated jigs and fixtures
- xi. Acceptance test plan/test schedules, inspection plan and key characteristic list
- xii. Test equipment Details
- xiii. Safety and operating instructions
- xiv. Trouble shooting
- xv. Do's & Don'ts
- xvi. Life
- xvii. Packaging, handling and storage instructions

5. Training and technology absorption by production agency

To facilitate faster technology absorption production agency shall organize training for the production team with assistance from design agency.

6. Repeat Type Test

To evaluate the technology absorption by PO, repeat type test are essential. Design agency will formulate the repeat type test schedule and approved by certification agency will be followed. On completion of the repeat type test CEMILAC may issue production clearance. Necessary changes to Type Approval shall be taken up by design agency.

7. Roles and Responsibilities:

- a. **Design Organisation (DO):** DO is responsible for vendor assessment, TOT document finalisation and supporting the PO till the establishment of production setup.
- b. **CEMILAC:** To ensure airworthiness through evaluation through repeat type test, production clearance.
- c. **DGAQA:** Responsible for Quality Assurance (QA) and acceptance of Airborne Store for service release.

SUBPART-C2: AB-INITIO DESIGN & DEVELOPMENT OF AIR ARMAMENT STORES AND AIR LAUNCHED WEAPONS LEADING TO ISSUE OF TYPE APPROVAL

Rationale

It is necessary to demonstrate that an air armament store's design meets appropriate safety and performance requirements. A systematic, independent Certification process is required towards this. The award of a Type Approval (TA) demonstrates that the air armament store has met the Design safety and performance requirements.

Contents

- 21.C2.1 Applicability**
- 21.C2.2 User Requirements**
- 21.C2.3 Certification of Ab-initio Design and Developed Air Armament Stores and Air Launched weapons**
- 21.C2.4 Identification**
- 21.C2.5 Technical Specifications**
- 21.C2.6 Airworthiness Certification Plan (ACP)**
- 21.C2.7 Quality Assurance Plan**
- 21.C2.8 Flight Testing**
- 21.C2.9 Production of the Air Armament Stores and Air Launched Weapons**

21.C2.1 Applicability

Regulation

The regulations contained in this subpart are applicable to Air Armament Stores and Air Launched weapons which are intended to be installed on Indian Military Airsystems.

Acceptable Means of Compliance

- a. This subpart is applicable for Air Armament Stores and Air Launched Weapons for which a Technical Specification is approved by CEMILAC and are identified in accordance with subpart Q of IMTAR.
- b. Air Launched Missiles (ALMs) are not covered under this Subpart. Subpart B3 is applicable for such systems.
- c. Air Armament Stores and Air Launched Weapons designed and developed by foreign firms on contract placed by Indian agencies and are meant for use by Indian Defence Services shall follow this subpart. However, the clearance shall be issued in the form of LoA.

Guidance Material

Nil

21.C2.2 User Requirements

Regulation

Requirement for the Air Armament Stores and Air Launched Weapons shall be resulting from a Service Qualitative Requirement (SQR) or from an Airsystem development process, which has potential application with Indian Military Services.

Acceptable Means of Compliance

- a. The requirement for the Air Armament Stores and Air Launched Weapons should be derived based on a Service Qualitative Requirement (SQR) from the user services.
- b. The requirement may also be derived from an Airsystem design & development or upgradation process or indigenous substitution of Airborne Stores.
- c. A concept of Operation (CONOPS) for the store should be arrived based on the CONOPS of the intended Airsystem. The CONOPS should also be the basis for selection of the Applicable Airworthiness Codes and Criticality level.

Guidance Material

- a. A feasibility study may be undertaken by the DO to establish whether it is practicable to meet the QR and identify the scientific and technical issues as well as to acquire an appreciation of the cost and time to complete the project.
- b. Based on the feasibility studies more precise QR are evolved if considered necessary.

21.C2.3 Certification of Ab-initio Designed and Developed Air Armament Stores and Air Launched Weapons

Regulation

- a. Ab-initio designed and developed Air Armament stores that are intended to be installed on the Indian Military Airsystems shall be Airworthiness Certified by CEMILAC.
- b. Such Airborne stores shall hold a valid Provisional Clearance (PC) or Type Approval (TA) prior to the Clearance for Service Use (CSU).

Acceptable Means of Compliance

- a. The approach to Certification and through life Airworthiness Assurance Plan shall be in accordance with the regulations provided at **Subpart C1** unless specifically elaborated.
- b. CEMILAC shall be responsible for the Certification of the Airborne Store and DGAQA shall be responsible for the Quality Assurance during design & development as well as production.
- c. DGAQA is also responsible for the QA coverage of the stores during any maintenance activities carried out by organisations other than the user agencies.

Guidance Material

- a. The certification process comprises the following 06 major phases:
 - i. Phase 1– Establish and agree the Type Approval Basis (TAB).
 - ii. Phase 2 – Agree the Certification Plan. (CP)
 - iii. Phase 3 – Agree the Quality Assurance Plan
 - iv. Phase 4 – Demonstrate compliance with the TAB.
 - v. Phase 5–Review of Certification Evidence.
 - vi. Phase 6- Issue of Provisional Clearance / Type Approval
 - vii. Phase 7- Post Certification Activities
- b. The Type Approval Data Sheet (TADS) of the Air Armament Stores and Air Launched Weapons shall be an input in framing the Clearance for Service Use(CSU) of the store. The Type Approval **should not** be issued until the store is operationally evaluated by the user and a feedback is provided thereof. For already Type Approved Stores, if changes in the Type Design is carried out, refer regulations on Modification as per **SUB PART E**.
- c. Successful completion of the certification phases for a new Air Armament Stores or Air Launched Weapons will result in CEMILAC issuing a Provisional Clearance or Type Approval to the Design Organisation.
- d. A PC or TA will certify that the Airborne Store:
 - i. Has been designed and developed by an approved organization(s).
 - ii. Meets the approved TAB, or that any Airworthiness provisions not complied with, are compensated for by controls, factors, or mitigations that provide an equivalent level of safety.
 - iii. Is supported by appropriate Air borne store Type Record, Technical Information and Maintenance manuals of the Store.
 - iv. Programmes for new Airborne Stores, for which CEMILAC/DGAQA have previously agreed with a certification plan, will result in the issue of PC/TA as per DDPMAS 2002. However, if the CEMILAC's Certification activities conclude that the

requirements of these regulations have been met in full, a PC or TA may be issued based on this Regulation.

21.C2.4 Identification

Regulation

Air Armament Stores and Air Launched Weapons which are properly identified only shall be cleared for installation on for Air Systems and subsequently delivered to user services.

Acceptable Means of Compliance

Air Armament Stores and Air Launched Weapons Should be identified as per Subpart Q

Guidance Material

Nil

21.C2.5 Technical Specifications

Regulation

The Main Contractor shall bring out the detailed technical specification that meets the User requirements.

Acceptable Means of Compliance

- a. System Requirement Specification Document to be made by the Main Contractor and approved by CEMILAC.
- b. The document shall take into account the User requirements and shall address the system level requirements and its dependency on the other systems.

Guidance Material

- a. User Requirement document
- b. Main Contractor's preliminary investigations /studies defining the project.
- b. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the user requirements.
- c. Detailed technical specification by the design agency is the starting point for progression of the activities in regards to design and development of the

system. The detailed technical specification must be agreed amongst CEMILAC, users and the DO, and shall contain the following details but not limited to :

- i. Design requirements like weight, type of suspension system, length, diameter etc.
 - ii. Performance characteristics like lethality, penetration, ballistic parameter etc.
 - iii. Environmental requirements
 - iv. Applicable specifications and standard followed
 - v. Interface and integration requirements like platform compatibility, connectors, electrical parameters etc.
 - vi. Input/Output requirements to be met
- d. As the technical specification is made at the beginning of the project, it may not fully describe the designer's intention. There may also arise a need to revise the Technical specification as the development progress because of various reasons such as inability to implement the initial concepts or changes in the users requirements. Such inadequacies in the technical specification are overcome by issuing amendments to the Technical specification through well defined configuration control procedures.

21.C2.6 Airworthiness Certification Plan (ACP)

Regulation

The Main Contractor **shall** propose to the CEMILAC a Certification Plan (CP) that **shall** include the means to demonstrate compliance with applicable Airworthiness codes.

Acceptable Means of Compliance

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a certification plan.
- b. The certification plan can be developed step by step, when the information needed is not available at the beginning of the project.
- c. The CP should be approved by the MAA before compliance demonstration commences and updated as necessary during the Certification process
- d. If the store is already operationalised / flight tested in another program, the compliance checklist shall specifically identify the delta requirements to be demonstrated, if any.

Guidance Material

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a certification plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable Airworthiness codes/standards
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions affecting airworthiness and environmental protection interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Artefacts/documents generated at each stage
 - vii. Software/Firmware considerations wherever applicable
 - viii. Test equipment and Rigs
 - ix. Route to Flight Testing – Safety of Flight (SOF) / Limited Qualification / Qualification Tests
 - x. Screening Requirements
 - xi. Flight Test Agencies

21.C2.7 Quality Assurance Plan

Regulation

The Design agency **shall** propose to the DGAQA a Quality Assurance Plan that **shall** include the QA milestones and activities.

Acceptable Means of Compliance

- a. The QAP should be approved by the DGAQA before compliance demonstration commences and updated as necessary during the Design, Development and Acceptance process

Guidance Material

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a QA Plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable inspection, process and acceptance standards

- iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Process flow & Stage wise inspection plan starting from raw material stage to finished product.
 - vii. Involvement of internal & external agencies at various stages.
 - viii. Documents generated at each stage
 - ix. Clearance procedures at each stages
 - x. Handling and storage conditions.
- b. The description on how compliance with QA points will be demonstrated, with proposed means of compliance, and any selected guidance material.
 - c. In case of inspection by sampling, applicable sampling plan with acceptable quality level (AQL) shall be specified.

21.C2.8 Flight Testing

Flight testing of Airborne store **shall** be carried out for the purpose of evaluating performance in accordance with the Means of Compliance finalized with the Certification Basis.

Acceptable means of Compliance

- a. Flight testing should be done in accordance to Regulations of Subpart P.
- b. Ground integration tests as per approved plan document, in accordance with Type Approval Basis (TAB) should be carried out prior to flight testing.
- c. The DO should provide evidence to the TAA by which compliance with the applicable CB is demonstrated as detailed in ACP.

Guidance Material

Nil

21.C2.9 Production of Air Armament Stores and Air Launched Weapons

Regulation

Limited Series or Series Production of the Air Armament Stores and Air Launched Weapons may be taken up by a Production Organisation on Receipt of PC or TA for the respective Store

Acceptable means of compliance

- a. Production of Airborne Store is explained in Subpart F.
- b. In case the Production agency and Design Organisation are different, the Procedure to be followed for Production Transfer of Technology is detailed at Annexure C to Subpart C1.

Guidance Material

- a. Production organization Approval Process
- b. Often design & development agency and production agency are not same. Hence production needs to be established at new production agency.

SUBPART-C3:AB INITIO DEVELOPMENT OF MATERIALS AND STANDARD/AGS PARTS WHICH ARE METALLIC OR NON-METALLIC, LEADING TO ISSUE OF LOA

Rationale

Airborne Stores such as materials and standard mechanical parts which are developed independently and form the parts of other Line Replaceable Units may be issued with a Letter of Approval (LoA).

Applicability

This subpart is applicable for the materials and standard mechanical parts for Ab-initio Development and Indigenous Substitution, License Production, Bought-out categories.

Contents

- 21.C3.1 Certification of Ab-initio Developed and Indigenous Substituted Military Airborne Materials**
- 21.C3.2 Certification of Military Airborne Materials for Licensed Projects**
- 21.C3.3 Certification of Bought-Out Military Airborne Materials**
- 21.C3.4 Certification of Metallic or Non-Metallic Standard Parts**

Introduction

The materials are the backbone for airframe, landing gear, aero engines components, airborne missile, and stealth applications. The materials are broadly defined as metallic alloys, polymers (plastics, elastomers, resins and fibres), ceramics, composites and consumables. The composites are further classified based on the matrix: Metal Matrix (MMC), Polymer Matrix (PMC) and Ceramic Matrix (CMC), and based on the reinforcement: particle reinforced, fibre reinforced and whisker reinforced. The materials are grouped into 3 categories:

- a. Alloys and MMCs are grouped as metallic materials. Mill form, un or semi-finished components, directly machined components from the feed stock or mill form and MMC based brake pads come under this group
- b. Polymer, ceramics, PMC and CMC are grouped as non-metallic materials. Polymer compounds and components, PMC components, PMC and C/C brake pads, carbon fibre, glass fabric and anything other than metallic based come under this group

- c. Aircraft turbine fuel, lubricants, oils, paints, coating, adhesives, plating and so on are grouped as consumables.

The reason for including consumables under the material category is to make a simple, concise and unified regulatory approach for the gamut of materials.

This regulation covers the regulatory approach to be followed for mill forms (as cast, rolled, forged etc.), un or semi-finished components (processed through casting, forging, rolling, extrusion, additive manufacturing, powder metallurgy, other metal forming methods, polymer-forming techniques), directly machined components from the feed stock or mill form, compounds and components from the non-metallic materials and consumables used in the airborne stores and systems. The mill forms (as-cast sticks, forged or rolled billets/bars/flats/plates/sheets and so on) are input feedstock to make semi-finished components or direct finished components through machining.

Materials are certified by the Material RCMA's. There are two RCMA's, namely RCMA (Materials) and RCMA (F&F) under the umbrella of CEMILAC. CEMILAC allocate material related work to both RCMA's depending on the work load and expertise. Other RCMA's are referred to as platform RCMA's. The platform RCMA's uses the material certified by the Material RCMA's to fabricate assemblies, subsystems, systems, LRUs or other air borne stores for air systems.

Since materials are used to manufacture components for LRUs, subsystems and systems and cleared as part of system and sub-system levels, so TA is not issued for the material. Therefore, military airborne materials that are intended to be used on an Air Systems Registered with the Indian military aircraft register and operated in the service environment shall be issued with a letter of approval (LoA) before their release to service (RTS). Material RCMA's should ensure that the materials are certified according to the RAs stipulated in this section. The Platform RCMA should use the LoA certificate of the material accorded by Material RCMA's in framing their initial release to service recommendation (RTSR) of the air system. The LoA certificate, in general, **should not** be issued until the material is operationally evaluated by the user and feedback is provided thereof.

21.C3.1 Certification of Ab-initio Developed and Indigenous Substituted Military Airborne Materials

Contents

- 21.C3.1.1 Applicability**
- 21.C3.1.2 Eligibility**
- 21.C3.1.3 Certification of Ab-initio Designed and Developed Airborne Materials**
- 21.C3.1.4 Application for Airworthiness Assessment of Airborne Materials**
- 21.C3.1.5 Airworthiness Certification Criteria**
- 21.C3.1.6 Certification Basis**
- 21.C3.1.7 Identification**
- 21.C3.1.8 Test Plan/Technical Specification**
- 21.C3.1.9 Airworthiness Certification Plan (ACP) and Certification Procedure**
- 21.C3.1.10 Quality Assurance Plan (QAP)**
- 21.C3.1.11 Design and Development (Part/Process)**
- 21.C3.1.12 Test and Evaluation**
- 21.C3.1.13 Deviations**
- 21.C3.1.14 Configuration Control**
- 21.C3.1.15 Clearance for Pre-Production Phase**
- 21.C3.1.16 Compliance to Certification Basis**
- 21.C3.1.17 Issue of LoA**
- 21.C3.1.18 Production**
- 21.C3.1.19 Concessions**
- 21.C3.1.20 Defects in Service**
- 21.C3.1.21 Amendment to a LoA**
- 21.C3.1.22 Responsibility of the LoA Holder**
- 21.C3.1.23 Transferability**
- 21.C3.1.24 Duration and Continued Validity**
- 21.C3.1.25 Record Keeping and Audit**
- 21.C3.1.26 Manuals**
- 21.C3.1.27 Instructions for Sustaining Airworthiness**

21.C3.1.1 Applicability

Regulation

The regulations contained in this subpart are applicable to Airborne Materials as defined in the Introduction

Acceptable Means of Compliance

This subpart is applicable for Airborne Materials for which a Technical Specification or Test Plan is approved by CEMILAC and is identified in accordance with subpart Q of IMTAR.

Guidance Material

Nil

21.C3.1.2 Eligibility

Regulation

An organisation which has demonstrated the capability for the development of materials only shall be involved in the development of such items.

Acceptable Means of Compliance

The development of the materials can be taken up by Public Sector, Private Sector or any Laboratories of Research & Development Organisations of Government, Semi-Government or Private Institutions which is designated as the executor of the licence agreement. The agency so awarded the contract will be called the Design and development organisation or main contractor.

Guidance Material

An organisation which has a DOA from CEMILAC have given preference for the development

21.C3.1.3 Certification of Ab-initio Designed and Developed Airborne Materials

Regulation

- a. Ab-initio designed and developed materials that are intended to be used in Indian Military Airsystems shall be Airworthiness Certified by CEMILAC.
- b. Such Airborne materials shall hold a valid LoA prior to the Clearance for Service Use (CSU).

Acceptable Means of Compliance

- a. The approach to Certification and through life Airworthiness Assurance Plan shall be in accordance with the regulations provided in this subpart in the subsequent sections.
- b. CEMILAC shall be responsible for the Certification of the Airborne material and DGAQA/MSQA shall be responsible for the Quality Assurance during design & development as well as production.
- c. DGAQA/MSQA is also responsible for the QA coverage of the material during any maintenance activities carried out by organisations other than the user agencies.

Guidance Material

- a. The certification process comprises the following 06 major phases:
 - i. Phase 1– Establish and agree the Certification Basis (CB).
 - ii. Phase 2 – Agree the Certification Plan (CP)
 - iii. Phase 3 – Agree the Quality Assurance Plan
 - iv. Phase 4 – Demonstrate compliance with the CB.
 - v. Phase 5–Review of Certification Evidence.
 - vi. Phase 6- Issue of Clearance for Preproduction Phase / LoA for critical materials and LTCC clearance for non critical materials
- b. The LoA **should not** be issued until the Airborne material is operationally evaluated by the main contractor and feedback is provided thereof.
- c. Successful completion of the certification phases for a new Airborne Material will result in CEMILAC issuing a LoA to the Design and Development Organisation.
- d. A Clearance for Preproduction Phase / LoA will certify that the critical Airborne Material:
 - i. Has been designed and developed by an organization(s).
 - ii. Meets the approved test plan/technical specification
 - iii. Is supported by appropriate Air borne Material Test Reports and Technical Information such as process sheet, part and process design details and so on of the Material, whichever is applicable to the class of the material.
 - iv. Programmes for new Airborne Material, for which TAA have previously agreed with a certification plan, will result in the issue of Clearance for Preproduction Phase / LoA. However, if the CEMILAC's Certification assurance activities conclude that the requirements of these regulations have been met in full, a Clearance for Preproduction Phase / LoA may be issued based on this Regulation.

21.C3.1.4 Application for Airworthiness Assessment of Airborne Materials Regulation

An application for certification and QA coverage to CEMILAC & DGAQA/MSQAA respectively shall be made by the main contractor in a form and manner established by them respectively.

Acceptable Means of Compliance

- a. Main contractor shall apply to CEMILAC for airworthiness certification coverage.
- b. Main contractor shall apply to DGAQA/MSQAA for Quality assurance coverage.

Guidance Material

- a. The application shall include:
 - i. A description of the firm
 - ii. A description of the Material being developed with the technical specification
 - iii. Intended end use platform
 - iv. Timelines for the development
 - v. Scope of the development
 - vi. Any special conditions

21.C3.1.5 Airworthiness Certification Criteria

Regulation

CEMILAC & DGAQA/MSQAA shall ensure that the airborne materials are approved against CEMILAC approved test plan or technical specification and drawing (if applicable)

Acceptable means of compliance

Airborne Material should be developed to the test plan/technical specification approved by CEMILAC and drawing (if applicable)

Guidance Material

- a. Material is generally developed based on the national and international aeronautical standards and specifications and/or the qualification criteria specified by the TAA in association with the designer/user and/or Customer.
- b. Cases where the aeronautical specifications or standards are not available or incomplete in ensuring the airworthiness, Test plan should be prepared by the main contractor in consultation with the TAA.
- c. Cases where the specifications/standards are not available but the previous qualification data is available for the same material, the main contractor can propose the data to TAA. TAA will analyse the data based on the operational environment of the end-use of the material and may accept data when the complete and accurate records of tests, analysis or evaluations specific to the material are available. The main contractor should

submit a comparison analysis matrix with reference to requirements in order to show that the previously qualified data for the same material satisfies all aspects of specific qualification requirements of the intended material. Any shortfall in the comparison analysis matrix may attract additional testing as decided by the CEMILAC.

- d. Case where the acceptance criteria for the particular test is not available from the standards/specifications or relaxation foreseen, may be finalized before issuing the LoA. However, in order to continue the development and use of the material, clearance for pre-production may be issued with the necessary limitations.
- e. The performance and qualification of the material should follow the advisory circulars/directives issued by CEMILAC from time to time and compliance to CEMILAC accepted standards/ technical specifications / test plan.

21.C3.1.6 Certification Basis

Regulation

Main contractor and CEMILAC shall have a mutually agreed Certification Basis (CB). Compliance to CB forms one of the basis for the issuance of LoA.

Acceptable means of compliance

CB should be prepared by the Main contractor and approved by CEMILAC.

Guidance Material

- a. CB shall be arrived at based on the applicable Airworthiness Certification Criteria (21.C3.1.5) and Airworthiness Certification Plan (21.C3.1.).
- b. Main contractor shall also specify the way of compliance to every requirement listed in the CB. The description of how compliance will be demonstrated, with proposed means of compliance and any selected guidance material. The description of the means of compliance should be sufficient to determine that all necessary data will be collected and compliance can be demonstrated.
- c. Main contractor may constitute LTCC committees with stakeholders to look into the adequacy of the proposed CB.

21.C3.1.7 Identification

Regulation

Main contractor shall ensure that the material is identified properly with its type, heat number, batch number, part number, serial number with other essential information in a manner legible and acceptable to all stakeholders.

Acceptable means of compliance

Main contractor should identify the materials as per the procedure agreed by TAA

Guidance Material

Subpart Q - identification.

21.C3.1.8 Test Plan/Technical Specifications

Regulation

The Main Contractor shall bring out the detailed test plan/technical specification that meets the User requirements.

Acceptable Means of Compliance

- a. Test plan/technical specification Document should be made by the Main Contractor and approved by CEMILAC.
- b. The document shall take into account the User and TAA requirements in addition to the requirements stipulated in the International/National aerospace specifications/standards

Guidance Material

Nil

21.C3.1.9 Airworthiness Certification Plan (ACP) and Certification Procedure

Regulation

The Main Contractor shall propose to the CEMILAC a Certification Plan (CP) that shall include the means to demonstrate compliance with applicable Airworthiness codes.

Acceptable Means of Compliance

- a. The applicant shall provide a certification plan for material development.
- b. The certification plan can be developed step by step when the information needed is not available at the beginning of the project.
- c. Local type certification committee (LTCC) should be conducted to finalize the certification plan
- d. The CP should be approved by the CEMILAC after discussing in local type certification committee (LTCC) and before compliance demonstration commences and updated as necessary during the Certification process.

Guidance Material

- a. CP contains, in general, the following:
 - i. Description of the project where material used (if applicable) and the use
 - ii. Applicable aerospace material standards
 - iii. Process sheet and relevant documents
 - iv. Applicable international material/process standards/specifications
 - v. Metallic material/ semi finished metallic component design criteria form (Annexure 1, Form 1) (if applicable)
 - vi. The input data sheet for C/C composite brake pads (Annexure 1, Form 2), Composites/ Ceramic Components (Annexure 1, Form 3), Metal Matrix /Polymer Matrix Composite Brake Pads(Annexure 1, Form 4), Polymeric materials, Paints and Coatings (Annexure 1, Form 5), FOL (Annexure 1, Form 6), (if applicable)
 - vii. Classification of Aeronautical Materials as per Table 1 (if applicable)
 - viii. Test plan
 - ix. Drawing (if applicable)
 - x. Major milestones in development activities and review stages
 - xi. Identification as per 21.C3.1.7

Table-1 Classification of Aeronautical Materials

S. No	Classification	Description
1.	Critical	Failure endangers the safety of the aircraft or crew or at least results in aborting the aircraft mission
2.	Non-Critical	Failure does not endanger the safety of the aircraft or crew nor does it result in aborting the mission

- b. The mill form and non-metallic materials are considered as critical or non-critical depending on the application.
- c. Un/semi-finished or directly machined from feed stocks or mill form metallic components and non-metallic components and consumables are classified based on its function in two categories: critical or non-critical. The definition of these categories is given in Table 1.
- d. Important documents to conduct LTCC for the certification of metallic un/semi-finished components or directly machined components from feed stocks or mill form and non-metallic components are drawing, type test schedule and process document.
- e. Important documents to conduct LTCC for the certification of non-metallic materials, compounds and consumables are type test schedule and process document.
- f. The classification should be proposed by the main contractor and duly approved by the platform RCMA.
- g. Once the criticality is finalized, the main contractor proposes the raw material/ingredient list, drawing, type test schedule, process documents and other

essential documents (design criteria form, input data sheet, specifications/standards and so on) to the TAA to conduct the local type certification committee (LTCC).

- h. The constitution of LTCC is given in Configuration Control 21.K.4
- i. The LTCC committee discusses the airworthiness qualification test requirements for the materials.
- j. The first step in the certification process is the raw material/ingredient qualification/acceptance. The main contractor should provide raw materials/ingredient list used to prepare the mill form/un/semi-finished metallic components, directly machined metallic components from feed stocks or mill form, non-metallic materials/consumables along with the certificate of conformance (CoC) and test release certificate (TRC) to the appropriate raw material/Ingredient standards/specifications if procured from the abroad or India. But in the case of un/semi-finished/directly machined metallic components, the mill form is the raw material to produce them. LoA should be produced, if procured from India. CoC and TRC should be produced if procured from Abroad. Cases where the CoC and TRC are incomplete in ensuring the airworthiness, Test plan shall be prepared by the main contractor in consultation with the TAA which may attract additional testing as decided by the CEMILAC to issue clearance for use.
- k. If any of these documents (CoC, TRC, LoA) is not available at the time for LTCC meeting, the main contractor should at least submit those documents to the TAA before beginning the processing of the mill form/ un/semi-finished/directly machined components/non-metallic materials and components, consumables.
- l. In case, commercial-grade raw material/ingredient/mill form from India is procured inadvertently for some reasons such as low order quantity, Make in India promotion, non-availability and so on, it should be approved by the TAA before its use.
- m. It is strictly prohibited to procure the commercial grade raw material/ingredient/mill form from abroad.
- n. In order to approve the commercial grade raw material/ingredient/mill form from India for the use, the main contractor should submit an application form (Annexure 1, **Form7**) for the commercial grade material approval. The TAA will evaluate its quality and fit to the intended applications and accord a Letter of Approval (LoA) for use to produce the specified mill form/ un/semi-finished/directly machined components/non-metallic materials and components, consumables.
- o. After the essential process and testing criteria to ensure airworthiness is evolved, the sampling frequency should be finalized. TAA has to decide the number of batches/quantity to be produced per batch/samples to be tested per batch in

consultation with the main contractor to ensure airworthiness. In case, the dispute in the sampling frequency arises, the decision given by TAA is final.

- p. The process documents, drawing, and test schedule for the development stage will be approved by CEMILAC. DGAQA/MSQAA shall approve the PATS (Production Acceptance Test Schedule) for the production stage. PAT can be either the test schedule approved by the CEMILAC as it is or sub-set of it as decided by DGAQA/MSQAA. This exercise by DGAQA/MSQAA shall be after assurance of LOA.
- q. In general, TAA is expected to participate and coordinate the process and test conducted by the main contractor. TAA can also delegate the witnessing role to the main contractor. But the process compliance report and test compliance report should be coordinated by the DGAQA/MSQAA.
- r. The main contractor has to submit the documents and the application for LoA for the critical airborne materials to the CEMILAC for the LoA clearance.
- s. Non critical airborne materials are cleared in LTCC.
- t. The list of documents, in general, but not limited to, includes CoC and TRC or LoA for the raw material or ingredient, approved test schedule, approved process documents, approved drawing, all test reports and test compliance report as per the approved test schedule, dimension report as per the approved drawing, process compliance report to the approved process document.
- u. The cases where long cycle testing is pending or feedback for machining, functional performance or flight performance (whichever is applicable for the particular class of material) is not available, the main contractor can apply for clearance for pre-production phase for the critical airborne materials. This allows the use of material for the fabrication of subsystems/systems/assemblies/LRUs or prototype trials. The clearance for the pre-production phase must stipulate the limitation and safety issues.
- v. CEMILAC will study and verify all documents compliance to the approved drawing, approved process document, approved test schedule and accord clearance for pre-production phase or LoA for the critical airborne materials depending on the request from the main contractor.
- w. The validity of the clearance for the pre-production phase and LoA for the critical airborne materials is given in respective subpart sections.
- x. Based on the clearance for pre-production phase or LoA for the critical airborne materials, DGAQA/MSQAA can clear the critical airborne materials for bulk production with or without limitations.

21.C3.1.10 Quality Assurance Plan (QAP)

Regulation

The main contractor **shall** propose to the DGAQA/MSQAAa Quality Assurance Plan that **shall** include the QA milestones and activities.

Acceptable means of compliance

- a. The QAP should be approved by the DGAQA/MSQAA before the production commences may be updated as necessary during the Design, Development and Acceptance process.
- b. Any changes in the QAP should be intimated to the DGAQA/MSQAA before implementation in the production phase.

Guidance Material

- a. In general, QAP should cover design and process data control, document control, raw material supplier control, inspection measuring, and test equipment control, Nonconforming material control, Corrective and preventive actions, handling and storage, internal audits, In-service feedback, quality escapes, Issuing authorized release documents
- b. QAP may be prepared based on Material RCMA approved test plan, Process Documents and/or mutually agreed national and international quality assurance standards.

21.C3.1.11 Design and Development (Part/Process)

Regulation

- a. The main contractor shall have a design and development process documents that result in the Airborne material meeting the user requirements and the Certification Plan.
- b. TAA and user agencies should be involved from the conceptual stage of the project in various reviews and evaluation.

Acceptable means of compliance

- a. Drawing and process documents should be approved by CEMILAC.
- b. The design and development activities should follow the guideline materials given in Airworthiness Certification Plan (ACP) and Certification Procedure, 21.C3.
- c. Part design of metallic or non-metallic based materials should be carried out as per the drawing document approved by TAA.

- d. Manufacturing of the metallic or non-metallic parts and consumables should be carried out as per the Process Document approved by TAA.
- e. Process document should contain a Process Flowchart indicating the sequence of all manufacturing/processing steps from raw material/ingredient selection to final despatch of the metallic/non-metallic material/consumables. The process document should be identified by a unique code number, Issue No, Rev. No. and Date of Issue / Revision.
- f. The Process Document should not be changed without the concurrence of TAA.

Guidance Material

The Process Document, in essence, shall consist of individual process details of all manufacturing/processing stages in sequence with the details of raw materials/ingredients to be used for manufacturing/processing, their specifications and sources, all process variables/ parameters and quality checks to be carried out during each manufacturing/processing stages, manufacturing drawings, and so on.

21.C3.1.12 Test and Evaluation

Regulation

The Airborne Materials shall be subjected to necessary tests to ensure compliance with applicable Airworthiness Certification Criteria requirements as defined in the CB & ACP prior to LoA approval

Acceptable means of compliance

- a. The main contractor should agree with the TAA to determine what testing is required and his level of involvement in reviewing any report or overseeing any activity.
- b. CEMILAC should be the approving authority for the test plan of the material being developed
- c. The laboratory in which testing carried out should possess the National Accreditation Board for Testing and Calibration Laboratories (NABL) approval or DGQA/MSQAA approval.
- d. The test equipment and all measuring equipment used for processing and testing should be appropriately calibrated.
- e. The main contractor should make arrangements that allow the TAA to make any investigations, inspection, or review any report necessary to determine compliance with the test plan, drawing and process documents.

- f. The main contractor should make arrangements for the TAA to make investigations of the main contractor including partners, subcontractors and suppliers. This includes assisting and cooperating with the TAA in performing investigations and audits conducted during the initial assessment and subsequent surveillance. Assistance to the TAA includes all appropriate means associated with the facilities of the main contractor to allow the TAA to perform these investigations and audits, such as a meeting room and office support.

Guidance Material

- a. National Aerospace and Defence Contractors Accreditation Program (NADCAP) approval, and AS 9001 approval are preferable for the organization involved in the chemical processing, coatings, plating, conventional machining, heat treating, non-destructive testing activities to produce the metallic or non-metallic materials and components and consumables.
- b. The TAA has his right of access to any report to witness any test necessary to determine that no feature or characteristic makes the Air System unsafe.

21.C3.1.13 Deviations

Regulation

Any deviations observed to the drawing, test plan and process documents before the issue of clearance for pre-production phase or LoA shall be reported to TAA for suitable disposition.

Acceptable means of compliance

- a. The effects of the process related deviations or dimensional issues or testing values deviations observed in the materials should not affect the airworthiness of the subsystems/systems where the material is used. For this case, the deviation may be accepted through concession as given 21.C3.1.19, Failing which, the material is rejected on the ground of major deviation leading to endangering the safe operation of the air system.
- b. Suppose, the deviation is observed after the issue of clearance for pre-production phase or LoA, any change deemed necessary or inevitable in the process or test criteria, drawing requirements, raw material/ingredient type or source may be carried out, that should be intimated to the CEMILAC and corresponding documents should be amended accordingly. Also, Clearance for pre-production phase or LoA for the subject material issued earlier should be suitably amended before commencing the production.

Guidance Material

Deviations observed during manufacturing processes shall be analysed thoroughly by the Main Contractor. The probable causes for an occurrence of the deviation, implications of the deviation and remedial measures to avoid recurrence etc shall be studied and the report should be submitted to CEMILAC.

21.C3.1.14 Configuration Control

Regulation

The Design agency shall have a proper configuration control board, called local type certification committee (LTCC) to address the design and development of the material during Design and Development phase.

Acceptable Means of Compliance

- a. Materials which are planned for design and development/indigenization should be discussed in the LTCC
- b. The LTCC constitution should be as per 21.K.4

Guidance Material

The role and purpose of LTCC are given in the Guidance Material of Airworthiness Certification Plan (ACP) and Certification Procedure 21.C3.1

21.C3.1.15 Clearance for Pre-Production Phase

Regulation

- a. The case when the long term properties (long time taking tests such as fatigue, creep, stress corrosion cracking etc) as per the test plan is under progress but the project PDC demands the material for further processing or functional testing, Clearance for Pre-Production Phase shall be given based on meeting short term properties (Short time taking tests such as Microstructure, Chemistry, Tensile, Impact, etc.) and other requirements to the test plan, drawing and process sheet.
- b. This clearance shall be applicable for the fabrication of finished components and/or for allowing assembly and functional tests with lesser severity but strictly not for flying in the air system.

Acceptable means of compliance

- a. CEMILAC should issue clearance for pre-production phase to the main contractor when all submitted reports except long term test requirements have satisfied to the requirements of the testplan, drawing and process sheet.
- b. Clearance for pre-production phase for the critical airborne materials should be the basis for DGAQA/MSQAA to clear the material for further processing/functional testing.

- c. Clearance for the pre-production phase should be given for 2 years and if requested by the main contractor, a subsequent extension for 2 years should be given prior to the issue of LoA.
- d. Failing to convert to LoA within 4 years from the date of clearance for pre-production phase results in revoking the clearance of the pre-production phase and fresh development of the materials should be initiated.

Guidance Material

Nil

21.C3.1.16 Compliance with the Certification Basis

Regulation

After successful completion of design, development and testing phases, the Main Contractor shall prepare compliance to requirements listed in the drawing, process sheet and test plan in the form of compliance report.

Acceptable means of compliance

- a. The Main Contractor should prepare the compliance report for submission to CEMILAC along with the application for issue of LoA.
- b. All the supporting documents to comply to CB and CP followed during the design and development should also be submitted to the CEMILAC
- c. Non-compliances to CB and CP requirements, if any, should be clearly brought out with proper analysis reports bringing out their impact on airworthiness to take the decision on acceptance or rejection of the material.

Guidance Material

Nil

21.C3.1.17 Issue of LoA

Regulation

CEMILAC shall issue the LoA for the material stores

Acceptable means of compliance

- a. Process parameter record should comply to the approved process document requirements

- b. All test reports coordinated by the internal quality of the main contractor and DGAQA/MSQAA (if they are involved during processing/testing) should comply to the approved test plan and drawing (if applicable)
- c. All dimension should meet the approved drawing
- d. Machining and functional test feedback for the un or semi-finished metallic or non-metallic components (if applicable) should be satisfactory
- e. Flight trial feedback for the consumables should be satisfactory
- f. LoA should be given for 10 years.
- g. The main contractor should apply for the renewal before 6 months of the expiry. Failing which, the LoA should not be renewed.
- h. Renewal of LoA should be given for 10 years.

Guidance Material

Letter of Approval is the certificate which states that the design and development of a new or amended material comply with the airworthiness requirements in accordance with the approved test plan, approved drawing, approved process documents (whichever applicable), functional and user requirements.

21.C3.1.18 Production of Airborne stores

Regulation

Production of the Airborne Materials shall be taken up by a Production Organization on Receipt of LoA for the respective airborne materials.

Acceptable Means of Compliance

- a. LoA holder should take up production of the Airborne Store.
- b. If the LoA holder and Production Organization are different, necessary Transfer of Technology should be carried out.

Guidance Material

Nil

21.C3.1.19 Concessions

Regulation

CEMILAC shall issue the concession to the Main contractor, if the main contractor seeks on the basis on the process related defects/inconsistencies or dimensional issues in the materials.

Acceptable means of compliance

- a. The application form in the prescribed form (Annexure 1, **Form 8**) for the concession should be submitted to CEMILAC.
- b. CEMILAC should grant concession only if the effect of the process-related defects/inconsistencies or dimensional issues on the materials does not affect the airworthiness of the subsystems/systems where the material is used.

Guidance Material

Nil

21.C3.1.20 Defects in Service

Regulation

Defects in service observed in the material shall be reported to the main contractor, production agency, CEMILAC and DGAQA/MSQAA.

Acceptable Means of Compliance

- a. User services should raise a defect report and circulate to designers, production agency, CEMILAC and DGAQA/MSQAA.
- b. A defect investigation mechanism should be set up at the main contractor premises to establish the reason and evolve the preventive measure plan for the future material supplies by the main contractor.
- c. Defects noticed during repair/overhaul phase shall also be dealt with in a similar manner. The main contractor shall raise the defect report in such cases.

Guidance Material

Nil

21.C3.1.21 Amendment to a LoA

Regulation

CEMILAC shall issue the change requiring in a LoA, if requested by the main contractor.

Acceptable means of compliance

- a. Any change in the component drawing, process sheet and test plan after the LoA issue should call for the change/updates in the LoA.
- b. Based on the severity/criticality of changes, CEMILAC is authorized to seek mini or full type testing as per the test plan to the main contractor.

Guidance Material

Nil

21.C3.1.22 Responsibility of the LoA Holder

Regulation

LoA holder shall be responsible to maintain all the documents pertaining to the LoA till the expiry of the air system.

Acceptable means of compliance

- a. LoA holder should show the documents whenever and whatever TAA asks.
- b. LoA holder should apply for the renewal before 6 months of the expiry. Failing which, the LoA should not be renewed.
- c. LoA holder should intimate to TAA on the adherence of raw material and process quality to the test plan and process documents and process and testing equipment calibration periodically every five years.
- d. CEMILAC should revoke the LoA for the subject materials if any serious non-adherence or change found at any time during the LoA validity period.
- e. LoA holder should adhere strictly to the quality control aspects of bulk production as stipulated by prescribed Inspection agency/ DGAQA/MSQAA after LoA issuance.

Guidance Material

Nil

21.C3.1.23 Transferability

Regulation

- a. LoA shall, in general, not be transferable to any other organisation.
- b. The case where a transfer of LoA from a development agency to a production agency is required, unless both the agencies are not same, the material shall be subjected to full LoA tests for ensuring compliance with the laid down specifications before production is commenced. Changes to the procedure, if required, shall be agreed by CEMILAC on specific request.
- c. The case where the LoA holder is preferred to transfer the intellectual property right or make it available to other organisation/ company by licensing agreements under the

egis of CEMILAC. All such materials shall be subjected to full LoA tests for ensuring compliance with the laid down specifications. After successful completion of the LoA test, CEMILAC shall issue a new LoA to such material.

- d. LoA shall be still valid and applicable if there is a change of address of the organisation (supported by the appropriate certificate) provided no changes to the manufacturing site of the organisation, facilities, type of work, staff, manager or the person nominated. If the site of manufacturing unit changes, Material shall ask mini or full type testing depending on the case-to-case basis.

Acceptable means of compliance

Nil

Guidance Material

Nil

21.C3.1.24 Duration and Continued Validity

Regulation

Refer the subpart 21.C3.1.17

Acceptable means of compliance

- a. The LoA should no longer be valid if any change in process documents, drawing, test plan is carried out without prior concurrence of TAA.
- b. Upon notification of suspension or revocation, the LoA should be surrendered to the CEMILAC and the users to be informed.
- c. The main contractor should inform the CEMILAC and users as soon as practicable when the main contractor is no longer able to meet the LoA Holder responsibilities.

Guidance Material

Nil

21.C3.1.25 Record Keeping and Audit

Regulation

The main contractor shall maintain all records for a period of limiting to the service life of the respective air system to establish traceability in the event of any kind of failure.

Acceptable means of compliance

- a. The records should be stored in a manner that ensures protection from damage, alteration and theft.
- b. The records should remain readable and accessible for the duration of the retention period and made available to the defect investigation board on request.
- c. The records that have been mandated for retention should be available for audit purposes.
- d. The records which are declared as organization propriety/ company confidential should be sealed in the presence of the CEMILAC representative and to be kept in the safe custody of the LOA holder.
- e. Actions should be taken in the event that Airworthiness records are lost, corrupted or inaccurate, to mitigate the impact on Air Safety.
- f. Hard copy records should be scanned and stored electronically, but subject to the condition that the electronic copy is a true, legible and complete facsimile of the original.

Guidance Material

Nil

21.C3.1.26 Manuals

Regulation

CEMILAC shall prepare the manuals regarding the materials and publish in the public domain to benefit the agencies who involved or are interested into development of the airborne materials

Acceptable means of compliance

- a. Manuals should be segregated under the three headings: (1) Metallic materials (Mill form and un or semi-finished metallic components), (2) Non-metallic materials and components, and (3) Consumables.
- b. The TAA shall ensure that all master copies of manuals required to certify the material are produced, maintained and updated.

Guidance Material

The manuals may be used by the main contractor as a ready reference to evolve performance and qualification criteria for a particular class of airborne materials. However, this will be treated as a guidance document and updated from time to time based on the need. Any change/update/amendment will be informed to all stakeholders.

21.C3.1.27 Instructions for Sustaining Airworthiness

Regulation

- a. User/Main contractor shall periodically submit to CEMILAC the field performance of the materials.
- b. Reliability & maintainability cell shall be formed at the LoA holder place to deliberate on the high failure articles.

Acceptable means of compliance

- a. All the recommendations of the defect investigation committee shall be implemented in time-bound manner.
- b. If for any reason,CEMILAC is not satisfied with the performance of the material based on the feedback, after due investigation and consultation with the main contractor, the LoA issued earlier should be withdrawn. The DGAQA/MSQAAand user agencies like IAF/IN/IA should be informed about such withdrawals.

Guidance Material

Nil

LIST OF FORMS – Placed in Annexure 1

Form 1	Metallic material/ semi finished metallic component design criteria form
Form 2	C/C composite brake pads
Form 3	Composites/ Ceramic Components
Form 4	Polymer or metallic or metal matrix composite based brake pads and non-metallic materials
Form 5	Non-metallic materials and components, Paints and Coatings
Form 6	Application form for the commercial grade material approval
Form 7	Certification flow chart for the materials
Form 8	Application form for the concession in the materials

21.C3.1.2 Certification of Military Airborne Materials for Licensed Projects

Rationale

Airborne Materials which are developed under License shall be issued with a Letter of Approval (LoA) and the procedure of the certification of material under license production is explained below

Applicability

This subpart is applicable only for the materials for which the test plan, drawing and process documents of OEM are completely available from the licensor for the License Production.

Regulation

The certification procedure followed for the 21.C3.1.1 certification of ab-initio and indigenous substitution of military airborne materials shall be applicable with few changes which are listed below:

- a. There is no need to prepare the separate test plan, criticality classification, drawing and process sheets for the materials by the main contractor as these are already given by the licensor. Non critical airborne material shall be cleared in LTCC.
- b. Clearance for preproduction phase for the critical airborne materials shall not be needed.
- c. Machining and functional test/performance feedback for the un or semi-finished components and/or Flight feedback for the consumables are required to issue LoA for the critical airborne materials to absorb the source change of developer/manufacturer of the material.
- d. Concession or use of commercial-grade raw materials/ingredient to fabricate mill form, un or semi-finished components/ consumables shall strictly not be permitted.

21.C3.1.3 Certification of Bought-Out Military Airborne Materials

Rationale

Airborne Materials which are bought directly from abroad are defined as bought-out/Imported materials and the procedure of the certification of material under bought-out category is explained below

Applicability

This subpart is applicable only for the materials which are bought directly from abroad.

Regulation

- a. Imported materials which have a certificate of conformance (CoC) and test release certificate (TRC), LoA clearance is not required from the CEMILAC. TAA shall accept the imported materials based on the CoC and TRC to the relevant aeronautical material standard/specification.
- b. Imported materials which do not have test release certificate shall be given LoA by the CEMILAC
 - i. The main contractor shall prepare test plan and drawing (if applicable) with the essential testing matrix based on the available information from the user, past experience of the main contractor and relevant aerospace standards/specifications and get approval from the TAA.
 - ii. Other certification procedure to issue LoA for the critical airborne materials shall follow the subpart 21.C3.1.1 certification of ab-initio and indigenous substitution of military airborne materials. Non critical airborne materials shall be cleared in LTCC.
 - iii. Clearance for preproduction phase shall not be needed for the critical airborne materials.
 - iv. Machining and functional test/performance feedback for the un or semi-finished components and/or Flight feedback for the consumables are not required to issue LoA for the critical airborne materials.
 - v. Concession shall strictly not be permitted.
 - vi. The applicability of the LoA for the critical airborne materials is restricted to the material source and a particular batch supply imported.

Guidance Material

It is recommended not to import the materials as far as possible to boost the indigenization and Make in India schemes

21.C3.1.4 Certification of Standard/AgS Parts of Metallic and Non-Metallic

Rationale

Materials (metallic and non-metallic parts such as fasteners, seals, bearings and so on) which have established drawing and established material standards/specifications are called Standard/AGS parts. These drawing and material standards/specifications are internationally recognised. The procedure of the certification of the standard/AGS parts of metallic and non-metallic is explained below

Applicability

This subpart is applicable only for the standard/AGS parts of metallic and non-metallic which have established drawing and/or established material standards/specifications.

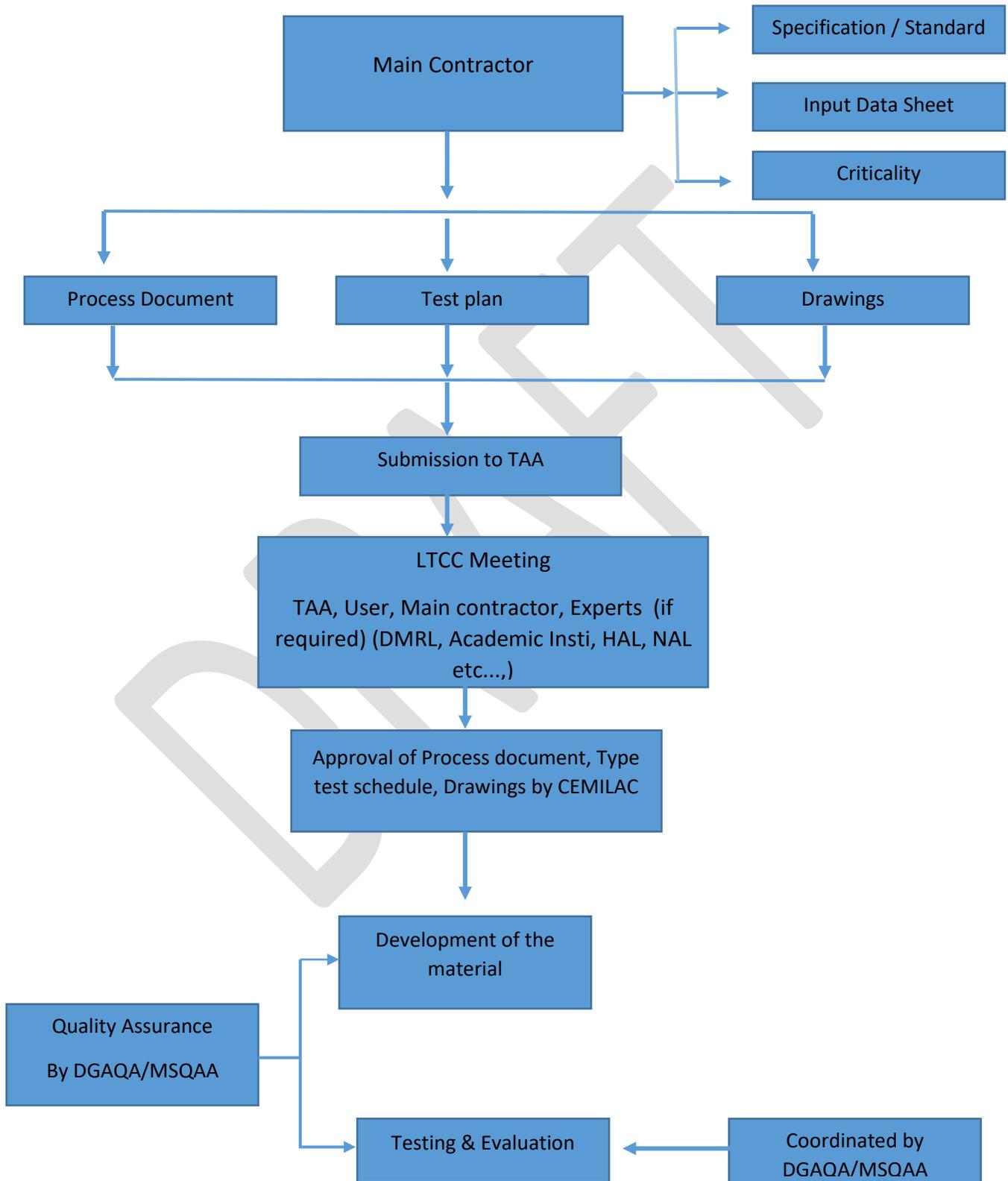
Regulation

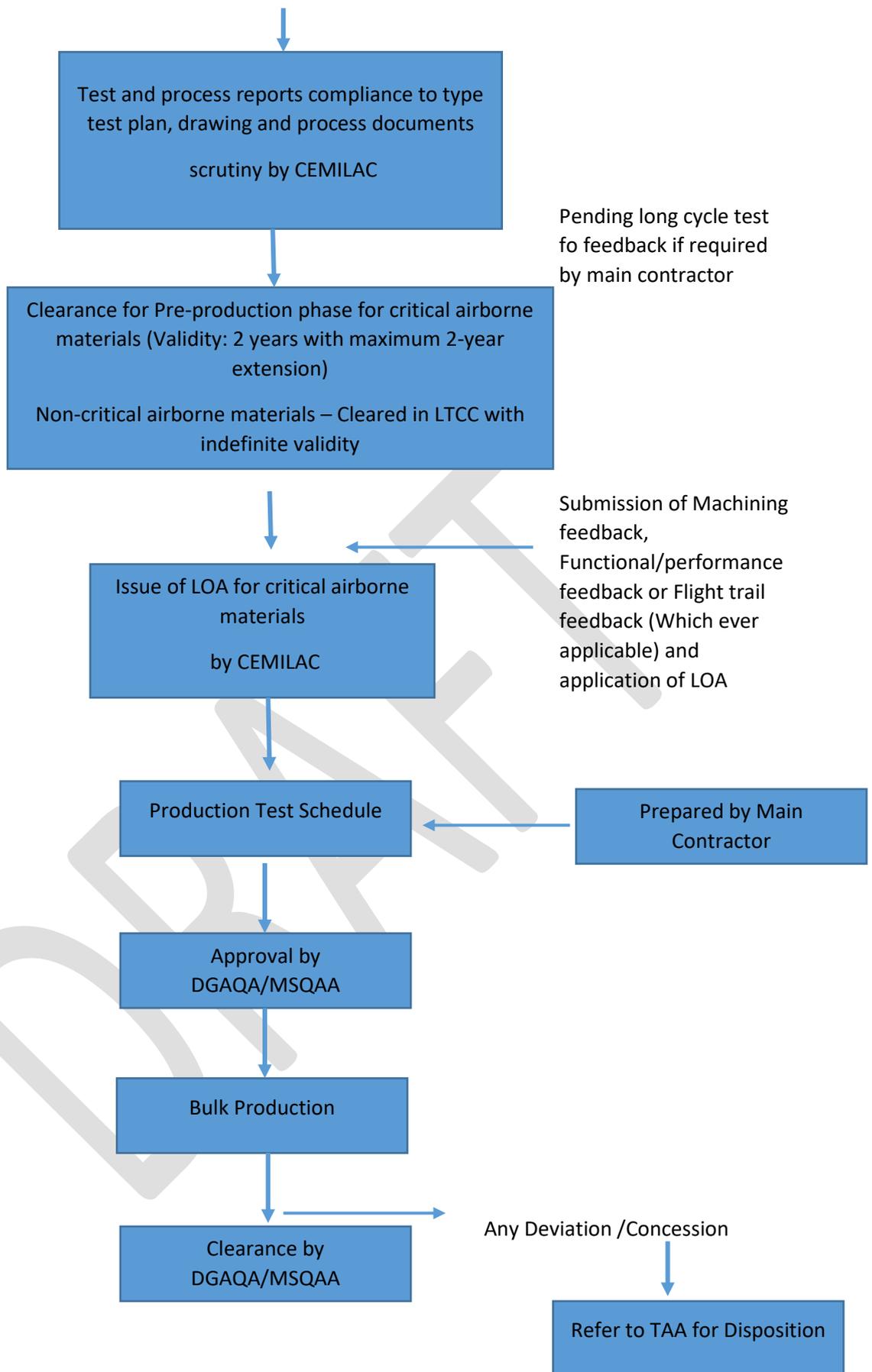
The procured standard/AGS parts of metallic and non-metallic from India or Abroad shall be accepted based on the certificate of conformance (CoC) and test release certificate (TRC) to the established drawing and/or material standards/specifications.

Guidance Material

It is recommended not to import the standard/AGS parts as far as possible to boost the indigenization and Make in India schemes

The certification flow chart for the materials for section 21.C3.1 is given below for easy reference.





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Form 1 - Metallic material/ semi finished metallic component design criteria form

Project : _____
 Name of Inspection Agency : _____

Material Grade & Mill form: _____
 Heat Treatment Condition: _____
 Size (mm) : _____

Sl. No.	Component	Classification	Stress Condition			Environmental Conditions	Temperature Conditions	Weldability requirements*	Any other information
			Primary	Secondary	Static/ Dynamic loading conditions				
		Critical/ Non critical	Eg. Fracture Toughness, Fatigue, YS, UTS	Eg. Fracture Toughness, Fatigue, YS, UTS			*Type of Welding, No. of joints, Components details which are to be welded, Material type, WPS & PQR Status approved or not? Vendor details		

Enclosures:

1. Brief write-up about the Project
2. End use of the Components along with justification for classification
3. Drawings, photographs of components
4. QA Plan
5. Details of Supplier, if already identified
6. Application for LoA

Signature
 Name & Designation
 Name of Organisation (with Seal)

Countersigned by Platform/User RCMA
Form 2 - Carbon-Carbon Aircraft Brake Discs

Project:
Name of Inspection Agency:
Developing Agency:
Manufacturing Agency:

Material:
Manufacturing Process Route:
Supply Condition:
Nominal Dimensions:

Sl. No.	Component Name	Classification	Material Property Requirements	Service Conditions	Environmental and Temp Conditions	Requirements of Metallic Attachments, if any	Any other information
			Physical, Mechanical, Thermal and Friction and Wear				
		Critical/ Non-critical	e.g., <u>Physical Properties:</u> Density, Porosity, etc. <u>Mechanical Properties:</u> Flexural Strength, Tensile Strength, Compressive Strength, Shear Strength, Interlaminar Shear Strength, etc. <u>Thermal Properties</u> Specific Heat, Thermal Diffusivity, Thermal Conductivity, CTE, Weight Loss by TGA (Bare + with Anti-Oxidant Coating), etc. <u>Friction and Wear Properties on Brake Dynamometer</u> Co-efficient of Friction, Wear (Thickness Loss), etc.	Kinetic Energy (Normal, Overload, RTO), Brake Application Speed, Brake Pressure, Stop Time, Static Torque, Temperature Rise, Wear (Thickness Loss) etc.			

Enclosures:

7. Brief write-up about the Project
8. End use of the Components along with justification for classification
9. Drawings, photographs of components
10. QA Plan
11. Details of Supplier, if already identified
12. Application for LoA

Signature
Name & Designation
Name of Organisation (with Seal)

Countersigned by Platform/User RCMA

Form 3 - Composites/ Ceramic Components

Project:
Name of Inspection Agency:
Developing Agency:
Manufacturing Agency:

Material:
Manufacturing Process Route:
Supply Condition:
Nominal Dimensions:

Sl. No.	Component Name	Classification	Mechanical Property Requirements	Environmental Conditions	Temperature Conditions	Other Property Requirements (Physical, Thermal, Electromagnetic, Rain-erosion, etc.)	Any other information
			Based on Static/ Dynamic loading conditions				
		Critical/ Non-critical	Eg. Tensile Strength & Modulus, Flexural Strength & Modulus, Compressive Strength & Modulus Fracture Toughness, Fatigue, etc.			Density, Porosity, Specific Heat, Thermal conductivity, CTE, Moisture absorption coefficient, Weight Loss(TGA), Tangent Loss, Dielectric Constant, etc	

Enclosures:

13. Brief write-up about the Project
14. End use of the Components along with justification for classification
15. Drawings, photographs of components
16. QA Plan

- 17. Details of Supplier, if already identified
- 18. Application for LoA

Signature
Name & Designation
Name of Organisation (with Seal)

Countersigned by Platform/User RCMA

DRAFT

Form 4 - Metal Matrix /Polymer Matrix Composite Brake Pads

1	Reference No	Date
2	Part No	Part name
3	Brief description of application of part	
4	Criticality of part	
5	Type of Brake Pad:	
6	Operating temperature or temperature exposed:	
	Parameter	Value
7	Max. Design Landing weight of Aircraft at Sea level (Kgf)	
8	Max Brake Application Speed on Design Landing (m/sec)	
9	No of Landing Brakes per Aircraft (Nos)	
10	Max. Take-off weight of Aircraft	
11	Mean Service life of brake linings	
12	Nominal Friction material thickness per face of brake Disc	

Signature
Name & Designation
Name of Organisation (with Seal)

Countersigned by Platform/User RCMA

Form 5 - Polymeric materials, Paints and Coatings

1	Reference No	Date
2	Nomenclature of the Product	
3.	Governing Specification	
4	Brief description of application of part/End use	
5	Criticality of part	
6	Operating medium	
7	Operating temperature or temperature exposed:	
8	List of main functional test carried out:	
9	Any post treatment in the part before assembly	

Signature
Name & Designation
Name of Organisation (with Seal)

Countersigned by Platform/User RCMA

Form 6 - FOL

1.	Nomenclature of FOL Store :	
2.	Governing specification:	
3.	Equivalent specification:	
4.	End use applicability	
5.	Criticality class	
6.	Category: Abinitio, Indigenization, licensed production, Imported products,	
	NATO code / JSD /Any other designation, if Any	
7.	Test certificate /CoC / CoA	
8.	OEM extract / maintenance manual with end use details	
9.	Testing agency	
10.	Process applicability	
11.	Formulation requirements	
12.	Shelf life	
13.	Retesting frequency	
14.	Packaging and storage requirements	

15.	Other applicable information, if any	
16.	Company profile, contact details	

Form 7 - Application form for the commercial grade material approval

DRDO/SERVICES/PSU/PRIVATE		Request For Use of Non-Aero Grade		
		CEMILAC BANGALORE - 560075		
<u>Classification:</u> Restricted	<u>Project:</u>	LRUs/System	Ref No :	No. of Pages: 1 of 1
(1) Original or Aero Material Grade/Specification (Enclose specification):				
(2) Non-Aero /Commercial Material Grade planned to use with Test release Certificate(Enclose specification):				
(3) Method of Melt Processing :		Air melting/VIM/VAR/ESR/Any other		

Annexure 1

(4) Process used for making the part	Casting/forging/rolling/ P/M/ 3D printing/ welding/ machining/any other	
(5) Heat treatment process details & any other operation to get desired properties		
(6) Tensile Properties Requirements as per design:		
(7) Deviation of the Tensile properties from the original or aero-grade material, if any:		
(8) Chemical composition deviation, from the original or aero-grade material, if any:		
(9) Requirement of long term properties for the application, if any, from the designer perspective:	Fatigue/Creep or Stress rupture /Corrosion/ any other (Specify the requirements)	
(10) Factor of Safety, and Criticality as per DDPMAS 2002		
(11) Post processing on the part, if any	Coating/plating/welding/machining/ anyother	
(12) Functional test details, if any		
(13) Design Philosophy:	Fail safe/Safe cycle/Infinite life/Damage tolerant	
Raised Designer/Main contractor By:	Name	Signature / Date
Checked By (Designer/Main contractor):		
Reviewed By (CEMILAC):		

Approved By (CEMILAC):		
CC:		

Form 8 - Application form for the concession for the materials

Main Contractor's Ref. No.

Dated

Sub-Contractor's Ref. No. - -----

NOTE: 1. The granting of this deviation is strictly limited to this specific application and is not to be regarded as a precedent.

IT IS NOT AN AMENDMENT TO THE CONTRACT AND IS WITHOUT PREJUDICE TO ANY OF THE DEPARTMENT'S RIGHT THEREUNDER.

2. If the application is prepared by a sub-contractor, it must be signed and submitted by the main contractor.

PART – I

Annexure 1

1	Main Contractor (Name & Address)	-
2	Main Contractor Number	-
3	Sub-Contractor (Name & address)	-
4	Sub Contract No.	-
5	Description of the Material	
6.	Standard/ Specification / Drg. No / Process documents (which ever applicable)	
7.	(a) Quantity (b) Batch / Heat / Lot No.	
8.	Description of Deviation in the materials TA6V. (Continue on separate sheet if necessary)	
9	Reference number of deviations previously granted. (a) of a similar nature (b) For the quality / period at items 7 above	

10	<u>Reason for deviation</u>	
11	<p><u>If the deviation is granted, are any of the following adversely affected?</u></p> <p>(State YES, NO or N.K (not know</p> <p>If answer is YES particulars are to be attached.</p> <ul style="list-style-type: none"> a) Safety b) Interchangeability c) Maintenance d) Strength e) Functioning/Performance f) Life of item 	
12	<p>Design or development clearance from the Main contractor (Design) office.</p> <p>Agreed / Conditions attached</p> <p>(* Delete as necessary)</p>	

Signature and designation of Part/Process Design Department

Date:

Submitted by: -

Signature

On behalf of :

Date

Position held :

PART – II (TO BE COMPLETED BY THE QA AUTHORITY)

1. Remarks and opinion of CEMILAC on Merit of application

(Including confirmation or amplification of the statement made in part I, section 11.)

Date

Signature of Rep. CEMILAC

Designation / Rank

Remarks and opinion of DGAQA/MSQAA on Merit of application

Date	Signature	Designation / Rank	Ref:
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2. DECISION BY CEMILAC

Date	Signature of Rep. CEMILAC	Designation / Rank
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DRAFT

SUBPART -C4: AB-INITIO DEVELOPMENT OF AIRBORNE STORES LEADING TO LOA

Rationale

Depending upon the suitability in military applications or based on the requirements, the Design Agencies may take up design and development of airborne stores which are not Line Replaceable for the Airsystems. Mostly these stores are cleared as a part of Airborne Stores where they are integrated with. However, often these stores are supplied as spares to user/maintenance organisations to carry out D/O Level maintenance of Airborne Stores. Certain stores may be developed as a part of indigenous substitution efforts. Apart from this, certain stores which are generic in nature may find application at multiple Airborne stores. Clearance of such stores as a separate entity is discussed in this Subpart.

Contents

- 21.C4.1 Applicability**
- 21.C4.2 Application for Airworthiness Assessment of Airborne Store**
- 21.C4.3 Airworthiness Certification Plan (ACP)**
- 21.C4.4 Quality Assurance Plan**
- 21.C4.5 Identification**
- 21.C4.6 Design and Development**
- 21.C4.7 Software & Firmware**
- 21.C4.8 Test Rigs & Test Equipment**
- 21.C4.9 Test & Evaluation**
- 21.C4.10 Deviations**
- 21.C4.11 Defects During**
- 21.C4.12 Configuration Control**
- 21.C4.13 Issue of LoA**
- 21.C4.14 Production**
- 21.C4.15 Transferability**
- 21.C4.16 Duration and Continued validity**

21.C4.1 Applicability

Electronic / Electrical Modules / SRUs which are generic in nature / functionalities and finished parts shall be issued with a Letter of Approval (LoA) if it is developed and evaluated independently.

Acceptable Means of Compliance

- a. This subpart is applicable for Electronic / Electrical Modules / SRUs, Finished parts which are not considered as Line Replaceable Units (LRUs) for which a Technical Specification is approved by CEMILAC/RCMA and are identified in accordance with Subpart Q.
- b. Generic software and generic firmware may also be issued with LoA. However, development and certification process should be in accordance with Subpart C6.
- c. Modules and finished parts designed and developed by foreign firms on contract placed by Indian agencies and are meant for use by Indian Defence Services should also follow this subpart and issued with a LoA, if certification coverage is provided by Indian TAA.

Guidance Material

Nil

21.C4.2 Application for Airworthiness Assessment

Regulation

An application for certification and QA coverage shall be made by the DO/ firm in a form and manner established by CEMILAC & DGAQA.

Acceptable Means of Compliance

- a. The organisation shall hold an approved Quality Management System(QMS) or shall be in the process of obtaining it.
- b. The application shall include:
 - i. A description of the firm and its approval status
 - ii. A description of the store being developed
 - iii. Intended end use platform
 - iv. Timelines of the program
 - v. Scope of the program
 - vi. Any special conditions

Guidance Material

Nil

21.C4.3 Certification Plan (CP)

Regulation

The Design agency **shall** propose to the CEMILAC a Certification Plan (CP) that **shall** include the means to demonstrate compliance with applicable Airworthiness codes.

Acceptable Means of Compliance

- a. For a particular development activity and as part of the certification process, the applicant shall prepare a Certification Plan (CP) containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable Airworthiness codes/standards
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions affecting airworthiness and environmental protection interfacing with the Authority.
 - v. Major Project milestones and review stages
 - vi. Artefacts/documents generated at each stage
 - vii. Software/Firmware considerations wherever applicable
 - viii. Test equipment and Rigs
 - ix. Screening Requirements

Guidance Material

- a. The description on how compliance will be demonstrated, with proposed means of compliance (see appendix to this AMC below for example codes), and any selected guidance material. The description of the means of compliance should be sufficient to determine that all necessary data will be collected and compliance can be demonstrated.
- b. A compliance checklist addressing each paragraphs of the type-certification basis and environmental protection requirements applicable to the project, with reference to the means of compliance and to the related compliance documents.
- c. If the store is already operationalised / flight tested in another program, the compliance checklist shall specifically identify the delta requirements to be demonstrated, if any.
- d. When the store is qualified to a different standard/ code/ criterion, the DA shall show compliance by preparing a requirements comparison analysis matrix. Any shortfall in the

comparison analysis matrix may require more analysis, qualification and testing to meet requirement of the approved certification plan.

21.C4.4 Quality Assurance Plan

Regulation

The Design agency **shall** propose to the DGAQA a Quality Assurance Plan that **shall** include the QA milestones and activities.

Acceptable Means of Compliance

- a. For a particular development activity and as part of the QA process, the applicant shall provide a QA Plan.
- b. DGAQA may delegate certain QA activities to the internal QA of the design organisation depending on the maturity of the QMS of the organisation. This delegation of responsibilities shall be brought in the QA plan.
- c. The QAP should be approved by the DGAQA before compliance demonstration commences and updated as necessary during the Design, Development and Acceptance process

Guidance Material

- a. QA Plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable inspection, process and acceptance standards
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Process flow & Stage wise inspection plan starting from raw material stage to finished product.
 - vii. Involvement of the stakeholders at various stages.
 - viii. Documents generated at each stage
 - ix. Clearance procedures at each stages
 - x. Handling and storage conditions.
- b. The description on how compliance will be demonstrated, with proposed means of compliance, and any selected guidance material. The description of the means of

compliance should be sufficient to determine that all necessary data will be collected and compliance can be demonstrated.

21.C4.5 Identification

Regulation

Each Airborne Store shall be uniquely identified and permanently & legibly marked in accordance with the applicable identification data.

Acceptable Means of Compliance

Airborne Stores shall be identified as per Subpart Q.

Guidance Material

Nil

21.C4.6 Design and Development

Regulation

The design and development activities shall follow a system engineering approach. TAA should be involved throughout the life cycle phases of the project as envisaged in certification and Quality assurance plans and in various reviews and evaluation processes.

Acceptable Means of Compliance

- a. Requirement Review, PDR and CDR shall be conducted for the stores at appropriate stages.
- b. Technical Specifications, MDI, Drawings, BOM, Test Rig Specification, QTP and Functional Test Procedure shall be prepared by the DO and approved by CEMILAC before commencement of tests.
- c. Electrical and Bus ICD, Hardware Design Document and installation drawings shall be provided by the design agency to CEMILAC for reference.
- d. The QT tests shall be carried out by the DO with coordination of DGAQA.
- e. Design changes, if necessary during the evaluation process shall only be with the concurrence of CEMILAC
- f. Software certification shall be carried out for all the software components in the system.
- g. The test results and compliance matrix, both endorsed by DGAQA shall be analysed by CEMILAC.

Guidance Material

The various activities in Design and Development process, leading to finalisation of the baseline configuration of the store to be subjected to test and evaluation, is elaborated in Annexure A of Subpart 21.C1

21.C4.7 Software & Firmware Development

Regulation

Software/Firmware used in Airborne Stores shall comply with the applicable airworthiness regulations for the software/firmware aspects of airborne systems and equipment certification.

Acceptable Means of Compliance

- a. Developers of Airborne stores containing Software/Firmware should demonstrate the means of compliance for the Software /Firmware aspects.
- b. Software/Firmware should be developed and tested in accordance with an established Software Development Life Cycle Process.
- c. The criticality level of the software should be defined. Criticality level should be the outcome of a System Safety Assessment Process carried out at appropriate level depending on the end usage.
- d. The objectives of each stage of the SDLC should be identified and Means of Compliance shall be arrived at.
- e. A certification plan should be finalised in accordance with the Acceptable Means of Compliance.

Guidance Material

- a. Development and airworthiness evaluation of Software & CEH components shall follow the guidelines listed at Subpart C6.

21.C4.8 Test Rigs and Test equipment

Regulation

Test Rigs and Test equipment used to demonstrate the compliance with applicable requirements and Airworthiness Codes shall have necessary approvals from TAAs.

Acceptable Means of Compliance

- a. Test Rigs, Simulators, Test equipment etc with its associated software should have necessary approvals prior to using for compliance demonstration and should be in accordance with Subpart T

- b. Test Rig Software/Firmware should be certified as per relevant certification criteria and in accordance with Subpart C6.

Guidance Material

- a. Test Rigs and Equipment may be classified into the following categories as per Sub Part T:
 - i. Used only during Design and Development
 - ii. Used during Production
 - iii. Delivered to user services

21.C4.9 Test and Evaluation

Regulation

The Airborne Store shall be subjected to necessary tests to ensure compliance with applicable Airworthiness Codes and performance requirements as defined in the certification program prior to release to user services.

Acceptable Means of Compliance

The steps to be followed for Test and Evaluation are explained at Annexure C of Subpart 21.C1

Guidance Material

When reviewing any test report or activity, the independent checking function of the Design Organization is made to ensure:

- a. That materials and processes adequately conform to the specifications for the proposed Type Design.
- b. Those parts of the Airborne store adequately conform to the drawings in the proposed Type Design.
- c. That the manufacturing processes, construction and assembly adequately conform to those specified in the proposed Type Design.
- d. That the test equipment and all measuring equipment used for tests are adequate for the test and are appropriately calibrated.

21.C4.10 Deviations

Regulation

Deviations with respect to the approved drawings observed during manufacturing and/or assembly of qualification prototypes and prototype deliverables (used for development

evaluation) shall be referred to the Non-Conformance Review Board (NCRB) for acceptance or otherwise.

Acceptable Means of Compliance:

- a. A Deviation Disposition shall be constituted by the Main Contractor for disposition on deviations from approved drawings observed during Manufacturing and/or Assembly of Qualification Prototypes and Prototype Deliverables.
- b. Non-Conformance Review Board shallBoard comprise the following members
 - i. Rep of Main Contractor responsible for design & development activities
 - ii. Rep of RCMA
 - iii. Rep of DGAQA
 - iv. Rep from User agencies (is a part of project team)
 - v. Quality representative of Main Contractor responsible for design & development activities
- c. Deviation Disposition Board meeting shall be chaired by Main Contractor responsible for design & development activities. The board may co-opt members from other agencies
- d. The board may recommend additional analysis/testing to assess the implications of the deviation. The same shall be carried out by the Main Contractor and submitted to the Board.

Guidance Material

- a. Deviations observed during manufacturing/assembly of qualification prototypes and prototype deliverables shall be analyzed thoroughly by the Main Contractor and referred to Deviation Disposition Board for suitable disposition.
- b. The probable causes for occurrence of the deviation, implications of the deviation and remedial measures to avoid recurrence etc shall be studied.
- c. The board shall study the implications of the reported deviation on the aspects viz. Function, Strength, Safety, Life, Interchangeability and Maintenance of the accessory etc. A decision on acceptance of the deviation with or without any limitations/restrictions or rejection of the part/ unit shall be taken accordingly.
- d. The board shall also scrutinize the possible causes for occurrence of the deviation and suggest suitable remedial measures to avoid recurrence of deviation to the agencies concerned
- e. Minutes of meeting of *Deviation Disposition Board* on disposition of the reported deviation shall be finalised with recommendations

21.C4.11 Defects During development

Regulation

The failure / defects in Airborne Stores observed during design and development phase shall be properly investigated and remedial measures shall be incorporated.

Acceptable Means of Compliance (AMC):

- a. A Defect Investigation committee shall be constituted for each development project with members from Designer, Designer QA, CEMILAC, DGAQA and user services (wherever applicable)
- b. The failed store along with details regarding reported failure / defect shall be forwarded by main contractor to Defect Investigation committee for thorough investigation.
- c. Defect Investigation committee shall analyze the failure / defect and identify the reasons of failure. Based on these inputs, the committee will suggest remedial measures. These details will be endorsed in the defect investigation report and signatories to this report are members defect investigation committee.
- d. Main contractor shall forward a modification proposal to RCMA/CEMILAC based on the remedial measures suggested by the Defect Investigation Committee as a Change Note.
- e. Main Contractor along with CEMILAC will arrive at the required modifications evolve the testing required for verifying.
- f. The main contractor has to compile failures / defects, their analysis and corrective action taken and forward to CEMILAC and DGAQA.
- g. If the Defect Investigation Results in incorporation of any new functionalities, same shall be referred to Change Control Boards (CCBs)

Guidance Material

- a. Document approved by CEMILAC with respect to testing due to modification required on prototype units.
- b. After finalization of modification required and before implementation of modification, the documents configuration is to be manage through Configuration Control Board.
- c. The committee is to be chaired by domain expert not part of organization responsible for design and development activities.

21.C4.12 Configuration Control

Regulation

The Design agency shall have a proper configuration control mechanism to address the changes in baseline configuration of the stores as well as documents during Design and Development phase.

Acceptable Means of Compliance

- a. A configuration management plan to be prepared at the beginning of the program.
- b. Configuration items should be uniquely identified, documented and controlled. This may include, but is not limited to, hardware, software, design representations of hardware and software, tools or other data items used for certification credit and baselines.
- c. Change control and traceability of changes shall be maintained. This requires that life cycle data identified in the plans shall be secured and retrievable.
- d. Any change in requirements or incorporation of additional requirements shall be referred to CCBs.
- e. Changes resulting from Defect Investigation shall be referred to CCBs only when it calls for a requirement change or incorporation of additional requirements.
- f. The Configuration Control Board consisting of the following members:
 - i. Rep RCMA / CEMILAC
 - ii. Rep Main Contractor responsible for design and development
 - iii. Rep. Main Contractor responsible for Quality Assurance
 - iv. Rep. Main Contractor responsible for manufacturing
 - v. Rep DGAQA

Guidance Material

- a. Any deviations from functional / performance requirements or failures during qualification/ground / flight testing of the Airborne Stores during the design and development phase may lead to some modifications in the baseline configuration
- b. Modification may also arise due to incorporation of new requirements, improvement in maintainability, testability etc. (Ref 21.C1.16)
- c. Modifications cleared by the DIC or CCBs (21.C1.15 & 21.C1.16) shall be submitted by main contractor to RCMA / CEMILAC in the form of ECNs & SCNs.
- d. Approved ECNs & SCNs by CEMILC/RCMA shall be the basis for incorporating Modifications.
- e. Implementation of modification will be carried out by main contractor.
- f. An approved Engineering Change Note (ECN) for hardware Components and related documents and Software Change Note (SCN) for Software components, along with approved baseline configuration shall be treated as the revised baseline configuration.

21.C4.13 Issue of LoA

Regulation

The DO **shall** be issued with a Letter of Approval when CEMILAC/RCMA has accepted that the requirements of CB have been fully met.

Acceptable Means of Compliance

The evaluation as per ACP should be completed. Compliance report along with application for LoA should be submitted by DO.

Guidance Material

Nil.

21.C4.14 Production

Regulation

Limited Series or Series Production of the Airborne store may be taken up by a Production Organisation on Receipt of LoA for the respective Store

Acceptable means of compliance

- a. Production of Airborne Store is explained in Subpart F.
- b. Each deliverable item should hold a certificate of Airworthiness

Guidance Material

- a. Production organization Approval Process, Supart G2
- b. Subpart H - CoA
- c. AFQMS by DGAQA

21.C4.15 Transferability

Regulation

If a LoA is to be transferred, the transfer shall be made only to a Design Organisation registered with Govt. Of India.

Acceptable Means of Compliance

- a. The LoA transfer should be made with the agreement of CEMILAC.
- b. LoA transfer should not be made when the same LoA is suspended or withdrawn by CEMILAC.
- c. The LoA issued assumes usage in the Indian Environment only and needs to be redefined in scope for further transferability.

GuidanceMaterial

In case of change in ownership of the firm / acquisition, LoA may be transferred to the new owner as per provisions.

21.C4.16 Duration and Continued validity

Regulation

LoA subject to any constraints **shall** remain valid for life subject to the Design Organization remaining in compliance and providing that the certificate has not been suspended or revoked.

Acceptable Means of Compliance

- a. Upon notification of suspension or revocation, the LoA should be surrendered to the CEMILAC and the users to be informed.
- b. The vendor should update all the LoA documents with the latest hardware and software modifications/Updates and prepare the updated Design documents for renewal of LoA by the TA authority.
- c. The Vendors should ensure all design changes/corrections in drawings are incorporated in the LoA documents.

Guidance material

Nil

SUBPART-C5 : AIR BORNE STORES, FOR WHICH IMTSO EXISTS, LEADING TO IMTSO APPROVAL (IMTSOA)

Rationale

- a. A Technical Standard Order (TSO) is a detailed airworthiness specification issued by a recognized certification body to ensure compliance with the essential airworthiness requirements for a particular store. Indian Military Technical Standard Order (IMTSO) are the TSOs released by CEMILAC considering Indian Military requirements. Although CEMILAC has not released any IMTSO, TSOs issued by other certification authorities are also considered provided they have potential application with Indian Military Services.
- b. Any organization that produces or is preparing to produce an IMTSO store, shall be eligible as an applicant for an IMTSO Authorization (IMTSOA) on demonstrating that the article complies with the technical conditions of the applicable IMTSO, and submitting the corresponding statement of compliance.
- c. When a DO is authorized to manufacture a material, part, or appliances to a IMTSO standard, this is referred to as IMTSO authorization. Receiving a IMTSO Authorization include both design and production approval.

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DRAFT

21.C5. 1 IMTSOA

Regulation

Indian Military Technical Standard Order (IMTSO) is a detailed airworthiness specification issued by CEMILAC describing minimum performance standard for a specified material, parts, or appliances to ensure compliance with the essential airworthiness requirements.

Acceptable Means of Compliance

- a. When authorized to manufacture a material, part, or appliances to a IMTSO standard, this is referred to as IMTSO authorization.
- b. Receiving a IMTSO authorization include both design and production approval.
- c. Receiving a IMTSO authorization is approval to manufacture an article that may be installed on an aircraft only after showing that the article meets the specific airworthiness requirements (certification basis) of a particular aircraft model. In other words, receiving a IMTSO authorization means that an article meets a minimum performance requirement independent of the article's intended installation on an aircraft.
- d. Receiving a IMTSO Authorization is not an approval to install and use the article in the aircraft. It means that the article meets the specific IMTSO and the applicant is authorized to manufacture it.
- e. The applicant has to ensure and demonstrate TAA that the IMTSO compliant article is appropriate for use on the aircraft and meets all of the installation and operational requirements.
- f. A separate CEMILAC approval is required to install an IMTSOA article on an aircraft for carrying out the evaluation.

Guidance Material

- a. Nil

21.C5. 2 Applicability

The regulations contained in this subpart are applicable to the development and certification of Airborne Stores for which an IMTSOA released by CEMILAC exists.

Acceptable Means of Compliance

- a. CEMILAC may release IMTSO for certain generic Stores to ensure compliance with the essential airworthiness and as a minimum performance standard for specified store.

- b. The TAA **shall** ensure that any applicable store installed into or onto the Air System complies with the technical conditions of the IMTSA under which it was approved.
- c. TSOs issued by other certification authorities are also considered provided they have potential application with Indian Military Services

Guidance Material

- a. If a store is holding a TSO issued by other certification agency, the applicant should show compliance by preparing a comparison between such TSO and IMTSA. Any shortfall in the comparison may require more analysis and/or qualification and/or testing to meet requirement of the IMTSA.

21.C5.3 Demonstration of Design Organisation (DO) Capability

Regulation

The organization responsible for the design and development of the IMTSA store shall demonstrate its capability to TAA, by demonstrating its approved Quality Management System (QMS) and by holding a Design Organisation Approval (DOA).

Acceptable Means of Compliance

- a. The Design Organisation (DO) should have a Design Organization Approval(DOA) as per Subpart G.
- b. The design organisation shall hold an approved Quality Management System (AFQMS) from DGAQA.

Guidance Material

- a. Each applicant must allow the DGAQA & CEMILAC or its authorised representatives to inspect its quality system, facilities, technical data, and any manufactured products or articles and witness any tests, including any inspections or tests at a supplier facility, necessary to determine compliance with this Subpart.
- b. AFQMS document released by DGAQA
- c. Design Approved Organization Scheme (DAOS) - Subpart G

21.C5.4 Identification

Regulation

Any IMTSA Store, considered for issue of an IMTSA shall be properly identified.

Acceptable Means of Compliance

IMTSOA Store shall be identified as per Subpart Q

Guidance Material

Nil

21.C5. 5 Airworthiness Certification Plan (ACP)

Regulation

The DO **shall** propose to the CEMILAC a Certification Plan (CP) that **shall** include the means to demonstrate compliance with applicable IMTSO.

Acceptable Means of Compliance

- a. The certification plan can be developed step by step, when the information needed is not available at the beginning of the project.
- b. The CP should be approved by the CEMILAC before compliance demonstration commences and updated as necessary during the Certification process

Guidance Material

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a certification plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable IMTSO Provisions
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions affecting airworthiness and environmental protection interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Artefacts/documents generated at each stage
 - vii. Software/Firmware considerations wherever applicable
 - viii. Test equipment and Rigs

21.C5. 6 Quality Assurance Plan

Regulation

The DO **shall** propose to the DGAQA a Quality Assurance Plan that **shall** include the QA milestones and activities.

Acceptable Means of Compliance

- a. The QAP should be approved by the DGAQA before compliance demonstration commences and updated as necessary during the Design, Development and Acceptance process

Guidance Material

- a. For a particular project and as part of the technical familiarisation, the applicant shall provide a QA Plan containing the following information:
 - i. Description of the project and the kind of operations envisaged
 - ii. Applicable inspection, process and acceptance standards
 - iii. Special conditions, equivalent safety findings and environmental protection requirements (where applicable).
 - iv. Identification of relevant personnel making decisions interfacing with the Authority, unless otherwise identified to the Authority
 - v. Major Project milestones and review stages
 - vi. Process flow & Stage wise inspection plan starting from raw material stage to finished product.
 - vii. Involvement of internal & external agencies at various stages.
 - viii. Documents generated at each stage
 - ix. Clearance procedures at each stages
 - x. Handling and storage conditions.
- b. The description on how compliance with QA points will be demonstrated, with proposed means of compliance, and any selected guidance material.

21.C5. 7 Design Development and Evaluation

Regulation

- a. The DO shall have a design & development process that results in the Store meeting the IMTSOA requirements and the Certification Basis.
- b. TAA should be involved from conceptual stage of the project in various reviews and evaluation.

Acceptable Means of Compliance

- a. The DO shall follow Design, Development and Evaluation process in accordance with Subpart C1, para 21.C1.12 through 21.C1.19.

- b. DO, who requests for approval to deviate from any performance standard of an IMTSA shall demonstrate that the standards from which a deviation is requested are compensated for by factors or design features providing an equivalent level of safety.
- c. The request for approval to deviate, together with all pertinent data, shall be submitted to the TAA.

Guidance Material

Nil

21.C5. 8 Application for IMTSA

Regulation

An application for an IMTSA shall be made to CEMILAC by the DO on completion of design evaluation activities.

Acceptable means of Compliance

- a. The data required in both cases are:
 - i. A statement of compliance certifying that the applicant has met the requirements of this regulation
 - ii. A Declaration of Design and Performance (DDP)
 - iii. One copy of the technical data required in the applicable IMTSA

Guidance material

- a. The holder of an IMTSA is entitled to produce and to mark the article with the appropriate IMTSA marking, ensuring compliance in accordance with the provisions of this regulation.
- b. Upon satisfaction of compliance to this regulation CEMILAC shall issue IMTSA for airborne stores.

21.C5. 9 Declaration of Design and Performance (DDP)

Regulation

A DDP shall be submitted to the TAA by DO for issuance of IMTSA.

Acceptable means of Compliance

- a. Information corresponding to Type Design and Type Testing, identifying the article and its design and testing standard.
 - i. The drawings and specifications, and a listing of those drawings and specifications, necessary to define the configuration and the design features of

the product shown to comply with the applicable type-certification basis and environmental conditions

- ii. Information on materials and processes and on methods of manufacture and assembly of the product necessary to ensure the conformity of the product
 - iii. An approved airworthiness limitations section of the instructions for continuing airworthiness
 - iv. Any other data necessary to allow by comparison, the determination of the airworthiness of products of the same type.
- b. The rated performance of the article either directly or by reference to other supplementary documents.
 - c. A statement of compliance certifying that the article has met the appropriate IMTSO.
 - d. Reference to relevant test reports.
 - e. Reference to the appropriate Maintenance, Overhaul and Repair Manuals.
 - f. The level(s) of compliance, where various levels of compliance are allowed by the IMTSO.

21.C5. 10 Design Changes to airborne stores having IMTSO

Regulation

The holder of the IMTSO authorisation may make minor design changes without further authorisation by CEMILAC.

Acceptable means of Compliance

- a. The changed article keeps the original model number (part number changes or amendments shall be used to identify minor changes) and the holder shall forward to TAA any revised data that are necessary for compliance with the regulation.

Guidance material

- a. Any design change by the holder of the IMTSO authorisation that is extensive enough to require a substantially complete investigation to determine compliance with the IMTSO is a major change. Before making such a change, the holder shall assign a new type or model designation to the article and apply for a new authorisation or fresh IMTSOA.

21.C5. 11 Record Keeping

Regulation

All relevant design information, drawings and test reports, including inspection records for the article tested shall be held at the disposal of the TAA and shall be retained as the information necessary to ensure the continued airworthiness of the article and of the air system in which it is fitted.

Acceptable means of Compliance

- a. Contractor shall prepare the compliance of IMTSA of airborne stores and submit all the artefacts in the prescribed format for having the record at TAA.

Guidance material

NIL

21.C5. 12 Obligations of the IMTSA holder

Regulation

The holder of an IMTSA shall fulfil certain obligations to upkeep the Airworthiness of IMTSA Store

Acceptable means of Compliance

The holder of an IMTSA shall have the following obligations:

- a. Manufacture each article ensuring that each completed article conforms to its design data and is safe for installation
- b. Prepare and maintain, for each model of each article for which an IMTSA authorisation has been issued, a current file of complete technical data, test data and inspection records
- c. Prepare, maintain and update master copies of all manuals required by the applicable airworthiness specifications for the article
- d. Make available to users of the article and to the TAA on request those maintenance, overhaul and repair manuals necessary for the usage and maintenance of the article, and changes to those manuals
- e. Continue to meet the certification requirements of the IMTSA regulation.
- f. Upon request, allow the TAA to
 - i. Witness any tests
 - ii. Inspect the technical data files on that article

Guidance material

NIL

21.C5. 13 Production of IMTSOA Stores

Regulation

Limited Series or Series Production of the IMTSOA may be taken up by a Production Organisation on Receipt of IMTSOA.

Acceptable Means of Compliance

- a. IMTSOA holder may take up limited/series production of the Store.
- b. If the IMTSOA holder and Production Organisation are different, necessary Transfer of Technology shall be carried out.
- c. Provisions in Subpart F shall be followed.

Guidance Material

- a. Production of Stores shall be carried out as per provisions provided in Subpart F.

21.C5. 14 Duration and Continued Validity

Regulation

An IMTSO authorisation shall be issued for an unlimited duration.

Acceptable means of Compliance

It shall remain valid unless:

- a. The conditions required when IMTSO authorisation was granted are no longer being observed
or
- b. The obligations of the holder specified in 21.C5.12 above of this subpart are no longer being discharged
or
- c. The article has proved to give rise to unacceptable hazards in service
or
- d. The authorisation has been surrendered or revoked under the applicable administrative procedures established by the Authority.
- e. Upon surrender or revocation, the certificate shall be returned to TAA.

Guidance material

NIL

21.C5. 15 Transferability

Regulation

Except for a change in ownership of the holder, which shall be regarded as a change of significance, an IMTSA authorisation issued by TAA is not transferable.

Acceptable means of Compliance

- a. Each change to the design assurance system or quality system in the production organization that can significantly affect the compliance of the article to the IMTSA, shall be approved by TAA.
- b. An application for approval shall be submitted in writing and the organisation shall demonstrate that it will continue to comply with this regulation after implementation of the change.
- c. TAA shall establish the conditions under which a production organisation approved under this regulation may operate during such changes unless the TAA determines that the approval should be suspended.

Guidance material

NIL

21.C5. 16 Failures, malfunctions and defects

Regulation

The holder of IMTSA shall have a system for collecting, investigating and analysing reports of and information related to failures, malfunctions, defects other occurrences in the operation or storage of the article covered by the IMTSA which cause or might cause adverse effects on the airworthiness of the article.

Acceptable means of Compliance

- a. This information shall be made available to all known operators of the article and, on request, to any person authorized by TAA.
- b. The holder of IMTSA shall report to TAA any failure, malfunction, defect and other occurrence related to the article covered by the IMTSA, which has resulted in or may result in an unsafe condition.

- c. These reports shall be made in a form and manner established by the TAA, as soon as practicable and in any case dispatched not later than 72 hours after the identification of the possible unsafe condition, unless exceptional circumstances prevent this.

Guidance material

- a. When a failure, malfunction, defect results from a deficiency in the design, or a manufacturing deficiency, the holder of IMTSOA shall investigate the reason for the deficiency and report to the TAA the results of its investigation and any action it is taking or proposes to take to correct that deficiency.
- b. If the TAA finds that an action is required to correct the deficiency, the holder of IMTSOA shall submit the relevant data to the TAA.

DRAFT

21.C6 AIRBORNE /GROUND SYSTEM SOFTWARE AND COMPLEX ELECTRONIC HARDWARE (CEH)

Rationale

Software certification for airborne systems, provides reliable and safe software for intended use in Military application. In the context of airworthiness certification of embedded airborne systems and software, there are three main aspects to be taken into account. They are safety, reliability and security of systems and platforms. Safety of embedded systems has two main aspects they are functional safety aspect and digital system induced safety aspect. In order to fine tune the safety aspect, there are several standards, procedures, policies, guidelines available by applying which the process of certification shall be carried out.

Complex Electronic Hardware (CEH) consists of custom micro-coded components like ASICs/FPGAs/PLDs etc. A Line Replaceable Unit (LRU) can be split into three parts: Hardware, Software and CEH. Akin to qualification of hardware, software and CEH also need qualification. Certification of CEH is gaining importance due to complexity and volume of logic being built into it. CEH is increasingly replacing computing processors and other hardware elements in modern electronic design in military airborne applications. Off-the-shelf components like Intellectual Property (IP) cores and their certification plays a decisive role in using them in CEH designs.

Ground System Software is the supporting software for airborne software and end-users. It has got varying level of complexity and is certified by DGAQA. Exceptions are Ground control software which are part of the control loop of the Unmanned Airsystems, affecting the performance of the Airsystem and hence has to be treated at par with airborne software. Certification of Ground System and Ground Control software is required to keep up the confidence level for certification authority in airborne counterparts.

Applicability

The regulations contained in this subpart are applicable to Airborne Software, Ground System Software, Complex Electronic Hardware (CEH) and IP cores.

- a. This subpart shall be applied for Airborne Software which is considered as part of Line Replaceable Units (LRUs)/accessories.
- b. This Subpart shall be applied for CEH and IP cores which is considered as part of Line Replaceable Units (LRUs)/accessories.
- c. This Subpart shall be applied for the ground components of Unmanned Air Systems (UAS).

- d. This Subpart shall be applied for Ground System Software which are a part of Ground equipment classified as TTGE and Test Rigs under Subpart T.
- e. Software/CEH of LRUs and Sub-systems designed and developed by foreign firms on contract placed by Indian agencies and are meant for use by Indian Defence Services shall follow this subpart.

Contents:

- 21.C6.1 Ab-initio Design and Developed Airborne Software
- 21.C6.2 Ab-initio Design and Developed Airborne CEH
- 21.C6.3 Certification of Ab-initio Design and Developed Ground System Software

Annexure A

- Fig-1: Software Certification Process
- Table -1: List of artefacts based on criticality
- Table - 2: Certification process based on criticality
- Table- 3: Certification guidelines for DFT

Annexure B – Format for Software Change Request (SCR)

Annexure C – Format for Software Problem Report (SPR)

Annexure D – Format for Letter of Acceptance(LoA) for CEH

21.C6.1 CERTIFICATION OF AB-INITIO DESIGN & DEVELOPED AIRBORNE SOFTWARE

Rationale

Software has made way into Systems and Technologies to the extent that it has become indispensable in military systems, where they have gone deeper in past few decades. From a small and less critical Telemetry system to a larger more critical Flight control system, they play a fundamental and decisive role. Software certification is existing in airborne military applications for past few decades and now gearing up to address more challenges in form of trending technologies in military scenarios. More and more of what the Military is going to do will be software intensive. In this regard, Airborne software needs extensive design evaluation and testing for which test benches, test jigs and test rigs will be created at various levels and stages of software design and development. For which, software certification can be brought out into following regulations as shown below.

Contents

- 21.C6.1 Certification of Ab-initio Designed and Developed Airborne Software**
- 21.C6.1.1 Application for Airborne Software Certification Coverage**
- 21.C6.1.2 Identification**
- 21.C6.1.3 System Requirements and Software Criticality Level**
- 21.C6.1.4 Constitution of Software IV&V team**
- 21.C6.1.5 Certification Plan (CP) for Software**
- 21.C6.1.6 Software Planning**
- 21.C6.1.7 Software Requirements Analysis**
- 21.C6.1.8 Software Preliminary and Detailed Design**
- 21.C6.1.9 Software Coding**
- 21.C6.1.10 Module Level Testing**
- 21.C6.1.11 Integration Level Testing**
- 21.C6.1.12 Software Verification and Validation**
- 21.C6.1.13 Software Quality Assurance**
- 21.C6.1.14 Software Configuration Management**
- 21.C6.1.15 Certification of Software Modification and Adaptation**
- 21.C6.1.16 Software designed and developed by Foreign vendor/Boughtout Sw &**

Changes

- 21.C6.1.17 Tools /COTS Certification Process**
- 21.C6.1.18 Missile Software Approval**
- 21.C6.1.19 UAV Software Airborne Segment Certification**
- 21.C6.1.20 UAV Software Ground Segment Certification**

21.C6.1 Certification of Ab-initio Designed and Developed Airborne Software Regulation

Ab-initio designed and developed software for indigenously designed airborne stores shall be Airworthiness Certified by CEMILAC prior to the Clearance of the corresponding airborne store for flight trials and subsequent service use.

Acceptable Means of Compliance

- a. The approach to Certification shall be in accordance with the regulations provided in this subpart in the subsequent sections.

Guidance Material

- a. The certification process comprises the following major steps:
 - i. Determination of Software Criticality Level based on System Safety Assessment
 - ii. Identifying the system requirements allocated to software.
 - iii. Agreement with Certification Plan (CP) and other plans
 - iv. Verification of Software Requirements
 - v. Verification of Software Design and implementation
 - vi. Conduct of Software Evaluation and Testing
 - vii. Demonstration of compliance with CP and review of Certification Evidence
 - viii. Issuance of Software Clearance
- b. Successful completion of certification process for an Airborne Software will result in CEMILAC issuing a Software Clearance to the Main contractor.

21.C6.1.1 Application for Airborne Software Certification Coverage

Regulation

Main contractor shall apply to CEMILAC for software certification coverage of airborne software.

Acceptable Means of Compliance

- a. The application shall include:
 - i. A description of the firm and its approval status
 - ii. A description of the software being developed/ Functional Requirement Specification
 - iii. Criticality classification of the software
 - iv. Standard compliance mandated by the user, if any
 - v. Intended end use platform

- vi. Time-lines of the program
 - vii. Scope of the program
 - viii. Any special conditions
- b. Demonstration of Design Organization (DO) capability shall be done by the main contractor.

Guidance Material

NIL

21.C6.1.2 Identification

Regulation

Airborne Software which are uniquely identified through configuration control only shall be cleared for installation on for Air Systems and subsequently delivered to user services.

Acceptable Means of Compliance

- a. Airborne Software shall be uniquely identified as a configurable Software Component.
- b. Software component shall be uniquely identified by version number and checksum.

Guidance Material

- a. Following guidelines for identifying different versions of CSC may be adopted, if compatible with the aircsystem configuration identification scheme:

Sw V x.y.z

'x' will increment by 1 in case of a functional increment

'y' will increment by 1 in case of a requirement or design change

'z' will increment by 1 in case of code change against error correction

21.C6.1.3 System Requirements and Criticality Level

Regulation

The Main Contractor shall assign Criticality Levels to the software components on the basis of System Safety Assessment.

Acceptable Means of Compliance

- a. System Requirements allocated to software shall be identified and allotted to each of the planned Software components. CEH requirements also shall be identified and

allotted to CEH. This shall be documented and approved by the main contractor as SARAD (System Architecture & requirements allocation document).

- b. Safety requirements that define the fault detection, fault tolerance and fault avoidance characteristics of the system are to be determined from the allocated software requirements, apart from functional and performance requirements.
- c. Failure modes shall be identified.
- d. Criticality Level shall be determined for each of the software and CEH component. Software Criticality classes recommended are: Safety Critical, Mission Critical and Non-Critical.
- e. SSA report and SARAD duly approved by the main contractor shall be released.

Guidance Material

- a. System Safety Assessment (SSA) methods (like Fault Tree Analysis (FTA), Functional Hazard Analysis (FHA), Common Mode Analysis (CMA) etc.,) shall be applied to determine the Criticality Level.
- b. System Requirements and derived requirements shall be fed back to the SSA process for determining the impact of safety on the Airsystem.
- c. Information exchange between system, hardware and software development life cycle processes shall bring out compatibility issues between hardware/ software, external interfaces, acceptability of software derived requirements etc.,
- d. User Requirement document may be used for identifying System Software Requirements.
- e. Main Contractor's preliminary investigations /studies defining the project may be used.
- f. There may also arise a need to revise the System requirements allocated to software as the development progress because of various reasons such as inability to implement the initial concepts or changes in the user's requirements. Such inadequacies in the system requirements document are overcome by issuing amendments through well-defined configuration control procedures.
- g. Different architectural strategies may be adopted in hardware or software or combination of both to limit the impact of failures of individual components of hardware or software on system by providing isolation by partition, common mode failures avoidance, dissimilar design, failure detection and other such techniques.

21.C6.1.4 Constitution of Software IV&V team

Regulation

IV&V team shall consist of system experts, domain experts, testing experts from relevant stake holder organizations and CEMILAC and DGAQA representatives.

Acceptable Means of Compliance

- a. IV&V Team shall be constituted by main contractor with relevant stakeholders.
- b. IV&V team shall to be independent from the software design and development team.
- c. IV&V shall formulate IV&V planning and participate in testing and test reporting activities.
- d. IV&V recommendation is a required input for CEMILAC Software certification.

Guidance Material

NIL

21.C6.1.5 Certification Plan (CP) for Software Regulation

The Main Contractor shall propose to the CEMILAC a Certification Plan (CP) that shall include the means to demonstrate compliance with applicable Airworthiness standards.

Acceptable Means of Compliance

- a. The applicant shall provide a certification plan to demonstrate compliance to the required standards and criticality.
- b. The CP shall be approved by the CEMILAC before compliance demonstration commences and updated as necessary during the Certification process
- c. If the software is already operational / flight tested in another program, the compliance checklist shall specifically identify the delta requirements to be demonstrated, if any.
- d. Software certification shall be carried out concurrently with the software development.
- e. Means of compliance to objectives shall be provided.

Guidance Material

- a. CP may be called as PSAC (Plan for Software Aspects of Certification)
- b. CP forms the basis of agreement between the design agency and certification authority on the activities to be carried out and objectives to be met during the software development life cycle.
- c. CP shall bring out the architectural considerations (if any), intended use/modifications of/to previously developed software, need for tool qualification, and any other additional considerations.
- d. Fig-1 in Annexure A shows Software Certification process.
- e. Certification plan to contain the following information:
 - i. Applicable Airworthiness codes/standards
 - ii. Identified Criticality level of software

- iii. Special conditions, equivalent safety findings
 - iv. Development and Test environment of software.
 - v. Previously Developed Software/ Field loadable Software considerations
 - vi. Need for Tool Qualification
 - vii. Major Project milestones and review stages (Stage of Involvements)
 - viii. Route to Flight Testing of software
 - ix. Scheme to recertify the software in case of modifications
 - x. Any other relevant information ((Eg: handling of dead and de-activated code, usage of advance Sw technologies like Formal methods, model based design, MSDF, AI etc or any other may be brought out).
- f. Software guidelines and standards are listed as guidelines though not exhaustive:
- i. Internationally followed Software Life Cycle Processes like IEEE 12207 etc.,
 - ii. RTCA DO-178C, Software Considerations in Airborne Systems and Equipment Certification.
 - iii. DRDO Standard for Software Development (DSSD), DRDO Bhawan, N Delhi, 2018
 - iv. RTCA DO-330, Software Tool Qualification Considerations,
 - v. RTCA DO-331, Model-Based Development and Verification Supplement to DO178C and DO-278A
 - vi. RTCA DO-332, Object-Oriented Technology and Related Techniques Supplement to DO-178C and DO-278A
 - vii. RTCA DO-333, Formal Methods Supplement to DO-178C and DO-278A
 - viii. RTCA DO-254 / EUROCAE ED-80, Design Assurance Guidance for Airborne Electronic Hardware (for CEH)
 - ix. RTCA DO-278 / ED-109, Guidelines for Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) Systems Software Integrity Assurance” (For ground based avionics software).

21.C6.1.6 Software Planning

Regulation

Once the CP is agreed and approved by CEMILAC, the Main Contractor **shall** propose to the CEMILAC plan documents on Development, Configuration Management, Verification and Quality Assurance.

Acceptable Means of Compliance

- a. Availability of Development plan, Configuration management plan, Verification plan and Quality assurance plan with respect to the criticality of the software planned.

- b. Adherence to the approved plans shall be ensured by the QA group of the main contractor.
- c. If necessary, the plans may be updated by the main contractor with concurrence of CEMILAC, during certification process.

Guidance Material

- a. The proposed plans shall be consistent with each other.
- b. In Annexure A, Table-1 shows the tailoring guidelines and list of artefacts based on criticality of software. This list of artefacts forms the basis of certification. Table-2 shows tailoring of software development and certification process based on criticality of software. Table-3 shows guidelines for software certification for SOF clearance.
- c. Development plan contains Software life cycle process and its transition criteria, software development environment and the software development standards like requirements standard, design standard, coding standard, model standard etc.
- d. Configuration management plan describes the Configuration identification, Baselines and management of bi-directional traceability, problem reporting, change management, archive, and retrieval, CM of tools etc.
- e. Verification plan describes the combination of reviews, analysis and testing to be carried out at different levels for the evaluation of the software. The verification and validation activities and required level of independence are finalized depending on the criticality level of the software. Details of test environment and jigs/fixtures/rigs along with analysis tools and simulators used are captured.
- f. Quality assurance plan brings out the organizational structure and responsibilities and establishes the technical and managerial independence of personnel involved in quality assurance activities. The quality assurance activities describe the reviews to be held with respect to software life cycle phase, audits for ensuring compliance to defined plans and standard and testing to be performed to verify the compliance to requirements and reporting of observations to management.

21.C6.1.7 Software Requirements Analysis

Regulation

Software Requirements and Interface Requirements shall be prepared by the main contractor and reviewed by the IV & V team, before commencement of design.

Acceptable Means of Compliance

- a. Software Requirements Specification(SRS) shall be in consistent and bi-directionally traceable to System requirements allocated to software.
- b. Main contractor shall ensure that derived software requirements if any shall be fed back to SSA process for safety assessment and appropriately release SSA report. If Sw

Criticality level raises based on this feedback, then suitable amendments and actions to be taken by main contractor.

- c. Software Requirements Review (SRR) has to be conducted to evaluate the completeness and correctness of the requirements with all relevant stakeholders.
- d. SRS (Software Requirement Specifications) shall identify all requirements such as:
 - i. Functional, performance requirements
 - ii. All external and internal interface requirements
 - iii. Feasibility and compatibility with target computer
 - iv. Engineering constraints
 - v. Initial determination and allocation of resource
 - vi. Growth potential in terms of memory and processing time
 - vii. Safety and security requirements and fault tolerance, fault detection and avoidance capabilities
 - viii. Other non-functional requirements
 - ix. Operation, priority and sequence of function
- e. IRS (Interface Requirement Specifications) shall identify all requirements such as:
 - i. Type of signals (viz. analog, digital, discrete)
 - ii. Source and destination of signals
 - iii. Arrival or update rate
 - iv. Format in the case of digital data
 - v. Parity details
 - vi. Range and sign conventions
 - vii. Precision and accuracy requirements
 - viii. Engineering units and valid range
 - ix. Any other information or special conditions applicable

Guidance Material

- a. Review recommendations to be documented and tracked for closure.
- b. Software Test cases to be written based on SRS/IRS.
- c. IRS may be contained in SRS itself in the case of non-critical software.

21.C6.1.8 Software Preliminary and Detailed Design

Regulation

Software Design Document shall be developed by the main contractor and reviewed by the IV & V team and other relevant stake holders.

Acceptable Means of Compliance

- a. Software Design shall be in consistent and traceable to Software requirements.
- b. Main contractor shall ensure that derived software design if any shall be fed back to SSA process for safety assessment and appropriately release SSA report.
- c. Agreed upon design standards and plans shall be adhered.

- d. Preliminary and detailed design reviews should be conducted to finalize the design.
- e. Software design document should list out all low level requirements & derived low level requirements.
- f. Algorithms shall be analysed for correctness by an expert committee set up by the main contractor. The report of this committee shall be considered by IV & V team for validation of algorithms. (Eg: Secure communication, navigation, modulation/demodulation, FIR/ Kalman filters, image processing etc).
- g. Software Design shall bring out:
 - i. Software architecture
 - ii. Major functional subsystems
 - iii. Input/output interfaces, processing modes
 - iv. Implementation strategy regarding:
 - 1. Real time kernel and Schedulers
 - 2. Interrupt handling
 - 3. Fault handling
 - 4. Data latency
 - 5. Exception handling
 - 6. Built in test & diagnostic data recording
 - 7. Change over logic for multi-channel redundant systems
 - 8. Watch dog timer implementation

Guidance Material

- a. Design methodology shall be chosen based on software architecture.
- b. Data handling and buffering of critical parameters to be handled.
- c. Parameter data to be identified and incorporated in design.
- d. Detailed design shall include software architecture to unit level.
- e. Software design shall be fully supported by functional and procedural descriptions of the system (Eg: Data and Control flow diagrams in case of structured design, sequence diagrams, object diagrams, class hierarchy diagrams, system modes and system transition diagrams in case on OO design).
- f. Derived design and any design constraints shall be bi-directionally traced.
- g. Modularity, robustness, abstraction, high cohesion and low coupling to be maintained in the design.
- h. Fault identification, fault tolerance mechanisms and defensive approaches to be built into the design.

21.C6.1.9 Software Code Analysis

Regulation

Software Code shall be analysed, and code walkthrough review shall be carried out by the IV & V team before commencement of testing.

Acceptable Means of Compliance

- a. Software Coding shall be consistent and traceable to Software Design and requirements.
- b. Agreed upon coding standards and plans shall be adhered to for Software Coding.
- c. Static and dynamic code analysis shall be carried out by the IV & V to confirm that the code quality is acceptable.
- d. Code walkthrough review is held by the main contractor to present the control and data flow of the software to the IV & V team.

Guidance Material

- a. Peer review of the code may be conducted to eliminate front line errors.
- b. Where ever required, Compiler validation with respect to the method of utilization has to be taken up to avoid compilation-related problems.
- c. Usage of optimization options should be avoided for safety critical as well as mission critical applications. If used, effect of usage of optimization and other compiler options has to be investigated and uniform methodology has to be used for all modules and for all build processes.
- d. Usage of Auto code generator(ACG) for critical systems demands for the tool qualification of ACG.

21.C6.1.10 Module Level Testing

Regulation

Software Testing shall be carried out at unit and software component level by the main contractor.

Acceptable Means of Compliance

- a. For unit level, each software unit shall be individually tested for its functionality.
- b. For component level, different interrelated units are tested together for correctness of interfaces and their combined functionality
- c. Test inputs, test drivers, Test plans, test cases, test procedures and expected and actual test results shall be produced and kept under strict configuration control.
- d. The traceability between the software requirements and the test cases shall be accomplished by the requirements-based test coverage. The requirements which cannot be tested need to be tested at higher levels. The traceability between the code and test cases shall be accomplished by the structural coverage.
- e. Agreed upon test plans shall be adhered to.
- f. The test plan, procedures, test data, and test report are provided to the IV & V team.

Guidance Material

- a. For safety critical software, analysis to be done to ensure that the compiler does not generate extraneous code.
- b. Memory utilization and timing required to be measured for all modules.

- c. Appropriate testing tools to be used to measure the coverage of module level test cases as per plan.

21.C6.1.11 Integration Level Testing

Regulation

Software-software integration, hardware-software integration and system integration testing shall be performed by the main contractor along with the IV&V team.

Acceptable Means of Compliance

- a. For software-software integration, all the software components shall be assembled for functional testing.
- b. For hardware-software integration, the software shall be operated in the target environment to verify if software complies with requirements. Full functional and performance requirements including failure modes shall be tested.
- c. For system integration testing, other components outside system boundary shall be integrated.
 - i. Normal and failure mode functionalities and their interactions shall be tested.
 - ii. Interface tests and switching between redundant systems shall be carried out at this level.
 - iii. Data bus loading and frame time loading are to be measured at this level.
- d. The evidence of software testing at each level shall be verified.
- e. Bi-directional Traceability shall be established from requirements to test cases.
- f. Test inputs, test drivers, Test plans, test cases, test procedures and expected and actual test results shall be produced and kept under strict configuration control.
- g. Agreed upon test plans shall be adhered to.
- h. The test plans, procedures, test data and test report shall be submitted to the IV & V team.
- i. The test plan and procedures shall be reviewed by TARB for completeness and approved by CEMILAC.

Guidance Material

- a. Hardware-software integration testing to begin when functional sections of the software system have been completed.
- b. The testing to be performed on a system/software rig. As far as possible, it should use input signals generated in real time by interface simulation under control.
- c. The tests to be automated as far as practicable for ease of execution and to ensure repeatability.
- d. It is anticipated that 'dry runs' of the system integration tests will be carried out prior to formal tests.

- e. If system uses partitioning, then the robustness of partitions in IMA system to be validated.
- f. Memory map, worst case execution time, exceptions, interrupts; load etc to be analysed for critical systems.

21.C6.1.12 Software Verification and Validation

Regulation

Verification & Validation of software shall be carried out in two phases: Designer V&V (in-house) and IV&V.

Acceptable Means of Compliance

- a. Designer V&V activities and quality assurance activities for any phase shall be completed before delivering the products for IV&V activities.
- b. An IV&V plan shall be made specific to the project after identifying the criticality of the software and based on the gray areas in the development process.
- c. The detailed procedure for IV&V is given in subsequent paragraphs:
 - i. Safety Critical Software
 - 1. IV&V process at various stages of Software Development Life Cycle (SDLC) will be carried out by the two-tier configuration - first by in-house V&V team and then by IV&V team.
 - 2. The IV&V team shall also carry out the following major activities in addition to regular IV&V activities:
 - a. Tool Verification Qualification, Compiler Validation and Object Code Verification, identification of test cases
 - b. Complete dynamic real time testing on a certified test rig, wherein the correctness of test rig software is assured.
 - 3. IV&V recommendations will form an essential input to CEMILAC for clearance of the software.
 - 4. Continued airworthiness support will be provided by CEMILAC with the help of the IV&V team.
 - ii. Mission Critical Software
 - 1. IV&V process at various stages of SDLC will be carried out by two-tier configuration - first by in-house V&V team and then by IV&V team.
 - 2. IV&V recommendations will form an essential input to CEMILAC for clearance of software.
 - 3. Continued airworthiness support will be provided by CEMILAC with the help of the IV&V team.
 - iii. Non-Critical Software
 - 1. IV&V process at various stages of SDLC will be carried out by an in-house V&V team.

2. IV&V recommendations of the designers V & V team will form an essential input to CEMILAC for clearance of the software.
 3. Continued airworthiness support will be provided by CEMILAC with the help of the in-house V&V team.
- e. Following Technical reviews are to be conducted at appropriate stages of development.
- i. System Requirement Review
 - ii. System Design Review
 - iii. Software Requirement Review
 - iv. Software Design Review
 - v. Software Code Analysis and Review
 - vi. Test Readiness Review
 - vii. Flight Readiness Review
- f. Modified and incremental versions of the software shall also be reviewed. These reviews are as follows. These reviews are **INTERNAL REVIEWS, PEER REVIEWS AND IV&V INTERACTIONS**. Apart from the external reviews, internal reviews and peer reviews, as part of software development process, have to be planned. The type and frequency of interactions between IV&V team and the designer group shall be discussed and recorded in software development plan.
- g. **CONSTITUTION OF REVIEW COMMITTEES:** The formal review committees shall consist of representatives of the design group, the software QA group, user reps where ever available, representatives from aircraft functional design groups, representatives of the IV & V team, CEMILAC, DGAQA representatives, experts from academic institutions and allied design houses. The project head can decide the members of the internal and peer review committees.
- h. Main contractor is solely responsible for the design, development and maintenance of the software throughout the life cycle of the software.

Guidance Material

NIL

21.C6.1.13 Software Quality Assurance

Regulation

Software Quality Assurance shall be carried out based on agreed upon Software Quality Assurance Plan (SQAP) and endorsed by QA group of the main contractor.

Acceptable Means of Compliance

Software Quality Assurance activity shall ensure:

- a. Main contractor shall use applicable standards and follow established processes.
- b. Development reviews and audits shall be conducted.
- c. The transition criteria for the software life cycle processes shall be satisfied.

- d. Deviations from software development process shall be exposed as early as possible, evaluated, tracked and resolved and permitted deviations shall be recorded.
- e. SQA plan and software development plan shall be compatible.
- f. Prior to the delivery of software products submitted as part of a certification, a software conformity review should be conducted.
- g. Audit results and evidence of completion of the software conformity review of each software product shall be submitted for certification process.
- h. During D&D and certification process, the data regarding Problem reports, defects discovered, modules under frequent change, type of changes etc shall be maintained in a database and tracked to closure.
- i. Agreed upon SQAP shall be adhered to.

Guidance Material

- a. Software Quality Metrics to be established and documented in SQAP. The results/measurements are to be documented in SQA records.

21.C6.1.14 Software Configuration Management

Regulation

Every Software component being certified shall be placed under configuration control.

Acceptable Means of Compliance

- a. Software Configuration Management Plan (SCMP) proposed by Main contractor and approved by CEMILAC, shall uniquely identify and keep under configuration control all of the items of documentation, source code, executable code and other records that make up the software product or that are necessary to ensure its continued life support.
- b. Software Configuration Item (SCI) for software and Hardware Configuration Item (HwCI) for CEH shall be uniquely identified and configured.
- c. Baseline shall be established for those items to be kept under configuration control
- d. A configuration item should be bi-directionally traceable to the configuration item from which it was derived.
- e. Planned and defined methods shall be followed for archiving, storage, handling, retrieval and delivery of software products.
- f. Artefacts shall have revision numbering scheme along with unique identification number and date. Whereas, source code shall have version numbering scheme.
- g. Unique numbering scheme for software versions to be followed.

- h. Not only the embedded software but the test software and tools used in test rigs also have to be brought under configuration control.
- i. This process also tracks and records the problem reports and change requests raised against those configuration items during the life of the project. Software Change Request (SCR) format is given in Annexure B. Software Problem Report (SPR) format is given in Annexure C.
- j. Parameter data item shall be treated as a separate configuration item. Examples are configuration files that are not part of executable code which may contain:
 - i. Time and memory partitioning allotment information
 - ii. Activate/Deactivate mechanism and other initial settings/values for software components.

Guidance Material

- a. The Parameter data items shall be allotted with the same software criticality level as the software component that uses the parameter data. Verification and Validation activities for parameter data items shall be conducted in line with the corresponding software component.
- b. The parameter data items are to be verified separately for its correctness, completeness and consistency.
- c. Any change in parameter data item (Eg: Configuration files) to change the software version numbering suitably.
- d. The parameter data item files that are used in the airborne embedded software are also to be listed along with the build details of the software in the VDD.

21.C6.1.15 Certification of Software Modification and Adaptation

Regulation

Software changes during certification process after release to service shall be authenticated by CEMILAC before use in the airborne store.

Acceptable Means of Compliance

- a. During certification process or flight trials or in service, software modifications may become necessary due to software defects, improvements, hardware changes, requirement changes etc.
- b. Once the changes are identified, Software Change Request (SCR) shall be raised by the change originator.
- c. At airborne store level LCCB shall approve the changes and at platform level CCCB shall approve the same for implementation in the air system.

- d. Impact of software change shall be determined by Impact Analysis method and regression testing shall be carried out; if new test cases required, it shall be included.
- e. Adequacy of testing shall be evaluated by Test Adequacy Review Board (TARB) suitably constituted by main contractor and test procedure shall be co-ordinated by CEMILAC.
- f. Necessary approval from LCCB/CCCB shall be submitted to CEMILAC based on which CEMILAC shall issue software clearance.
- g. For introduction of the software mod into the aircraft, Local Modification Committee (LMC) shall be conducted by main contractor. For which, main contractor shall submit Advanced Mod Information to CEMILAC to put up the mod in Local Modification Committee (LMC).
- h. If LMC is done at system level, then one more LMC at platform level shall be held.
- i. Delta Display Incremental Build (DDIB) clearance shall be issued for
 - i. Non safety critical PVI
 - ii. Minor software corrections
 - iii. To resolve observation only from aircraft ground integration and flight evaluation feedback

Guidance Material

- a. Software changes can be of three types:
 - i. Aircraft level changes (Corresponding Change Control Board(CCB) is called CCCB (Central CCB))
 - ii. System Level changes (Corresponding Change Control Board is called SCCB (System CCB))Sub-system level changes (Corresponding Change Control Board is called LCCB (Local CCB))
- b. DDIB can be planned only on certified Build. The changes carried out in the software with respect to above mentioned categories shall be verified by IV&V and software build shall be tested in system integration rig/ software integration rig/ aircraft by respective IV&V, CEMILAC, RDAQA, QA, designer together. Participation of IV&V and QA representative during testing is mandatory and others can consider delegation. The test report shall cover details of version number, checksum of the changed system as well as other integrated systems. The test report shall be coordinated by designer, IV&V, CEMILAC QA and RDAQA and shall form the basis for form 1090 clearance by RDAQA for flight testing.
- c. Maximum of six DDIB is allowed on a certified build. The configuration control of DDIB software and artefacts shall be ensured by the software development team. On

completion of flight trials, the changes made in the DDIB shall be regularized and software shall be certified as per RA Software Modifications and Adaptations.

21.C6.1.16 Software designed and developed by Foreign vendor (CFE software)/ Bought-out Software and their software changes

Regulation

Software designed and developed by foreign vendor with or without Indian collaboration, for use in Indian airborne platforms shall be approved by CEMILAC for airworthiness.

Acceptable Means of Compliance

- a. The provisions of this document on the design, development and certification shall be followed before contract finalization and be included in the contracts.
- b. CEMILAC shall issue clearance for use of the approved software on aircraft flying in India based on the certificate given by the foreign airworthiness certification agency and the necessary design, development, verification and validation documents given by the foreign vendor through main contractor / service headquarters. Main contractor / Service Headquarters shall be responsible for obtaining the certificate from the foreign airworthiness certification agency and software design and test documents from the foreign vendor.
- c. The foreign vendor's designer may decide the standard for software design and development in consultation with the airworthiness certification agency of that country and prepare all the documents as per that standard. If the software development is a collaborative effort between an Indian agency and a foreign vendor, then methodology of software development, standards to be followed and the documents to be generated shall be finalized amongst the Indian agency, foreign vendor and CEMILAC.
- d. In case of Bought-out software, the requirements on certification and documentation shall be obtained from CEMILAC before contract finalization and be included in the contracts.
- e. For BoI software, SRS, Interface Control Documents, test reports, IV & V reports and version description document along with any other relevant information shall be made available to CEMILAC.
- f. Certificate, if any, issued by the foreign airworthiness certification agency for use of Bought-out software on similar type of aircraft shall also be obtained. CEMILAC would after the study of these documents decide on issue of clearance of bought out software for flight trials / service use.

- g. Subsequent to clearance of the software developed by the foreign vendor for service use on aircraft flying in India, if any change / up-grade is undertaken by the foreign vendor, with the support of the foreign airworthiness certification agency, then such change / upgrade shall be approved by CEMILAC only after the requisite documents are made available to them.
- h. Change / upgrade of the CFE/BoI software developed by the foreign vendor, subsequent to its clearance for service use on aircraft flying in India can also be undertaken by Indian agencies. If the Indian agency is to propose change / upgrade on the software developed by the foreign vendor, then they need to have the requirements, design and test documents and the source code as described in software development section.

Guidance Material

NIL

21.C6.1.17 Tools /COTS Certification Process

Regulation

Software tools that are used in D&D of software shall be certified by CEMILAC, as required.

Acceptable Means of Compliance

- a. In-house developed tools shall follow the same process of software development as that of the airborne software.
- b. In case of bought-out tools:
 - i. if output of the tool is verified manually, then they need not to be qualified. If the tool output is source code, then the usual process of certification shall be followed.
 - ii. If the output of the tool is not verified, then tools need to be verified according to criticality level of software for which it is used.
- c. For tool qualification, following documents shall be made:
 - i. Tool qualification plan, tool operational requirements, tool accomplishment summary, tool configuration, tool qualification report.

Guidance Material

NIL

21.C6.1.18 Missile Software Certification

Regulation

Software embedded in Missile system shall be certified by CEMILAC.

Acceptable Means of Compliance

- a. Criticality classification based on SSA for missile software shall be in consideration with the platform.

- b. Missile software approval shall be issued in line with procedures listed in previous regulations. All software processes and guidelines listed in previous regulations shall be applicable.
- c. Table-3 in Annexure A shall be used for clearance of software during various stages of development of missile.

Guidance Material

- a. Interface design and requirements of missile software with that of the platform to be validated along with SRS.
- b. 21.B3 subpart may be referred for further guidance.

21.C6.1.19 UAS Airborne Software Certification

Regulation

Unmanned Aerial System/Vehicle Software for the airborne avionics shall be certified by CEMILAC.

Acceptable Means of Compliance

- a. The SSA and software development lifecycle process shall follow the software development lifecycle activities as done for the system of manned aircraft and described in the earlier sections of this document.
- b. Based on the software criticality level determined, the design, development, testing, reviews, IV&V, SQA/SCM activities, tool qualification shall be suitably followed.
- c. The constitution of IV&V team and activities and independence shall follow the guidelines described in section IV&V for certification of this document.
- d. The certification of test rigs for testing the software shall be as described in section ground software approval section of this document.
- e. The software shall be certified for development flight trials on the completion of above described activities.
- f. The changes to be made to the software post certification shall be approved through change control boards. The detailed activities and constitution of change control boards are described in earlier sections of this document. On satisfactory completion of flight trials, the software is cleared for service use.
- g. Any modifications during in-service phase of software shall undergo the process described in the section Modifications and configuration control during in-service phase of this document

Guidance Material

- a. 21.B2 subpart may be referred for further guidance.

21.C6.1.20 UAS Ground Control Software Certification

Regulation

CEMILAC shall certify UAS Ground Control Software(GCS) in par with the airborne counterpart.

Acceptable Means of Compliance

- a. The criticality level of the Ground Control Software (GCS) shall be determined based on the criticality level decision of its airborne counterpart. SSA needs to take care of the GCS component while determining criticality levels.
- b. All other activities listed in UAS airborne software section shall apply here. Section on GCS in Ground Software shall also apply.

Guidance Material

- a. 21.C6.3.2 subpart may be referred for further guidance.

21.C6.2 Certification of Ab-initio Designed and Developed CEH

Rationale

Complex Electronic Hardware (CEH) consists of custom micro-coded components like Field Programmable Gate Arrays (FPGAs), Application Specific Integrated Circuits (ASICs) and other Programmable Logic Devices (PLDs). CEH is increasingly replacing computing processors and other hardware elements in modern electronic design in military airborne applications. Like hardware, the constituent software and custom micro coded components called as Complex Electronic Hardware (CEH) of a system or subsystem needs qualification. Of late, qualification of CEH is gaining importance due to the complexity and volume of algorithms/logic being built into it.

Airborne Electronics systems are presently designed widely with Complex Electronic Hardware (CEH). In Indian military avionics also, the trend of using CEH has increased. Even currently, many of the processor based applications are getting replaced with CEH. This necessitates a need for formulating a certification procedure.

Contents

- 21.C6.2.1 System Requirements and CEH Criticality Level
- 21.C6.2.2 Constitution of CEH IV&V team
- 21.C6.2.3 Certification Plan(CP) for CEH
- 21.C6.2.4 CEH Design and Development (D&D)
- 21.C6.2.5 CEH Evaluation and Tests
- 21.C6.2.6 CEH Configuration Control and Process Assurance
- 21.C6.2.7 CEH Clearance and Flight Tests
- 21.C6.2.8 Custom made Intellectual Property Cores (IP Cores)

21.C6.2.1 System Requirements and CEH Criticality Level

Regulation

The Main Contractor shall assign Criticality Levels to the CEH components on the basis of System Safety Assessment.

Acceptable Means of Compliance:

- a. System Safety Assessment is conducted by main contractor by identifying the safety, functional, performance and other requirements of the system.
 - i. Subsequently for each sub system, Preliminary System Safety Analysis(PSSA) shall be carried out to verify the robustness of design for the hazards identified in FHA.

- b. System Safety objectives thus arrived as a result of system design and safety assessment shall be categorized and assigned to CEH if these objectives could be well implemented in a CEH.
- c. Once the System Safety objectives are assigned, System requirements shall be allocated to CEH. This shall also define the external interfaces of CEH along with integration aspects for embedding either a custom made or COTS Intellectual Property (IP) core.
- d. CEH Criticality level for each function and hence for the whole CEH shall be determined. CEH Criticality classes recommended are: Safety Critical, Mission Critical and Non-Critical.
- e. Throughout the CEH design life cycle, there shall be feedback to system to ensure that CEH thus built will ensure system safety, functional and performance requirements allocated to CEH.
- f. SSA report and SARAD (System Architecture & requirements allocation document) duly approved by the main contractor shall be released.
- g. System Interface requirements wrt CEH shall be documented

Guidance Material:

- a. A single Criticality Level (Design Assurance Level, DAL) or a mix of Criticality Levels may be arrived. If a CEH contains functions that individually have different DALs such situations may be addressed by considering the entire CEH to highest DAL wherein DAL of shared resources also should be that of highest DAL.

21.C6.2.2 Constitution of CEH IV&V team

Regulation

IV&V team shall consist of system experts, domain experts, testing experts from relevant stake holder organizations and CEMILAC and DGAQA representatives.

Acceptable Means of Compliance

- a. IV&V Team shall be constituted by main contractor with relevant stakeholders.
- b. IV&V team shall to be independent from the CEH design and development team.
- c. IV&V shall formulate IV&V planning and participate in testing and test reporting activities.
- d. IV&V recommendation is a required input for CEMILAC CEH certification.

Guidance Material

NIL

21.C6.2.3 Certification Plan (CP) for CEH

Regulation

Main contractor shall propose to CEMILAC, a Certification Plan (CP) that shall include acceptable means to demonstrate compliance.

Acceptable Means of Compliance:

- a. CP shall address
 - i. Milestones, involved agencies, artefacts, audits.
 - ii. Means of compliance to objectives shall be provided.
 - iii. Level of CEMILAC involvement during the entire CEH certification life cycle.
 - iv. Design Assurance Strategy as per SSA based on DAL
 1. Comprising of advanced analysis method, product service experience and architectural mitigation
- b. Main contractor shall prepare CP and it shall be approved by CEMILAC before compliance demonstration commences and updated as necessary during the Certification process.

Guidance Material:

- a. Adequacy of Design Assurance Strategy shall be checked by IV&V and CEMILAC checking for any deficiencies in the strategy and suitably modifying it by proposing additional design assurance and architectural strategies.
- b. CEH development and verification environment, list of life cycle tools is selected during this stage.
- c. If there are mix of DALs, multiple Design Assurance Strategies may be arrived.
- d. CP may also be referred to as Plan for Hardware Aspects of Certification (PHAC).

21.C6.2.4 CEH Design and Development (D&D)

Regulation

- e. Main contractor shall have a D&D process for CEH which shall meet the AW Certification basis.

Acceptable Means of Compliance:

- a. CEH development life cycle processes along with supporting processes shall be carried out by the main contractor.
- b. Review process and Audit process shall be in place.
 - i. Main contractor shall track action points to closure for every review and audit.

Guidance Material:

- a. Plans apart from the chosen standard/criteria if required shall be prepared and approved.
- b. Planning, Development (Requirements Capture, Conceptual Design, Detailed Design, Implementation and Testing) and other supporting processes like IV&V, Configuration management, Process Assurance and Certification liaison to be carried out by the CEH Main contractor
- c. Certification activities like CEH planning review, Development review, V&V review and certification documents approval to be carried out by CEMILAC audits. PDR, CDR and other time-to-time reviews to be conducted by main contractor.
- d. List of tools to be used in full lifecycle development to be finalized at this stage.
- e. PDR, CDR and other reviews/audits as per plan to be conducted.
- f. Coverage report containing statement coverage, branch coverage, FSM coverage (states and transitions), toggle coverage and additional coverages for various module.
 - i. Module level, target level integration test plans to be prepared
 - ii. Test Summary to be prepared.
- g. White papers substantiating the need for certain CEH element /entity in the design, requirement of a certain SoC /device, Choice of Memory elements like DDR etc., to be prepared and submitted to CEMILAC by main contractor.
- h. Desk level analysis documents substantiating choice of certain memory elements, interface types etc to be prepared by main contractor and submitted to CEMILAC.

21.C6.2.5 CEH Evaluation and Tests

Regulation

IV&V shall perform evaluation and tests of CEH as defined in Certification Plan.

Acceptable Means of Compliance:

- a. IV&V shall perform Evaluation and tests for ensuring the correctness of CEH behavior
- b. Main contractor shall detail methods and means to perform the evaluation and tests. CEMILAC shall approve the test plans.
- c. Test Adequacy Review Board (TARB) shall review the test plan and test methodologies at system integration level. IV & V shall participate in the testing as per the recommendations of TARB.

Guidance Material:

- a. Tests may be performed at lab, simulated platform, rig, aircraft on ground and any other method stipulated in order to ensure correct CEH functionality. Emulators to be used for CEH behaviour testing.
- b. During QT (LQT/SOFT) of the LRU that contains the CEH, it is to be ensured that CEH that contains the basic design with Interface logic is used.

- c. In-Hardware run time dynamic testing method and means may be detailed. On target, At speed testing to be carried out for critical CEH application.
- d. Methods and means to perform Interface level robustness testing to be detailed in test plans.
- e. RTL model simulation reports to be prepared and compared. Verification coverage with well-defined coverage criteria to be detailed under elemental analysis.

21.C6.2.6 CEH Configuration Control and Process Assurance

Regulation

Configuration control and Process Assurance(PA)of CEH shall take place throughout the life cycle as per Configuration Management and Process Assurance Plan.

Acceptable Means of Compliance:

- a. Main contractor shall earmark Configuration Manager and PA manager and define their roles.
- b. Configuration Management and Process Assurance shall be done based on respective plans.
- c. At every phase of CEH life cycle, base-lining, archiving, version control to be done.
- d. HwCI (Hardware Configuration Items) to be uniquely identified.

Guidance Material:

- a. Problem Report generation and Change control procedures to be adhered.
- b. Ensure configuration of all identified CIs at project level along with CEH.
- c. Configuration Status Accounting may be done for traceability of CEH Configuration Item.
- d. PA activities like auditing, process review and reporting to be done at every phase.
- e. Sections of Software Configuration Management shall be referred wherever applicable.

21.C6.2.7 CEH Clearance and Flight Tests

Regulation

CEH clearance is accorded by CEMILAC base on airworthiness compliance evidence.

Acceptable Means of Compliance:

- a. Hardware Configuration Index (HCI) and Hardware Accomplishment Summary (HAS) shall be in place along with compliance to plan documents.
- b. CEH Clearance shall be given separately quoting the version no, checksum of CEH along with basis of clearance and other reference applicable documents in similar lines to software clearance.
- c. The basis of acceptance along with conditions and limitations will be brought out.

Guidance Material:

- a. CEH to be integrated with target hardware and operational flight software for flight trails.

21.C6.2.8 Custom made Intellectual Property Cores (IP Cores)**Regulation**

Custom made IP cores (hard, firm and soft IP cores) shall be certified by CEMILAC.

Acceptable Means of Compliance:

- a. CEMILAC shall issue IP Core Clearance as Letter of Acceptance (LoA). (Template in Annexure 'D')
- b. IP developer and IP user shall conduct tests for IP core as per test plan.
- c. Independent V&V(IV&V), Configuration Management and Process Assurance activities shall be in place.
- d. Reviews and Audits shall be conducted as per plans.
- e. IP core acceptance test plan to be approved by IP core user/developer and CEMILAC.
- f. Main contractor shall endorse a Certification of Design (CoD) for IP core, during application for Letter of Acceptance (LoA).
- g. IP developer shall inform CEMILAC whenever an IP user is using his IP core.

Guidance Material:

- a. All Regulations on CEH to be referred wherever applicable.
- b. If there is no identified IP user, the final acceptance test shall be conducted by IP developer himself with a suitable target device. If IP user exists, the final acceptance test shall be conducted by him with actual target device. This to be mentioned in plan.
- c. IP developer to show compliance to the following:
 - i. Project Specific Certification Plan
 - ii. CP/PHAC
 - iii. Any other criteria/std as per plan
- d. LoA to contain:
 - i. version no, checksum of IP Core
 - ii. Basis of acceptance and other applicable documents
 - iii. Conditions and limitations
 - iv. DAL of IP core
 - v. Validity of LoA
- e. Tests may be done at module level, integration level and target level of IP.
- f. IP developer to release user manual.

21.C6.3 Certification of Test Rig and TTGE Software

Rationale

Several types of Test rigs and Tools, Testers & Ground Equipment (TTGE) software are used in the development, production, Operation & Maintenance (O&M) of Aircraft and Airborne stores. Airborne software validation depends on the support and usage of this software performing desk level, lab level, rig level, platform level simulation and testing. It becomes imperative to certify this Test rigs and Tools, Testers & Ground Equipment (TTGE) Software.

Types of Test Rig software and TTGE Software

Software Tools, Test Equipment required during design/development, Production and O&M that are used for on ground testing of airborne software are brought out based on the following types. Refer 21.T subpart for categorization of Test Rigs and TTGE.

Ground Test Software:

- a. Test Rig Software: Software that resides in the ground Test Equipment/Test Rigs (Automated Test Equipment ATE) is used to exercise the hardware and /or software of the airborne systems, get the results and record/display/analyze them.
- b. Maintenance mode Software: Test Software that resides in the airborne stores and interfaces with the test rig during maintenance/ test mode of the system. This is generally used for hardware diagnostic purposes. These are not part of OFP but are required to be loaded in the system for ground checks and are considered as test software.
- c. Simulation Software: It is software that allows the user to observe an operation through simulation without actually performing that operation. (Eg: Power system behavior simulation, Radar signal processing simulation etc.,)
- d. Hardware Acceptance Test Software (HATS) software for LRU.
- e. Checksum verification and generation software.
- f. In-situ programming software tool.

Ground Control Software:

- g. Ground Control Software (GCS) is used in Unmanned Air Systems. It is the airborne counterpart which has to be treated in par with airborne software. Criticality and complexity levels for GCS software shall be applied with same rigour as airborne software. (Eg: UAS GCS software)

Ground Planning and Analysis software:

- h. FDA Software: Flight Data Analysis (FDA) or Flight Data Monitoring (FDM) program is designed to enhance flight safety by identifying an airline's operational safety risks. It is used also for Accident Investigations by using statistical and trend analysis.
- i. Mission Planning Software: Software to support mission preparation and mission execution activities like planning of all onboard and related on-ground activities,

generation of mission timeline. Optimization and co-ordination of all activities onboard is done.

Ground data loading and data retrieval software:

- j. Data loader software: (Eg: ARINC 615/603 based software data loaders, Fill gun software, threat libraries)
- k. Data Retrieval software (Eg: Milking data from FDR)

Calibration and Instrumentation software:

- l. Calibration software (Eg: Radar calibration, EW calibration, INS calibration)
- m. FTI software (Eg: Vibration recorder, Vibration analysis)

Airsystem and Pilot/crew related test software:

- n. Maintenance Software of the aircsystem
- o. Pilot/crew training software

Contents

- 21.C6.3.1 Ground Test Software Design, Development and Certification
- 21.C6.3.2 Ground Control Software Design, Development and Certification
- 21.C6.3.3 Ground Planning and Analysis Software Design, Development and Certification
- 21.C6.3.4 Ground Data Loading Software Design, Development and Certification
- 21.C6.3.5 Calibration and Instrumentation Software Design, Development and Certification
- 21.C6.3.6 Airsystem and Pilot related test software Design, Development and Certification

21.C6.3.1 Ground Test Software Design, Development and Certification

Regulation:

Ground Test Software shall be certified by CEMILAC.

Acceptable Means of Compliance:

- a. The software clearance of the ground/test equipment and test rigs required during development and production phase will be the responsibility of main contractor of these equipment and rigs in co-ordination with CEMILAC and DGAQA.
- b. Certification Plan for Test Rig shall be prepared by the main contractor in conjunction with DGAQA and other relevant stake holders.
- c. Technical specifications (TS) of ground/test equipment and test rigs to be prepared by main contractor and approved by CEMILAC for Type 1, 2 and 4 Test Rigs (Refer 21.T).
- d. Software requirements, software design/development, preparation of system level test plans of ground / test equipment and test rig system shall be done by main contractor.
- e. Software Requirements of the ground / test equipment and test rig shall be approved by CEMILAC
- f. Test Readiness Review (TRR) and Test Adequacy Review Board (TARB) shall be conducted by main contractor in co-ordination with DGAQA.
- g. IV&V, Configuration management and SQA activities, review process to be covered for full lifecycle of ground / test equipment and test rig software design, development and certification in co-ordination with CEMILAC.
- h. ATP of the ground / test equipment and test rig shall be approved by DGAQA.
- i. Compliance to certification plan for test rig shall be shown by the designer at the time of requesting for clearance certificate from DGAQA.
- j. CEMILAC to issue ground / test equipment and test rig software clearance certificate.
- k. DGAQA to issue ground / test equipment and test rig clearance certificate.

Guidance Material:

- a. The development and clearance procedure and the extent of the documentation required for test equipment software and test rig software may be arrived at jointly by CEMILAC and designers. Ground Test Software to be certified to that level of criticality either same or less than the corresponding OFP as per the Certification Plan.
- b. Following software documents to be made available:
 - i. Software Requirement Specification (SRS)
 - ii. Software Quality Assurance Plan (SQAP)
 - iii. Software Development Plan (SDP) as applicable
 - iv. Software Configuration Management Plan (SCMP)
 - v. Software Verification Reports (SVRs)

- vi. Independent Verification & Validation (IV & V) Plan & Report
- c. Test Rig clearance by DGAQA in coordination with main contractor is a prerequisite for taking up formal testing of airborne software by CEMILAC.
- d. Clearance of airborne software for service use will be accorded by CEMILAC only after ensuring that requisite test rigs are approved by DGAQA and are available at the premises of the organization taking up the production of the aircraft and systems.
- e. The production items shall be cleared by DGAQA in coordination with manufacturer/industry only after ensuring that the test rigs for testing both the hardware and the software in its entirety are available with the production agency and also the test rigs are compatible with the latest version of the airborne software.
- f. The safety interlocks to ensure that the equipment will not enter the test mode in flight to be verified and endorsed by CEMILAC while reviewing the test plan at System level.

21.C6.3.2 Ground Control Software Design, Development and Certification

Regulation:

Ground Control Software shall be certified by CEMILAC.

Acceptable Means of Compliance:

- a. SSA and criticality level study of GCS shall be made before commencement of Certification Plan (CP). Suitable criticality level shall be determined.
- b. The software clearance of Ground Control Software required during development, production and O&M phase will be the responsibility of main contractor of Ground Control Software in co-ordination with CEMILAC.
- c. Certification Plan for Ground Control Software or together with Airborne software shall be prepared by the main contractor in conjunction with relevant stake holders.
- d. Technical specifications (TS) of Ground Control Software to be prepared by main contractor and approved by CEMILAC.
- e. Software requirements, software design/development, preparation of system level test plans of Ground Control Software shall be done by main contractor based on the software criticality.
- f. Test Readiness Review (TRR) and Test Adequacy Review Board (TARB) shall be conducted by main contractor
- g. IV&V, Configuration management and SQA activities, review process to be covered for full lifecycle of Ground Control Software design, development and certification.
- h. Compliance to certification plan shall be shown by the main contractor at the time of requesting for clearance certificate.
- i. CEMILAC to issue Ground Control Software clearance certificate.
- j. As GCS software is to be treated in par with airborne counterpart, software certification approach for Airborne software shall be followed here.

- k. Ground Control software testing to be done with custom made DGAQA certified test rig.

Guidance Material:

NIL

21.C6.3.3 Ground Planning and Analysis Software Design, Development and Certification

Regulation:

Ground Planning and analysis Software shall be certified by CEMILAC.

Acceptable Means of Compliance:

- a. CEMILAC to issue Ground Planning and analysis Software clearance certificate based on agreed upon software certification plan with main contractor.

Guidance Material:

- a. Configuration settings of aircraft to be done so that mission plans can be tested realistically.

21.C6.3.4 Ground Data Loading Software Design, Development and Certification

Regulation:

Ground Data Loading and analysis Software shall be certified by DGAQA.

Acceptable Means of Compliance:

- a. DGAQA to issue software clearance certificate.

Guidance Material:

NIL

21.C6.3.5 Calibration and Instrumentation Software Design, Development and Certification

Regulation:

Calibration and Instrumentation Software shall be certified by DGAQA.

Acceptable Means of Compliance:

- a. DGAQA to issue software clearance certificate.

Guidance Material:

NIL

**21.C6.3.6 Airsystem Maintenance and Pilot Training Software Design,
Development and Certification**

Regulation:

Airsystem maintenance and pilot training software shall be certified by DGAQA.

Acceptable Means of Compliance:

- a. DGAQA to issue software clearance certificate.

Guidance Material:

NIL

DRAFT

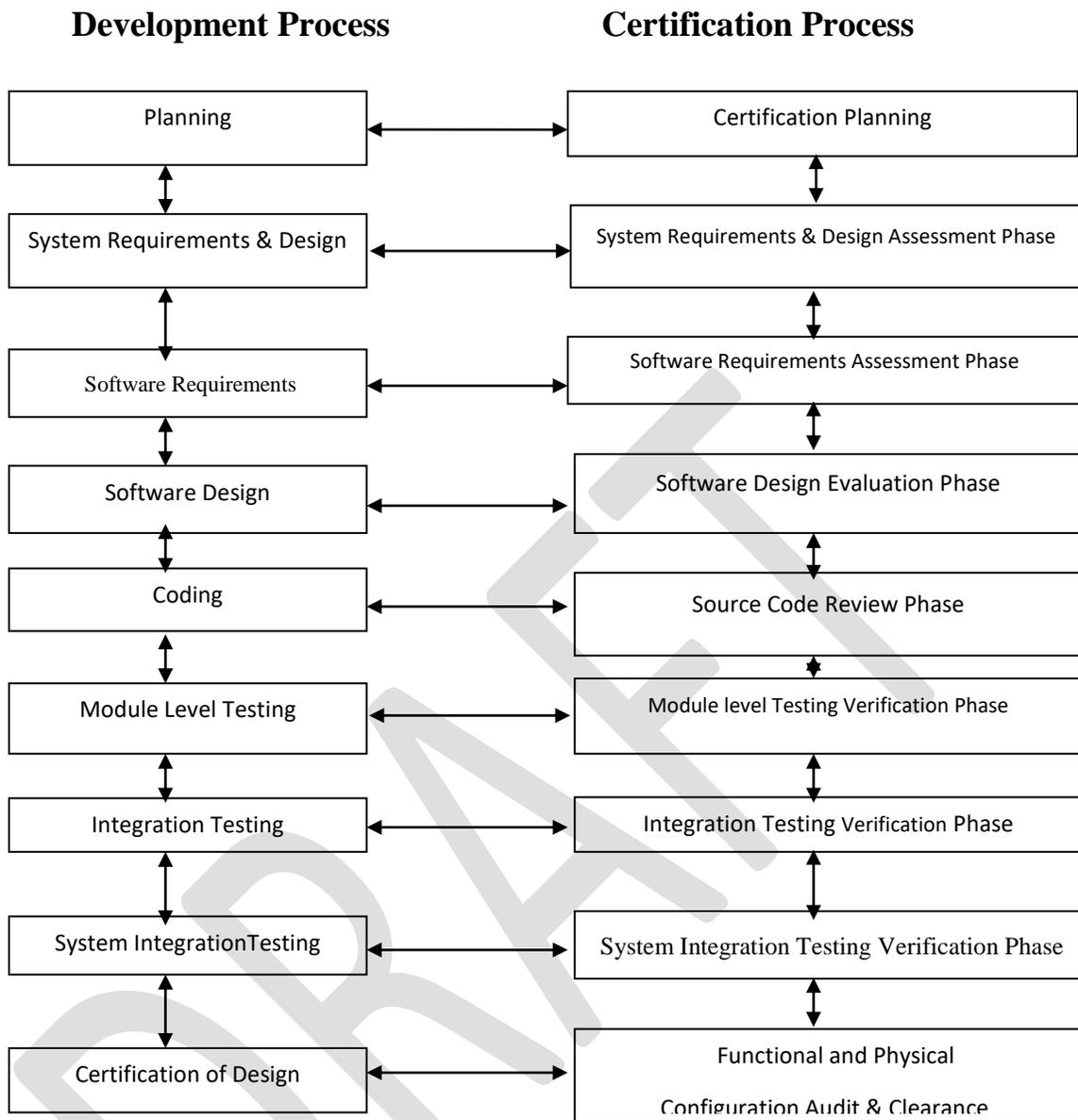


Fig-1: Software Certification Process

TAILORING GUIDELINES AND LIST OF ARTEFACTS, WHICH FORMS THE BASIS FOR CERTIFICATION

Software certification process and basis for clearance is to be tailored based on criticality classification of the system arrived through system safety analysis. The list of documents to be prepared and delivered to the certification agency by the organization responsible for software design & development is given in Table – 1.

Documents	Safety Critical	Mission Critical	Non-Critical	Coordination by CEMILAC
Requirements Phase				
System Safety Analysis	R	R	R	R
System Specification& System Design	R	R	R	NR
Software Requirements Specification	R	R	R	R
Interface Control Document/ IRS	R	R	R	NR
Planning Phase				
Software Development Plan	R	R	R	NR
Software Configuration Management Plan	R	R	R	R
Verification Plan	R	R	R	R
SQAP	R	R	R	R
Software Certification Plan &IVV plan	R	R	R	R
Requirements/Design Standard	R	R	R	NR
Coding Standard/Model Standard	R	R	R	NR
Software Design Phase				
Architecture Design Document	R	R	R	NR
Software Design Document	R	R	NR	NR
Firmware Support Manual	R	NR	NR	NR
Implementation Phase				
Source Code	R	R	R	NR
Software Version Description	R	R	R	R
Testing Phase				
Module Level				

Test Procedure, Test Cases and results	R	R	R	R
Hardware-Software Integration Level				
Test Procedure, Test Cases and test results	R	R	R	R
System Integration Level				
Test Procedure, Test Cases and test results	R	R	R	R
Platform Integration Level				
Test Procedure, Test Cases & Results	R	R	R	R
Software IV&V Reports	R	R	R	R
Software IV&V Recommendation	R	R	R	R

Table-1

Note 1: 'R' stands for Required; 'NR' stands for Not Required

Note 2: Coordination by CEMILAC is required only if the document is required for the particular criticality classification

TAILORING OF SOFTWARE DEVELOPMENT AND CERTIFICATION PROCESS BASED ON CRITICALITY OF SOFTWARE

The software development process and software certification process described above can be tailored for use for mission critical and non-critical software systems in the following way:

Certification Requirement	SAFETY CRITICAL	MISSION CRITICAL	NON CRITICAL
Test Coverage	100% Statement, decision & MC/DC coverage	100% Statement & decision coverage	100% Statement coverage.
Traceability	bidirectional	bidirectional	Top down only
Tool Validation	Required	Required	Not required
Compiler Validation	Required	Not required	Not required
Object Code Verification	Required	No required	Not required
RTOS Certification	Required	Validation& Assessment Required	Validation& Assessment Required
Independent Verification & Validation	Required	Required	Designer V&V required
Configuration Management	Required	Required	Required

Table-2

GUIDELINES FOR SOFTWARE CERTIFICATION FOR SOF

Complete IV & V activities for Safety of Flight (SOF) clearance, may not be carried out in most programs due to still fluid state of requirements, flight trial schedules etc.. Whereas by the time Qualification Test (QT) is completed and Provisional Clearance (PC) issued, unit has reached a maturity level, all the flight trial feedback is absorbed in the hardware and software. When QT is in progress, all the IV & V activities will be done in parallel. This is the final software which will go into production. The following table brings out the minimal guidelines for software certification for SOF. Same applies to CEH also.

Certification Activity	SOF Clearance	LQT/QT clearance	Missile software for CFT and dummy drop clearance	Missile software for target trials
Requirement Review	R	R	R	R
Design Review	R	R	R	R
Final Level Coding Std adherence	R	R	R	R
Code Analysis	NR	R	NR	R
Coverage Analysis	NR	R	NR	R
Module level & S/w Integration testing	NR	R	NR	R
LRU level HSI testing	R	R	NR	R
Missile level integration testing	--	--	R	R
TARB review	NR	R	NR	R
Config Mgt and VDD	R	R	R	R

Table-3

Proforma for Software Change Request (SCR)

Aircraft Name:..... Project Name:

System Name: Equipment / LRU Name:.....

Software Change Request No.

Software Version No. Equipment / LRU Mod Status:

Change Type:

- New Requirement
- Suggestion for Improvement
- Design Change
- Flight Test Feedback
- System Problem
- Integration Problem
- Hardware Change
- Others -----

References:

(e.g. Minutes of the meeting, memos issues, technical notes generated etc.)

Note: If the change is necessitated due to any problem faced in the operational field units, then complete details of feedback / problem report from services are to be given.

Change Description:

Please attach supporting documents for the requested change
(Problem Report, relevant updates on software documentation etc.)

LCCB / SCCB Status:

New Software Version No.

Originator..... Date

Distribution:

- (a) Design Team**
- (b) IV&V Team**
- (c) CEMILAC**
- (d) SCCB / LCCB / CCCB**

Proforma for Software Problem Report

Aircraft Name:.....

Project Name:

System Name:

Software Version No.

Hardware Identification

Other Related Software:

Test Scenario:

- Flight Test
- On Ground Aircraft Integration
- System Integration
- ATP
- Others

Description of Problem:.....

Type of Problem: Random / Repeatable

Problem Raised By:.....

Date:

Distribution: Copies of software problem report must be sent to: -

- (a) Project Director
- (b) Chief of Design House
- (c) Software Designer
- (d) CEMILAC
- (e) CRI / DGAQA

Template: Letter of Acceptance (LoA) for IP cores

<Letter No.>

<Date>

<To>

<The IP core developer/ LoA Requester>

LETTER OF ACCEPTANCE FOR USE OF < IP core name >**LoA No. : < LoA No.>**

<IP core developer Application reference no. >

1. Introduction:

<Introduction to the IP core developer>

<Brief on IP core and its necessity>

2. Integration and Configuration of IP Core:

<Refer IP core data sheet>

<User manual of IP core>

3. Acceptance of IP Core:

<IP core name> designed and developed by <IP core developer> is hereby accepted for use in < Application name>, subject to the conditions mentioned in this Letter of Acceptance (LoA).

3.1. Basis of acceptance and applicable documents:

<List of all docs including CoD of IP core, data sheet, Cemilac directives and other IP core documentation>

4. Limitations:

<Mention limitations in design and usability of IP core>

5. Conditions of Acceptance:

For IP Developer:

<Mention conditions for IP Developer and validity duration of LoA>

For IP Integrator:

<Mention conditions for IP Integrator>

<Signature>

<CEMILAC Authorized Signatory>

Encl: <Data sheet of IP core and CoD>

SUBPART -D: MODIFICATIONS OF AIR SYSTEMS LEADING TO AMTC/SMTC

Rationale

An Air system is subjected to various modifications during its life span with an implication of changes in its type-design status. Such changes are subjected to classification and require approval prior to its implementation. This Subpart establishes the procedure for the approval of Changes to the type design carried out by the Main Contractor of Air System (who is the MTC Holder) or by an Organisation Other than Main Contractor (Who is not the MTC holder) leading to issue of Amended Military Type-Certificates (AMTC) or Supplemental Military Type Certificate (SMTC) respectively. Modifications may be introduced by the Design Department as a development modification to address production issues, to address obsolescence, improve reliability & availability or at the request of the customer to meet his special operational or maintenance requirements. Modifications may be decided upon at any time during the manufacture of Air System at works or subsequent to the delivery of Air System to the customer.

Contents

- 21.D1.1 Eligibility for taking up Modification and Alteration /Amendment of an Air System**
- 21.D1.2 Demonstration of capability**
- 21.D1.3 Classification of changes in type design**
- 21.D1.4 Approval of Alteration / Amendment to an Air System.**
- 21.D1.5 Airworthiness Certification Plan for a Modification**
- 21.D1.6 Designation of applicable Airworthiness Code/standard**
- 21.D1.7 Process of Approval of Modification**
- 21.D1.8 Constitution of LTC**
- 21.D1.9 Constitution of LMC**
- 21.D1.10 Constitution of Local Concession Committee (LCC)**
- 21.D1.11 Classification of modifications**
- 21.D1.12 Issue of Amended Military Type Certificate (AMTC) or Supplemental Military Type Certificate (SMTC)**
- 21.D1.13 Duration and continued validity**
- 21.D1.14 Record keeping**
- 21.D1.15 Instructions for Sustaining Type Airworthiness**

21.D1.1 Eligibility for taking up Modification & Alteration /Amendment of an Airsystem

Regulation

Any organisation that has demonstrated, or is in the process of demonstrating, its capability shall be eligible as an applicant for an Amended Military Type Certificate (AMTC) or Supplemental Military Type-Certificate (SMTC) under the conditions laid down in this Subpart.

Acceptable Means of Compliance

Nil

Guidance Material

Nil

21.D1.2 Demonstration of Organisation capability

Regulation

- a. Any organisation applying for an AMTC or a SMTC shall demonstrate its capability by holding a design organisation approval (DOA), issued by CEMILAC.
- b. By way of derogation from paragraph (a), as an alternative procedure to demonstrate its capability, an applicant may seek concurrence from CEMILAC for the use of procedures setting out the specific design practices, resources and sequence of activities necessary to comply with this Subpart to get approval for the Modifications carried out on the Air System.

Acceptable Means of Compliance:

Organisation may apply for a supplemental military type-certificate, without being the original design organisation. In this case the Organisation should enter an agreement with a design organisation which holds Type Design data to ensure the undertaking of specific actions and obligations. If Organisation is not able to enter into an agreement with a design Organisation which holds Type Design data, then the Concurrence from the respective User Services shall be obtained for taking up such modification and responsibility of ensuring Continuing airworthiness of modified Air system solely lies with the User Services.

Guidance Material

Refer to Subpart G1 Design Approved Organisation Scheme.

21.D1.3 Classification of changes in type design

Regulation

Any change in Type Design **shall** be classified as 'alteration / amendment' or 'modification'. Classification shall be approved by CEMILAC or Air System Design Organization (ASDO) under privilege.

Acceptable Means of Compliance:

- a. A change that has no appreciable effect on the mass, balance, structural strength, operational characteristics, or any other characteristics affecting the Airworthiness of the Air System shall be classified as Alteration / Amendment. Changes pertaining to Air System having no changes in Function, Interchangeability, Life, Maintenance, Safety and Strength (FILMSS) shall only be classified as alteration/amendment.
- b. All other changes shall be classified as a modification.
- c. Reasons for a classification decision shall be recorded and approved by CEMILAC or by ASDO under a privilege This information shall be produced to CEMILAC during the Audit of the Organisation approval or as instructed by CEMILAC.
- d. The CEMILAC reserves the authority to reclassify a change if it is deemed appropriate to do so.

Guidance Material:

- a. Changes shall be classified as either alteration / amendment or modification, using the criteria of the Regulation and the complementary guidance. Figure 1 below illustrates the classification process.
- b. An Alteration/ Amendment is a design change which does not Affect the safety, operational use, reliability, inter changeability of the airborne store or any other specification of an Air systems/airborne store.
- c. Following types of design changes can be covered under Amendment/Alteration:
 - i. Minor dimensional corrections which do not affect the strength i.e. changes to bring the drawings in line with shop practice and to eliminate drawing errors as well as those which call upon minor manufacturing changes. Introduction or deletion of tooling related features or dimensions which may be required for optimally productionising a component
 - ii. Improved method of dimensioning or deletion of redundant dimensions which do not materially affect the part from the point of view of assembly or function.
 - iii. Minor changes like correction of rivet length, drawing reference, deletions or additions of unimportant notes or corrections of erroneous pictorial views shown.
 - iv. Corrections in the material schedule to include alternate materials, which is already approved in similar application.
 - v. Cable length change
 - vi. Minor changes in size of harness accessories like that of ID sleeve, HS boot, protection sleeve etc.
 - vii. Minor changes in use of harness accessories for instance, cable Identification sleeve in cases where cable printing is not possible, rain water tape in place where boot is not possible etc.

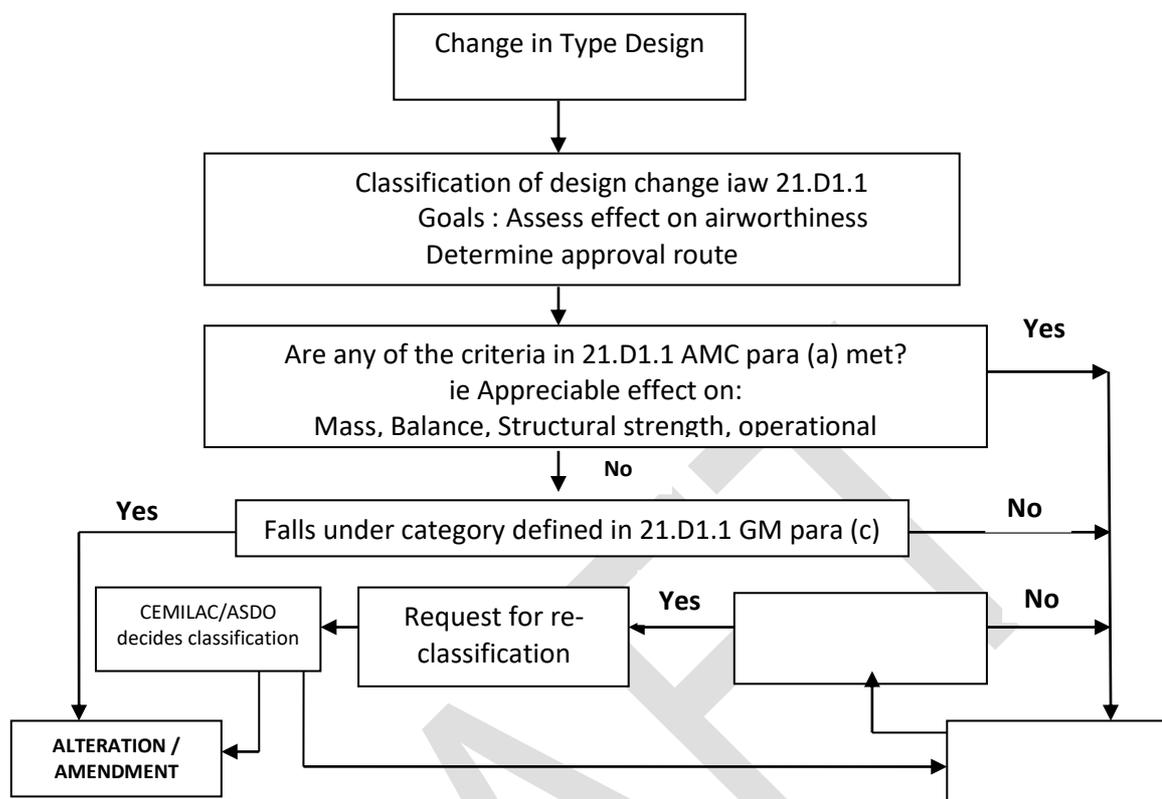


Fig 1: Classification Process

21.D1.4 Approval of Alteration / amendment to an Air System

Regulation

Alteration / amendment in a type design shall be classified and approved either:

- a. By CEMILAC; or
- b. By an appropriately approved Air System Design Organisation under a procedure agreed with the CEMILAC.

Acceptable Means of Compliance:

- a. Main contractor shall discuss the changes Alteration / Amendment in Drawing Change form with unique Amendment number to be coordinated by concerned CEMILAC/Authorised Signatory of ASDO.
- b. Documents like Drawings, MDI, Drawing Applicability List (DAL), SOP and ACBS shall be updated.
- c. The appropriate classification and approval of changes in Type Design carried out by the approved ASDO will be subjected to audit by CEMILAC during the Renewal of Organisation approval or as required by the Authority any time.

Guidance Material:

- a. When the approved ASDO is introducing an Alteration / amendment into the Air System under a procedure agreed with the CEMILAC, the role of the approved Compliance Verification Engineer shall be in agreement with CEMILAC.

21.D1.5 Airworthiness Certification Plan for Modifications

Regulation

The Main Contractor shall plan all the activities and engagement of TAA throughout the Modification phase of Air System to achieve compliance to TCB.

Acceptable Means of Compliance

- a. The Main contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stake holders and same shall be submitted along with the application or later. This ACP shall be approved by CEMILAC.
- b. For modifications not requiring long and complex compliance demonstration activities, an Airworthiness Certification Plan, as described in Subpart B, can be submitted with the application in a simplified format. The Certification Plan should contain at least the following elements
 - i. Purpose of change
 - ii. Description of change
 - iii. Applicability
 - iv. Applicable airworthiness Code/standards, special conditions, equivalent safety findings and environmental protection requirements
 - v. The description on how compliance will be demonstrated, with selected means of compliance and reference to compliance documents (i.e. Type Certification Basis)
 - vi. As appropriate, the involvement of the type-certificate holder of the product on which the STC is proposed.
 - vii. If relevant, the delivery schedule of compliance documents.

Guidance Material

- a. ACP defines the Modification process and engagement of TAA during this phase towards achieving compliance to TCB.
- b. The ACP identifies, when the compliance documents or evidence will be available and includes periodic progress reviews between the TAA, Main Contractor and other relevant organizations.
- c. ACP shall discuss about the formation of Various Committee required for the approval of Modifications to the Air System.
- d. ACP may consider the nature of the project like criticality & complexity, roles of all the stakeholders, Test & Evaluation process, maturity level of the ASDO etc.,

21.D1.6 Designation of applicable Airworthiness codes/standards for Modification

Regulation

The ASDO (Main Contractor) shall ensure that the application for the changes in Type Design (known as the 'changed product'), complies with the Airworthiness Codes/standards that are applicable and in effect at the date of the application for the changes unless compliance with Airworthiness Codes of later effective amendments is chosen.

Acceptable Means of Compliance

- a. If ASDO chooses to use an earlier amendment of the Airworthiness Code/standard, he should show that the changed product complies with the earlier amendment of the Airworthiness Code, and of any other requirement the CEMILAC finds is directly related. However, the earlier amended Airworthiness Code/standard should not precede the corresponding Airworthiness Code of the Type Design.
- b. If ASDO chooses to comply with Airworthiness requirements that are derived from an amendment to an Airworthiness Code that is effective after the filing of the application for a change to a type, the ASDO should also comply with any other Airworthiness requirements that the CEMILAC finds is directly related.
- c. If CEMILAC finds that the Airworthiness Codes referenced in the TCB do not provide adequate standards with respect to the proposed change, the ASDO should also comply with any special conditions, and amendments to those special conditions, prescribed under the provisions of Subpart B to provide a level of safety equivalent to that established in the Airworthiness Codes in effect at the date of the application for the change.

Guidance Material

- a. The following provides guidance for the application for changes in Type Design and to help in identifying the TCB for the Proposed Modification. The guidance and the diagram in **Figure 2** can be used to establish the TCB for changes in Type Design, in detailing evaluations, classifications, and decisions made throughout the process.
- b. The above regulation requires a change in Type Design to comply with the Airworthiness Codes that are applicable to the changed product and that are in effect at the date of the application, unless the change meets the criteria for the exceptions identified
- c. The ASDO can comply with an earlier amendment of the Airworthiness Code consistent with the requirements of Subpart D1, when one of the following apply.
 - i. A change is not significant.
 - ii. An area, system, part or appliance is not affected by the change.
 - iii. Compliance with the latest amendment for a significant change does not contribute materially to the level of safety.
 - iv. Compliance with the latest amendment would be impractical.

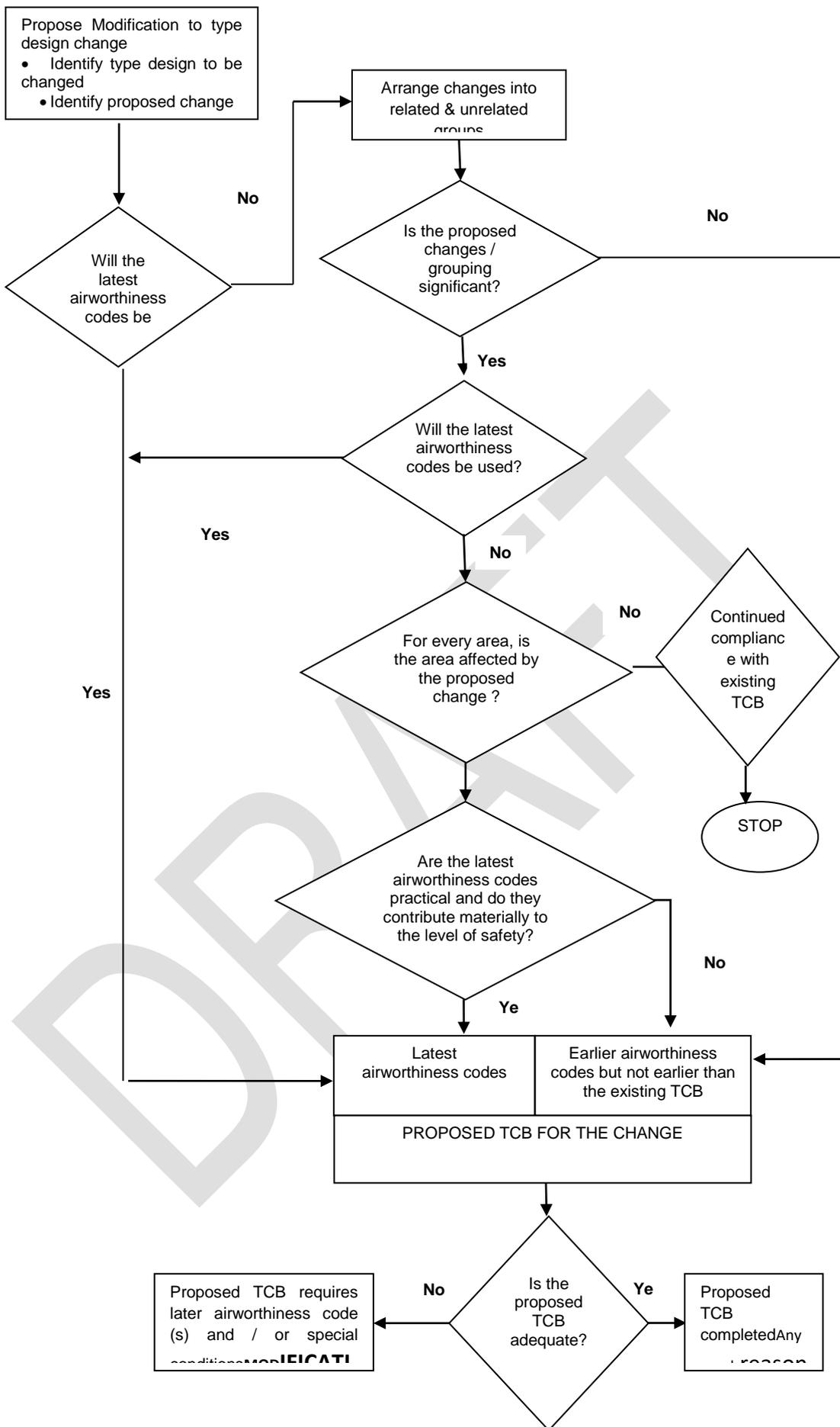


Figure. 2. Establishing the TCB for a changed product

- d. Note that earlier amendments shall not precede the corresponding amendment of the Airworthiness Code incorporated by reference in the MTC.
- e. If a change introduces a feature that was not addressed in the previous issue of the Airworthiness Code listed in the original TCB, but is addressed in the current issue, then the current issue would be applicable.
- f. However, when a proposed design change involves features or characteristics considered novel or unusual, or the intended use of the changed product is unconventional, or experience from other similar products in service or products having similar design features has shown that unsafe conditions may develop, and the proposed Airworthiness standards do not contain adequate or appropriate standards for the changed product, later amendments and or special conditions will be applied.
- g. The use of special conditions, under Subpart B, provides for when the proposed amendment of the applicable Airworthiness Code and any later amendment do not provide adequate standards to the proposed change.
- h. Documentation: All changes that result in a revision to the TCB are to be reflected on the amended MTC. The resulting TCB to supersede the previous one as it forms part of the compliance record required by the CEMILAC.

21.D1.7 Process of approval of Modifications

Regulation

All those design changes categorized as “Modification” shall be cleared through a Local Modification Committee (LMC) and shall be recommended to CEMILAC for issue of an AMTC or a SMTC, wherever applicable.

Acceptable Means of Compliance

- a. Different Committees are formed to handle those design changes categorized as “Modification” and to provide recommendations to CEMILAC to enable them to issue of an AMTC or a SMTC.
- b. Modifications shall be classified to indicate the urgency and application of each modification.
- c. All the cases where it is related to design and evolving procedures, CEMILAC is the final authority for taking decision and all those cases where it is related to inspection and quality control, RDAQA is the final authority for taking the decision.
- d. Main contractor is responsible to supply the customer, amendments to all related publications consequent to introduction of the modification.

Guidance Material

- a. A Local Technical Committee (LTC) is formed at Contractor place to evaluate the modifications proposed by the Main Contractor and those modifications that have been recommended by the LTC need to be considered by the LMC for ratification. Refer the section Constitution of LTC provided in 21.D1.8
- b. Modification during production or in-service phase is dealt by a Local Modification Committee (LMC). A Local Modification Committee (LMC) provides a forum for discussions on technical and associated matters and to take decisions regarding introductions and applicability of modifications. Refer the section Constitution of LMC provided in 21.D1.9A Local Concession Committee shall be formed at each contractor firm for discussion on the non-compliance of modifications on Air Systems, which will be delivered to the User. Refer the section Constitution of LCC provided in 21.D1.10
- c. Classification of modification shall be carried out as given in 21.D11
- d. The availability of amended publications shall be ensured before introduction of modified aircraft/engine/equipment into service use as given in 21.D1.15

21.D1.8 Constitution of Local Technical Committee (LTC)

Regulation

A Local Technical Committee (LTC) comprising of representatives from all the stakeholders shall be formed to discuss Technical aspects of Modification.

Acceptable means of Compliance

- a. LTC shall be formed by the Chairman of Local Modification Committee (LMC).
- b. The terms of reference of the LTC are as below:
 - i. Scrutiny/Study of design changes to the Air System (ab-initio developed, License & Bought out) proposed by the Main Contractor/Licensor and the justifications thereof.
 - ii. Finalization of test requirements for validation of the efficacy of proposed design changes and to establish their airworthiness.
 - iii. Analysis of results of tests decided at Para (ii) above.
 - iv. To decide on classification and applicability of Modification and Recommend the same to LMC.
 - v. Recommending approval of “Modifications” to Local Modification Committee (LMC).
- c. A Letter from the Main Contractor forwarding the agenda points along with requisite documents to all the stakeholders well in advance and requesting concerned division of CEMILAC for formation of LTC.

- d. Letter from concerned division of CEMILAC on formation of LTC at least two (02) weeks in advance for handling “Modifications” of Air System

Guidance Material

- a. Local Technical Committee (LTC) formed by CEMILAC shall have representatives from Design/Liaison, Quality Assurance/ Quality Control, Manufacturing & Methods/Technology departments of the Main Contractor, CEMILAC and ORDAQA/DGAQA.
- b. Chairman of the LTC may co-opt members from Main Contractor, Sub-contractor, Licensor or User Services wherever required.
- c. LTC shall function in accordance with the listed terms of reference for handling design changes in respect of the Air Systems designed & developed in-house as well as those manufactured under license from the OEM.
- d. Responsibility for convening Meetings of LTC and release of minutes thereof shall rest with Main Contractor.
- e. Every modification put up for consideration by the LTC shall be submitted in format indicated in Annexure TBD an Advance Modification information as per format at TBD must be issued by the Design Agency to CEMILAC, CRI and CSDO (Dett)/MAG (Avn). This has to be technically cleared by Concerned division of CEMILAC before the modification can be considered by the LTC.

21.D1.9 Constitution of LMC

Regulation

A Local Modification Committee (LMC) comprising of representatives from all the stakeholders is formed either by the Ministry of Defence or by CE(A), CEMILAC to handle those design changes categorized as “Modification.

Acceptable means

- a. The terms of reference of the Local Modification Committee shall be:
 - i. To Finalise the Classification of Modification and ratification of the Mod based on recommendations from LTC.
 - ii. To decide on applicability and the point of embodiment of the modification, to recommend manner of retro-compliance and effect on spares.
 - iii. To accord technical and financial approval to a modification (Financial approval only if LMC is constituted by MoD) proposal if found to be acceptable, subject to the financial limits of the LMC.
 - iv. To decide whether the modification will lead to issue of Amended Military Type Certificate or Supplemental Military Type Certificate by CEMILAC.
- b. Chairman of LMC will be the CRE/RD/Group Director of the concerned RCMA/CEMILAC dealing with the Air Systems.

- c. Chairman of the LMC may co-opt any other member from the contractor or user services where required.
- d. When an airframe modification proposal involves introduction of new items of airborne equipment, the LMC at the aircraft firm shall ensure that such items have been approved by Air /Naval/Army HQrs for the particular application and is also type approved or ratified in the LMC conducted for the airborne store.
- e. Modifications arising out of specific request from operating units, shall be considered by LMC after obtaining concurrence of Air/Naval/Army HQrs. A draft cost proposal proforma indicating the financial implications, aircraft from which this mod can be introduced on production, retro embodiment, redundancy etc., along with LMC's recommendation shall be sent to Directorate of Engineering at Air/Naval/Army/CG HQrs and CSDO/NASDO/Army by the main contractor.
- f. If the cost of the modification is beyond the financial powers of LMC, main contractor shall obtain the financial approval from user service HQ for embodiment of the modification.
- g. Minutes of LMC Meetings shall be circulated by concerned division CEMILAC to members and in addition to DGAQA, All service HQrs, Directorate of Engineering (Air HQrs), Director of Projects, ASTE, Director of Ground Electronics and Systems (where necessary) Coast Guard HQrs and CDA.
- h. An Index of Modifications shall be prepared by the main contractor as per Annexure TBD and circulated to All service HQrs, operating units, ASTE, Navy, Army, CSDO, NASDO, MAG (Avn), Coast Guard and various concerned agencies after obtaining the co-ordination of CEMILAC.

Guidance material

- a. The LMC shall consist of members from respective User Services (CSDO, NASDO, MAG(AVN), Air/Naval/Army/CG Headquarters), DGAQA, CDA, Contractor's representatives in Design, Production Engineering, Methods Engineering and Quality Control.
- b. A Draft Mod Leaflet(DML) as per format at TBD shall be prepared by the contractor & put up to LMC for each modification introduced irrespective of whether the mod is complied by the contractor or user. The draft mod leaflet shall be duly coordinated by CEMILAC. Draft Mod leaflets are to be prepared even in respect of modifications introduced by the Services. The Draft Mod leaflet is the document which would give exact details of work done, effect on publication, status prior to introduction of Mod, effect on spares etc
- c. RMS orders should be placed by Service Headquarters for embodiment of modification within a period of three months from the date of LMC approval.
- d. On ratification of DML by LMC, it shall be converted to a Mod leaflet duly approved by Chairman LMC and distributed to all stake holders and agencies earmarked to receive minutes of LMC.

- e. The index of modifications shall be as per format at TBD . The index of modifications is the only document which would give applicability as well as compliance status of modifications on various aircraft. This document must be kept updated once in a year by the main contractor. The (user) modification complied by the user must be intimated by the user services, to the contractor as and when completed to enable the contractor to update the index.

21.D1.10 Constitution of Local Concession Committee (LCC)

Regulation

A Local Concession Committee shall be formed at each contractor firm for discussion on the non-compliance of modifications and service instructions.

Acceptable means of compliance

- a. The terms of reference of the LCC are as follows:
 - i. To examine all concessions for non-compliance of modifications of Class B/2& C/3 nature.
 - ii. To examine all concessions for non-compliance of service instructions (Refer Subpart L) affecting flight safety.
 - iii. To examine the reasons for non-compliance.
 - iv. To determine the period for which concession can be granted if concession is acceptable.
 - v. To accept or reject concessions for non-compliance of modifications of C/3 or D/4 nature or equivalent Service instructions.
 - vi. To recommend acceptance or reject concessions for noncompliance of modifications of B/2 nature or equivalent instructions.
 - vii. The LCC is not authorized to grant concessions of Class B/2 modifications but can only recommend acceptance to Service Headquarters.
 - viii. The final acceptance of concessions for non-compliance of modifications of Class B/2 nature can only be decided by Service Headquarters based on the recommendations of LCC.
 - ix. The LCC can accept concessions of Class C/3 &D/4 modifications.
- b. The LCC shall be chaired by the Regional Director/CRE and shall have members from DGAQA, Design, Production and Quality Departments of the contractor firm and user representative.

Guidance material

- a. Refer sections on Service instructions in Subpart L (Continued Airworthiness) to understand various types of Service instructions.
- b. Concessions on non-compliance of modifications, SI/STI on manufacturing projects shall be referred to through RDAQA for concurrence in format at **TBD**. Concurrence on operational aspects should be in consultation with user

21.D1.11 Classification of modifications

Regulation

Modification shall be classified depending on Air System is held by the Main Contractor or by Services the as per listed procedure.

Acceptable means of compliance

Alphabetical Classification shall apply to the Air Systems held by the Main Contractor and Numerical classification for the Air systems held by the Services.

Guidance material

a. The following **Alphabetical Classification** apply to Air Systems/airborne stores being produced, reconditioned or repaired at contractor's place.

Class AA: Class AA modifications are those; whose incorporation is essential for the initial Release to Service(s) or approval for the introduction of a new equipment, and shall be embodied in all such items of main equipment prior to delivery. This class cannot be awarded once items of Air System have been delivered.

Class A: Modifications those are essential. Non-embodiment will involve safety, non-availability or impose severe operational limitations. They shall be embodied irrespective of any delay in delivery or scrap involved.

Class B: Modifications that are high priority. Non-embodiment will involve serious Operational limitations or could seriously reduce maintenance efficiency. They shall be embodied forthwith and parts made available as soon as practicable. Scrap and delay in delivery are permissible when authorised by the Modification committee.

Class C: Modifications that are important improvements for technical or operational reasons. They shall be embodied in production as soon as parts can be made available provided there is no delay in delivery. Scrapping of existing parts is permissible when authorised by the Modification Committee

Class D: Modifications that are less important improvements than class C. They shall be embodied in new production provided no scrap or delay in delivery is involved or during over haul / repair when un modified spares are exhausted.

b. **Special Order Only (SOO)**

This type of Classification applies to modifications which are necessary to satisfy a limited operational need to apply to a limited quantity of equipment. Examples are:

- i. Specific operational requirements which can be satisfied on a scale of less than one per aircraft or missile or equipment e.g. drop tanks, tropical and arctic equipment;

- ii. Those introducing special to type Service support equipment, tools or test equipment;
- iii. Experimental Modification.

c. A Numerical Classification

The following classifications apply to Air System/airborne stores held by the Services, to inform them of the urgency of action they will have to take to retain the Operational Airworthiness of the Air System.

Class 1: Essential Modifications. When the absence of the change would adversely affect safety or impose severe operational limitations. They shall be embodied immediately and are compulsory.

Class 2: Modifications that are high priority. When the absence of the change would impose serious performance or other operational limitations including the reduction of maintenance efficiency. They shall be embodied and are compulsory, the extent and the timing to be decided by the Modification committee.

Class 3: Modifications that are important (but less than class 2) for the improvement of operational efficiency, reliability, economy, servicing or maintainability to be gained, is judged by the change committee to outweigh the cost and effort of retrospective Embodiment.

Class 4: Modifications that are Non-retrospective and do not affect the inter changeability of spares. When LMC decide it is necessary to withdraw and modify or scrap existing spares. If required, they shall be embodied during repairs or reconditioning

Class 5: Modifications that are Non-retrospective which have no effect on the interchangeability of spares. If required, shall be embodied during repairs or reconditioning or when stocks of unmodified spares are used up.

Class 0: Modifications that have no In-service implications, but inter changeability of spares may be affected.

d. Authority for and Method of classification of Modifications:

- i. The LMC is responsible for the classification of Modifications and will indicate the extent of contractor and Service application on Modification leaflets.
Agreed application Class A/1, B/2, C/3, D/4 SOO
- ii. When using the classification SOO the nature and scope of the limited requirement will be clearly defined as advised by the Service departments representatives, and will instruct the contractor concerned to proceed by amplifying the application SOO as follows:
 1. To be embodied in the nth production aircraft/missile/ equipment or ,
 2. Provision of "X" complete modification sets to be delivered for specified aircrafts missiles/equipment, and
 3. Whether a draft modification leaflet is required

iii. The LMC may also recommend the use of either Service Modification Parties (SMP) or contractors' working parties (CWP) for the implementation of the modification on Air System. The CWP may be used for the embodiment of modifications in Classes 1, 2 and 3 where the work involved is considered to be beyond the capacity of the Service.

21.D1.12 Issue of Amended Military Type Certificate (AMTC) or Supplemental Military Type Certificate (SMTC)

Regulation

- a. CEMILAC shall issue an AMTC for a modified Air System to a Main Contractor/ASDO having MTC as agreed between Main Contractor & CEMILAC.
- b. CEMILAC shall issue a SMTC for the Airsystem for the modification carried out by any organisation, who is not a Military Type Certificate Holder.

Acceptable Means of Compliance

CEMILAC shall ensure the following before issue of Amended MTC:

- a. Recommendations from LMC shall be the basis for CEMILAC to issue the AMTC or SMTC for an Air System; and
- b. Any airworthiness provisions not complied with, are compensated with factors that provide an equivalent level of safety; and
- c. No new features or characteristic introduced as a part of this modification shall make the Air System unsafe.
- d. The modifications to the Air systems shall meet the applicable airworthiness codes and environmental protection requirements (where applicable).
- e. In the case of SMTC, the applicant has to enter into an arrangement with the type-certificate holder;
 - i. The type-certificate holder has provided no technical objection to the information submitted along with application to the CEMILAC, and
 - ii. The type-certificate holder has agreed to collaborate with the supplementary type-certificate holder to ensure discharge of all obligations for continued airworthiness of the changed product.
 - iii. By the way of derogation of para (i) & (ii) above, a concurrence from the User Services, who is the owner of this Air System has to be obtained for non-collaboration of MTCH in supporting continued airworthiness.

Guidance Material

- a. AMTC or SMTC will not be issued by CEMILAC until the changes to the Type design is brought Under Local Modification Committee (LMC).
- b. Normally Following Types Modifications may only result in issue of a AMTC or SMTC

- i. Replacement of existing Engine of an Air System with a higher powered engine.
 - ii. Installation of Air launched Missile on an Air system introducing major changes aerodynamic configuration.
 - iii. Major Avionics Upgradations.
 - iv. Major changes in structure which will affect the aerodynamic configurations.
- c. Successful completion of the Airworthiness Certification along with the conduct of LMC for a Modification in Type Design will usually result in the CEMILAC issuing the AMTC or SMTC

21.D1.13 Duration and continued validity

Regulation

An AMTC or SMTC shall be issued for a period of five years

Acceptable Means of Compliance

- a. On expiry of AMTC or SMTC, the further production activities of modified Air System by the holder or its production partner shall not be carried out.
- b. The AMTC or SMTC holder shall apply to CEMILAC in prescribed Proforma for the renewal of AMTC or SMTC six months prior to the expiry of the certificate.
- c. The expiry of AMTC/SMTC shall have no bearing on the airworthiness status of the modified Air systems already produced and supplied to the user services. It only results in stoppage of further production activities for the modified Air Systems.

Guidance Material

- a. CEMILAC may consider suspending or revoking a SMTC or an AMTC, When ASDO or its production partner do not meet the obligations during the continued airworthiness activities of the Air System.
- b. CEMILAC may obtain from user services the performance and safety record of the modified Air System at regular intervals. Based on the feedback received, if the user services and the TAA find it necessary, CEMILAC may suspend or withdraw AMTC or SMTC

21.D1.14 Record keeping

Regulation

For each change, all relevant design information, drawings and test reports, including inspection records for the changed product tested, shall be held by the applicant at the disposal of CEMILAC and shall be retained in order to provide the information necessary to ensure the continued airworthiness and compliance with applicable environmental protection requirements (where applicable) of the changed product.

Acceptable Means of Compliance

Unless otherwise laid down by CEMILAC, the records of the air system must be retained till removal of the last aircraft of the type certified from service.

Guidance Material

Nil

21.D1.15 Instructions for Sustaining Type Airworthiness Regulation

The approved ASDO responsible for the change, shall provide the variations to Instructions for Sustaining Type Airworthiness (ISTA) for the product, on which the change is to be installed, prepared iaw the applicable TCB, to the CEMILAC

Acceptable Means of Compliance

- a. Variations to the ISTA **should** be made available by the ASDO to the CEMILAC& User Services at the earliest opportunity along with the delivery of the first modified Air System.
- b. The ASDO shall promulgate the necessary Technical Information and ISTA required for the continuing airworthiness of the Air systems to the User Services.
- c. A programme showing how changes to the variations of the ISTA are promulgated **should** be submitted to the CEMILAC.
- d. The availability of some manuals or portions of the variations to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into service, but **should** be available in reasonable time at which the associated maintenance needs to happen before any of the products reaches the relevant age or flight hours or cycles

Guidance Material

- a. It is best practice for the ASDO to have a close working arrangement with the User Services and that the process and protocol for the timely provision of the sort of material outlined above is jointly understood and acceptable.
- b. For a description of what constitutes ISTA refer to Subpart B

SUBPART -E : MODIFICATIONS OF AIR BORNE STORES

Rationale

This subpart provides the regulation for any alteration/amendment or modification to the airborne store after issue of initial airworthiness clearances like IMTSOA, LoA and TA. Any change in design, material, process is treated as alteration/amendment or modification in airborne store. The regulations of this Subpart also cover modification of bought-out airborne stores and license manufactured airborne stores.

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- 21.E.1. Design changes during Production & Service Use**
- 21.E.2. Constitution of Local Technical Committee (LTC)**
- 21.E.3. Constitution of Local Modification Committee (LMC)**
- 21.E.4. Design Changes during Production – Alteration/Amendment**
- 21.E.5. Design Changes during Production – Modifications**
- 21.E.6. Publications & Promulgation of Modification**
- 21.E.7. Compliance of Modification**
- 21.E.8. Modification of airborne stores where LMC is not constituted**
- 21.E.9. Modification of airborne stores by Agency other than Certificate Holder**

21.E.1 Design Changes during Production & Service Use

Regulation

Any changes to the design of an airborne store (for which initial airworthiness approval has been issued), necessitated during production or service usage, shall follow a formal approach and duly approved in accordance with the requirements spelt out in the applicable regulations in 21.E.2 to 21.E.9.

Acceptable means of Compliance

The approach to be followed for the design change to the airborne store shall be based on

- a. Alterations/Amendments – Acceptance of such design changes by Local Technical Committee (LTC) as described in regulation 21.E.2
- b. Modifications – Acceptance of the modification by Local Technical Committee (LTC) and Approval thereof by Local Modification Committee (LMC) as described in regulation 21.E.3

Guidance Material

- a. Production of airborne store commences after the issue of initial airworthiness clearances like TA/LOA/IMTSOA. Changes to the Build Standard of an airborne store may be necessitated during its production or service use subsequent to its delivery.
- b. Such changes may arise to address issues like the failures observed during field use, capability and performance improvement, reliability improvement, obsolescence management, to mitigate non-availability of raw materials/standard parts, improving manufacturability and addressing maintainability issues.
- c. Modifications may be carried out when designer proposes or Defect Investigation committee or User recommends change to the existing SOP of the system. The viability of the modifications needs to be established before carrying out the proposed modifications
- d. Changes to the production build standard shall be categorized as “Alteration/Amendment” (minor changes) and “Modification” (major changes) by Main Contractor. In case categorisation of a particular design change as “Alteration/Amendment” or “Modification” is difficult to be decided, these shall be discussed with Technical Airworthiness Authorities through LTC.
- e. There may arise a need to introduce certain design changes to the accessories being manufactured under license. These design changes may be proposed by the Licensor (OEM of the accessory) or by the Licensee (Main Contractor) where support from

Licensor is not available. Design changes in respect of licence manufactured accessories shall also be dealt with on similar lines as done for the accessories designed & developed in-house.

21.E.2 Constitution of Local Technical Committee (LTC)

Regulation

A Local Technical Committee (LTC) comprising of representatives from all the stakeholders shall be formed by the Chairman of Local Modification Committee (LMC) {21.E.3}. The members & terms of reference of the LTC are as below:

- a. Members – Representatives of Main Contractor/ Licensor, CEMILAC, ORDAQA/DGAQA
- b. Chairman – Representative of CEMILAC
- c. Categorization of a Design change proposed by the main contractor as alteration/amendment or modification.
- d. Scrutiny/Study of design changes to the accessory proposed by the Main Contractor/Licensor and the justifications thereof
- e. To decide on classification and applicability of those design changes categorized as “Modification”
- f. Finalization of test requirements including environmental tests if any required for validation of the efficacy of proposed design changes and to establish their airworthiness.
- g. Analysis of results of tests decided at Para (e) above
- h. Acceptance of the design changes categorized as “Alterations/Amendments” for implementation.
- i. Recommending approval of “Modifications” to Local Modification Committee (LMC)

Acceptable means of Compliance

- a. Letter from the Main Contractor forwarding the agenda points along with requisite documents to all the stakeholders well in advance and requesting RCMA/CEMILAC for formation of LTC.
- b. Letter from RCMA/CEMILAC on formation of LTC at least one (01) week in advance for handling “Alterations/ Amendments” and at least two (02) weeks in advance for handling “Modifications”

Guidance Material

- a. Local Technical Committee (LTC) shall have representatives from Design/Liaison, Quality Assurance/ Quality Control, Manufacturing & Methods/Technology departments of the Main Contractor along with representatives of CEMILAC & DGAQA. Chairman of the LTC may co-opt members from Main Contractor, Sub-contractor, Licensor or User Services wherever required.

- b. LTC shall function in accordance with the listed terms of reference for handling design changes in respect of the accessories designed & developed in-house as well as those manufactured under license from the OEM. Responsibility for convening Meetings of LTC and release of minutes thereof shall rest with Main Contractor.

c.

21.E.3 Constitution of Local Modification Committee (LMC)

Regulation

Local Modification Committee (LMC) comprising of representatives from all the stakeholders is formed by the Government to handle those design changes categorized as "Modification". An LMC may be formed at the Contractor's premise which has the design responsibility for the modifications. The terms of reference of the LMC are as below:--

- a. Members – Representatives from the Design/Liaison, Quality Assurance/Quality Control, Production & Methods/Technology Departments of the Contractor, RCMA, ORDAQA, CSDO/NASDO/MAG (Avn), IAF/ Army/Navy/CG Headquarters and DAD/CDA
- b. Chairman – Chief Resident Engineer/Regional Director of the concerned RCMA
- c. To determine the feasibility and assess justification or other implications of introducing a modification.
- d. To decide on classification, applicability and the point of embodiment of the modification, to recommend manner of retro-compliance and effect on spares
- e. To accord technical and financial approval to a modification proposal if found to be acceptable, subject to the financial limits of the LMC.
- f. To accord technical approval and to recommend financial approval by the concerned service HQrs in respect of modifications whose cost is beyond the financial powers of LMC

Acceptable means of Compliance

- a. Letter from the Main Contractor forwarding the agenda points along with requisite technical documents well in advance and requesting RCMA for formation of LMC.
- b. Letter from RCMA forming LMC and forwarding the agenda points along with requisite technical documents at least one month prior to the conduct of meeting of LMC. However for Emergency LMC time lines for forwarding agenda points may be decided by LMC Chairman in consultation with Main Contractor and Users.

Guidance Material

- a. LMC formed by the Government shall function in accordance with the listed terms of reference for handling "Modifications" in respect of the accessories designed & developed in-house as well as those manufactured under license from the respective

OEM. Chairman LMC may co-opt other members from Contractor, Licensor or User Services wherever required.

- b. The LMC is not concerned with those design issues not involving production or issues of purely manufacturing in nature not involving any design changes. Such issues shall be dealt with directly by RCMA and ORDAQA respectively.
- c. Responsibility for convening Meetings of LMC and release of minutes thereof shall rest with RCMA. Minutes of LMC Meetings shall be circulated by the concerned RCMA to all the member agencies of LMC, external agencies not participating in the meeting but affected by the decisions taken in the LMC e.g. Air System Design & Certification agencies and CEMILAC.

21.E.4 Design Changes during Production – Alteration/Amendment

Regulation

Design changes necessitated during production and service use of an accessory, categorized as “Alteration/Amendment” shall be referred to the Local Technical Committee (LTC) in the prescribed format along with the necessary justification for introduction of such changes. LTC shall scrutinize, evaluate and accept these changes for their implementation.

Acceptable means of Compliance

- a. “Alteration/Amendment” proposal submitted by the Main Contractor in the prescribed format along with necessary justification
- b. Minutes of LTC meeting on scrutiny, evaluation and acceptance of “Alterations/Amendments” for their implementation

Guidance Material

An Alteration/Amendment is a design change which does not

- a. Affect the safety, operational use, life, reliability or other specification or design requirements of a store.
- b. Involve significant changes in production or changes which affect stores already produced.
- c. Affect the cost, the delivery program of the store or standard of spare parts
- d. Affect the interchangeability of the store.

The following design changes only will meet the above criteria and can be covered under Alteration/Amendment:

- a. Minor dimensional corrections which do not affect the strength i.e. changes to bring the drawings in line with shop practice and to eliminate drawing errors as well as those which call upon minor manufacturing changes.
- b. Improved method of dimensioning or deletion of redundant dimensions which do not materially affect the part from the point of view of assembly or function.
- c. Minor changes like correction of rivet length, drawing reference, deletions or additions of unimportant notes or corrections of erroneous pictorial views shown.
- d. Corrections in the material schedule which do not seriously affect the cost and the material procurement etc.

A suitable Drawing Office Procedure shall be evolved by the Main Contractor by which the "Alterations/Amendments" are introduced and implemented post their acceptance by LTC.

21. E.5 Design Changes during Production – Modifications

Regulation

- a. Modifications to an airborne store proposed by the Main Contractor shall be duly scrutinized, evaluated by the LTC as per the applicable terms of reference {21.E.2}.
- b. Thereafter the modification proposal, justification thereof and the validation/testing carried out shall be evaluated by LMC and then the modification shall be approved by LMC as per the applicable terms of reference {21.E.3}.
- c. All modifications proposed by Main Contractor shall be implemented only after approval of the same by LMC and approval of modification leaflet by RCMA. Subsequently, the modified accessories shall be released for use.

Acceptable means of Compliance

- a. Minutes of LTC meeting on the referring of "Modification Proposal" submitted by the Main Contractor and recommending consideration of the modifications by the LMC
- b. Advanced Modification Information (AMI) duly signed by RCMA/ CEMILAC after due acceptance of the Mod proposal by LTC
- c. Minutes of LMC meeting on approval of the "Modification Proposal" submitted by the Main Contractor
- d. Modification Leaflet prepared by the Main Contractor for each of the modifications and duly approved by RCMA/CEMILAC

- e. Index of Modifications prepared by the Main Contractor, updated once in an year and duly coordinated by RCMA/CEMILAC

Guidance Material

a. Classification of Modifications

Design changes falling outside the scope of Alteration/Amendment are categorized as Modification. Each of the modification proposed by the Main Contractor shall be suitably classified as per the guidelines given in the succeeding paragraphs. The classification shall be deliberated during the proceedings of LMC before its acceptance.

- i. Class 'A': Class 'A' modifications are those essential for safety and the absence of which involves, or may have already involved the grounding of aircraft, or impose an unacceptable operational limitation of flying or use of other equipment. They must be embodied before the acceptance irrespective of any delay in the delivery of the aircraft/aero engine/equipment concerned and regardless of the scrapping of existing parts.
- ii. Class 'B': This applies to high urgency modifications, required to reduce danger to personnel or to obviate operational limitations or serious maintenance shortcomings. Parts required will be made available as soon as practicable and will be embodied in production at the earliest opportune time. Delay in delivery of the aircraft/aero-engine/equipment concerned in order to advance the embodiment in production and the scrapping of existing parts may be authorised by the appropriate authority at Service Headquarters. These modifications will be embodied by contractors during repair or reconditioning and are to be embodied during repair or reconditioning carried out at service repair depots.
- iii. Class 'C': This applies to modifications of the same kind as in class 'B' but not having such a high degree of urgency. This classification does not allow delay in delivery of production but scrapping of existing parts is permissible when authorised by the appropriate authority at Service Headquarters so as to allow embodiment at an earlier point in production than would be the case if all existing parts were used up first. These modifications will be embodied by a contractor during reconditioning and will also be embodied during repair in so far as this can be done without my further stripping than is called for by the repair work concerned. The same conditions are to apply to reconditioning and repair at service depots.
- iv. Class 'D': This applies to improvements of less importance than class 'B' or 'C' which will be embodied in production line when parts already made are used up or modifications resulting in reliability & Maintainability improvements. Delay in

delivery is not permitted. They may be embodied during repair or reconditioning when stocks of unmodified parts are exhausted.

- v. Special Order Only (SOO): The term special order only (SOO) is applied to modifications which are applicable only to a specified number of aircraft/aero-engine/equipment or to specific types of servicing equipment

- b. Modification Proposal:
 - i. Every modification put up for consideration by the LTC and thereafter duly recommended to LMC by LTC, which shall be submitted in the "Modification Proposal" format prescribed by CEMILAC. The Mod Proposal shall be technically evaluated and accepted by the LTC as per the applicable terms of reference {21.E.2} before recommending the same for consideration by the LMC.

- c. Advanced Modification Information (AMI)
 - i. An Advanced Modification Information (AMI) in the prescribed format shall also be issued by the Design Agency to RCMA, ORDAQA and CSDO/NASDO/MAG (Avn). Post evaluation of the Mod Proposal by LTC, the AMI shall be technically cleared by RCMA before the modification can be considered by LMC.

- d. Modification Leaflet:
 - i. A Modification Leaflet as per the format prescribed by CEMILAC shall be prepared by the Main Contractor for each modification introduced irrespective of whether the Mod is compiled by the Contractor or the User. The mod leaflet shall be duly coordinated by RCMA. The Mod leaflet is the only document which would give the exact details of work done, effect on publications, status prior to introduction of Mod and effect of Mod embodiment on spares etc.

- e. Index of Modifications:
 - i. An Index of Modifications shall be prepared by the Main Contractor and circulated to Service HQrs, Operating Units, CSDO, NASDO, MAG (Avn), Coast Guard and various concerned agencies after obtaining the co-ordination from RCMA. The index of modifications shall be made as per format prescribed by CEMILAC. The index of modifications is the only document which would give applicability as well as compliance status of modifications on various aircraft. This document must be updated once in a year by the Main Contractor.

- f. General Guidelines on Introduction of Modifications:

The following are certain additional guidelines for introduction of modifications:

- i. Where a particular modification would affect airborne stores at another firm, the LMC shall ensure that the other firm is consulted. This is particularly important when discussion affects a sub-contractor at whose works there is a modification which is concerned in this matter. In such an event the other firm shall be given prior intimation so that, if desired, the representative of that firm may also attend the meeting.
- ii. When an airframe modification proposal involves introduction of new items of airborne equipment, the LMC at the aircraft firm shall ensure that such items have been duly cleared for modification in LMCs by relevant RCMA, approved by Air /Naval/Army HQs for the particular application and also the airborne store is duly Certified (TA/IMTSOA/LoA).
- iii. Modifications arising out of specific request from operating units, shall be considered by LMC after obtaining concurrence of Air/Naval/Army HQs. A draft cost proposal proforma indicating the financial implications, aircraft from which this mod can be introduced on production, retro-embodiment, redundancy etc., along with LMC's recommendation shall be sent to Directorate of Engineering at Air/Naval/Army/CG HQs and CSDO/NASDO/Army by the main contractor.
- iv. If the cost of the modification is beyond the financial powers of LMC, main contractor shall obtain the financial approval from user service HQ for embodiment of the modification.
- v. RMS orders should be placed by Service Headquarters for embodiment of modification within a period of three months from the date of LMC approval.
- vi. Suitable procedure shall be evolved for following up equipment modification. If the modification is of an important nature, an airframe mod number shall be given and the mod progressed. If the equipment is common to other aircraft operated by IAF/IN/Army/CG, views of Air/Naval/Army/CG HQs should be obtained before incorporating the mod. If the Airframe/Engine LMC considers that it is essential to introduce any modification on the equipment used on such airframe/engine, the LMC at equipment firm shall be so advised by the main contractor and RCMA at the main contractor. The equipment contractor/firm shall immediately place before the equipment LMC the proposals for the modifications.
- vii. Mod record data base should be maintained by Users, Production agency and Repair agency.
- viii. Modifications need to be carried out at the earliest as per the mod leaflet so that the known failures are avoided and required improvements/ functionality is achieved
- ix. User rep may bring out the logistics related issues and possible timelines in the embodiment programme
- x. The embodiment plan shall be worked out between ASDO and user services. Same shall be submitted to CEMILAC.

xi. The embodiment action should be monitored by LMC to Assess the effectiveness of the Modification in meeting the requirement and to Identify and resolve any problems in the embodiment programme.

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21. E.6 Publications and Promulgation of Modification

Regulation

The details of modification shall be published and promulgated to all the like service ASDO, Service Headquarters and TAAs.

Acceptable means of Compliance

- a. The modification leaflet, service bulletin shall forward to all the stakeholders within 30 days of LTC / LMC.
- b. All necessary publications related to the modifications that affect maintenance, serviceability and operations shall be provided to the User by the main contractor.

Guidance Material

The Service HQ to ensure that all technical information related to the modification are promulgated to the Squadrons and the respective Maintenance organisation of the User Services.

21.E.7 Compliance of Modification

Regulation

The retro-modification plan shall be carried out by the certification holder and the status shall be forwarded to the ASDO, service headquarters and the TAAs.

Acceptable means of Compliance

The modification plan and its applicability of embodiment shall be prepared by the main Contractor in line with the recommendations of the LMC.

Guidance Material

Nil

21.E.8 Modification of airborne stores where LMC is not constituted

Regulation

Wherever LMC is not constituted by MoD, CEMILAC shall form a committee. The committee will technically ratify the modification without financial implications.

Acceptable means of Compliance

- a. All necessary technical details to be provided to CEMILAC.
- b. In the absence of the necessary technical details, or OEM participation, a LTC as defined above may be formed to assess the technicalities involved in the modification.
- c. The modifications to the airborne store shall meet the applicable airworthiness codes and environmental protection requirements (where applicable).
- d. The LTC recommendation will be the basis for the approval of the modification.

Guidance Material

Nil

21.E.9 Modification of airborne stores by Agency other than Certificate Holder

Regulation

CEMILAC shall issue a clearance for the modification carried out on the airborne store by any organisation, who is not a Type Approval Holder

Acceptable means of Compliance

- a. Recommendations from LMC shall be the basis for CEMILAC to address the clearance.
- b. No new features or characteristic introduced as a part of this modification shall make the airborne store performance degraded.
- c. The modifications to the airborne store shall meet the applicable airworthiness codes and environmental protection requirements (where applicable).
- d. the applicant has to enter into an arrangement with the Type approval holder;
 - i. The Type approval holder has provided no technical objection to the information submitted along with application to the CEMILAC, and
 - ii. The type approval holder has agreed to collaborate with the applicant to ensure discharge of all obligations for continued airworthiness of the changed product.
 - iii. By the way of derogation of para (i)& (ii) above, a concurrence from the User Services, who is the owner of this airborne store has to be obtained for non-collaboration of Type approval holder in supporting continued airworthiness.

Guidance Material

Nil

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SUBPART- F : PRODUCTION OF AIR SYSTEMS AND AIRBORNE STORES

Rationale:

An organisation, which holds a Production Organisation Approval as per Provisions given at Subpart G2 may undertake production of such Air Systems / Airborne stores with an intend to supply those items to the user services.

Prior to delivery to the user services, TAA are responsible to establish the compliance to the approved baseline configuration and state of Airworthiness for all the Air Systems/Airborne Stores. This baseline is the fundamental starting point for all subsequent Military Airworthiness Reviews. Configuration variations will occur throughout the life of an Air System and failure to understand its configuration will make Continuing Airworthiness virtually impossible. This Regulation emphasises the need of establishing compliance to Approved Baseline Configuration, address deviations from the approved configuration, carry out Acceptance Tests to ensure performance requirements and thereby allowing any deviations to be rectified and subsequently issue a Certificate of Airworthiness (CoA) in the form of a Release Note/Q-423 for each Serial Number of such Air Systems / Airborne Stores.

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- 21.F.21** Amendment or modification
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- 21.F.25** Lifing Aspects

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21.F.1 Applicability

Regulation

This subpart shall be applicable in the following production scenarios:

- a. Production of Air Systems and Airborne Stores for which the organisation holds a TA/IMTSOA/LoA.
- b. Production of Air Systems and Airborne Stores for which the production organisation has a licence agreement from a design agency provided the products are Approved/certified by a recognised Airworthiness Authority.

Acceptable Means of Compliance

The provisions elaborated in this Subpart shall be applicable for the production of Air Systems and Airborne Stores under the following categories:

- a. Production of Air Systems and Airborne Stores for which the organisation holds a MTC/AMTC/SMTC/TA/IMTSOA/LoA shall follow the provisions followed in this sub part.
- b. Production of Air Systems and Airborne Stores for which the organisation has a licence agreement from a design agency shall follow the provisions detailed in this sub part. The licensor of the Air Systems / Airborne Stores shall hold a valid Approval/ Certification from a recognised Airworthiness Authority.
- c. If the licensor is a foreign OEM, the certification agency of the country of origin shall have a mutual recognition with Indian TAA.

Guidance Material

Nil

21.F.2 Eligibility

Regulation

Organisations involved in the production of Air Systems and Airborne shall have a structure with responsibilities, procedures, processes, and resources well organised, so that the products conform to the certified configurations and is in a condition for safe flight.

Acceptable Means of Compliance

- a. An organisations which has demonstrated the capability for the production of Air Systems and Airborne Stores only shall be involved in the production of such items. The production organisation shall hold a valid Production Organisation Approval (POA) from DGAQA in accordance with **Subpart G2**, for the production of such kind of Air Systems or Airborne Store.
- b. A Production Organisation intend to produce an Airsystem shall hold a valid RMTC/MTC from CEMILAC for the same. Alternatively, the PO shall hold a valid production license agreement (through a Transfer of Technology (ToT)) from an Indian or Foreign Airsystem developer.
- c. A Production Organisation intend to produce an Airborne Store shall hold a valid Type Approval/ LoA/ IMTSOA or a license for the production for such Airborne Stores from an Indian or Foreign agency.
- d. In case of Production under license agreement or Transfer of Technology, the PO shall obtain a Production Certificate from CEMILAC on completion of establishing the production process and evaluation of initial samples.

Guidance Material

- a. Each applicant for or holder of a POA must allow the DGAQA& CEMILAC or its authorised representatives to inspect its quality system, facilities, technical data, and any manufactured products or articles and witness any tests, including any inspections or tests at a supplier facility, necessary to determine compliance with this Subpart.
- b. Representatives of CEMILAC and DGAQA may be included in any negotiations by Government agencies, PSUs and non-government agencies, for entering into license agreements for production of Air Systems and Airborne stores. The transfer of type record of the Airsystem and its major components, from the country of origin to CEMILAC shall be included with the terms and conditions of the license projects.
- c. The Licensed Production of Airsystems /Airborne Stores may be taken up by Public Sector, Private Sector or any Laboratories of Research & Development Organisations of Government, Semi-Government or Private Institutions which is designated as the executor of the licence agreement. The agency so awarded with the contract will be called the licensee.
- d. The holder of a POA may obtain a Certificate of Airworthiness (CoA) as defined at Subpart H for each serial number of the Air Systems or Airborne Stores produced after establishing compliance with approved configurations and performance requirements.
- e. AFQMS document released by DGAQA shall be a reference document for POA.

21.F.3 Application for Production Evaluation Coverage

Regulation

Any organisation which intends to manufacture Air Systems or Airborne Stores under 21.F.1 shall make an application to CEMILAC and DGAQA in a manner established by DGAQA indicating the necessary details.

Acceptable Means of Compliance

- a. The application shall include the details such as:
 - i. Category under which the production is being taken up (21.F.4).
 - ii. Details of MTC/AMTC/SMTC/TA/CoA/IMTSOA/Equivalent
 - iii. Details of production facility
 - iv. For an imported aircraft, any acceptable evidence to support that the aircraft conforms to a design approved by the Authority of the State of registry.
- b. The organisation shall obtain an acknowledgement from CEMILAC and DGAQA prior to commencement of production activities.

Guidance Material

- a. Application Format as released by CEMILAC & DGAQA
- b. Contractual agreement with the OEM in case of license program

21.F.4 Quality Management System

Regulation

Each applicant for or holder of a Production Organisation Approval (POA) must establish and describe in writing a Quality Management System (QMS) that is approved by DGAQA.

Acceptable means of Compliance

- a. A well-established QMS ensures that the organisation has a reliable process which confirms that each product and the stores under production conforms to its approved design and is in a condition for safe operation. This quality management system shall be in accordance with Sub Part G2.
- b. AFQMS released by DGAQA or AS 9100 etc can be the baseline for establishing the QMS.

Guidance Materials

- a. The PO shall prepare a Quality Assurance Plan for production in consultation with DGAQA. QAP shall include:
- i. Design data control: Procedures for controlling design data and subsequent changes to ensure that only current, correct, and approved data is used.
 - ii. Document control: Procedures for controlling quality system documents and data and subsequent changes to ensure that only current, correct, and approved documents and data are used.
 - iii. Supplier control: Procedures that:
 1. Ensure that each supplier-provided product, article, or service conforms to the production approval holder's requirements; and
 2. Establish a supplier-reporting process for products, articles, or services that have been released from or provided by the supplier and subsequently found not to conform to the production approval holder's requirements.
 - iv. Manufacturing process control: Procedures for controlling manufacturing processes to ensure that each product and article conforms to its approved design.
 - v. Inspecting and testing: Procedures for inspections and tests used to ensure that each Store conforms to its approved design and performance requirements. These procedures must include the following, as applicable:
 1. An Acceptance Test Plan for each of the item produced.
 2. A functional test of each of the System produced.
 - vi. Inspection, measuring, and test equipment control: Procedures to ensure calibration and control of all inspection, measuring, and test equipment used in determining conformity of each product and article to its approved design. Each calibration standard must be traceable to a standard acceptable to the DGAQA.
 - vii. Inspection and test status: Procedures for documenting the inspection and test status of products and articles supplied or manufactured to the approved design.
 - viii. Nonconforming product and article control:
 1. Procedures to ensure that only products or articles that conform to their approved design are installed on a type certified product. These procedures must provide for the identification, documentation, evaluation, segregation, and disposition of nonconforming products and articles. Only authorized individuals may make disposition determinations.
 2. Procedures to ensure that discarded articles are rendered unusable.

3. Corrective and preventive actions. Procedures for implementing corrective and preventive actions to eliminate the causes of an actual or potential nonconformity to the approved design or noncompliance with the approved quality system.
- ix. Handling and storage: Procedures to prevent damage and deterioration of each product and article during handling, storage, preservation, and packaging.
 - x. Control of quality records: Procedures for identifying, storing, protecting, retrieving, and retaining quality records. A production approval holder must retain these records for at least 5 years for the products and articles manufactured under the approval and at least 10 years for critical components identified.
 - xi. Internal audits: Procedures for planning, conducting, and documenting internal audits to ensure compliance with the approved quality system. The procedures must include reporting results of internal audits to the manager responsible for implementing corrective and preventive actions.
 - xii. In-service feedback: Procedures for receiving and processing feedback on in-service failures, malfunctions, and defects. These procedures must include a process for assisting the design approval holder to—
 1. Address any in-service problem involving design changes; and
 2. Determine if any changes to the Instructions for Continued Airworthiness are necessary.
 - xiii. Quality escapes: Procedures for identifying, analyzing, and initiating appropriate corrective action for products or articles that have been released from the quality system and that do not conform to the applicable design data or quality system requirements.
 - xiv. Issuing authorized release documents: Procedures for issuing authorized release documents for Airborne Systems. These procedures must provide for the selection, appointment, training, management, and removal of individuals authorized by the production approval holder to issue authorized release documents. Authorized release documents may be issued in accordance with Subpart H, CoA.

21.F.5 Transition to Production

Regulation

The production organisation shall finalise the manufacturing and repair documentation, production Jigs / Rigs and establish mechanism to handle alterations/amendments and modifications.

Acceptable Means of Compliance

- a. The main contractor shall evolve in consultation with CEMILAC a detailed Drawing Office Procedure by which, issue and amendment of drawings, specifications etc., are controlled.
- b. The drawings shall be considered as sealed when the build standard of the Airsystem or Airborne store meets the TCB to a satisfactory level and is approved by CEMILAC.
- c. The method of sealing of drawings shall be agreed by contractor with CEMILAC and DGAQA.
- d. In case of production under license agreements, the Transfer of Technology and the First Article Inspection / Evaluation shall be completed prior to the sealing of drawings.

Guidance Material

- a. The changes to the drawings subsequent to sealing, shall be made in accordance with an amendment or modification procedure.

21.F.6 Production without RMTC/MTC

Regulation

Limited Series Production of Airsystem / Airborne Store may be commenced prior to the issue of RMTC/MTC whenever a satisfactory compliance to TCB is achieved with.

Acceptable Means of Compliance

- a. Except for the availability of RMTC/MTC, the provisions detailed at 21.F.7 is applicable.
- b. The number of units shall be restricted as agreed upon between the stakeholders.

Guidance Material

- a. If there are no flight safety concerns, CEMILAC may approve the baseline configuration applicable for production pending demonstration of certain performance requirements.

However, the method of implementing the changes, if any, needed to ensure compliance with those performance points, shall be finalised prior to the clearance.

21.F.7 Production of Air Systems under Restricted MTC

Regulation

The production organisation may take up limited series production of Air Systems under Restricted Military Type Certificate (RMTC)

Acceptable Means of Compliance

- a. The Production Organisation (PO) shall make an application to CEMILAC & DGAQA as elaborated in 21.F.3. PO shall demonstrate the capability to produce such Air Systems to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA.
- b. PO shall hold a restricted MTC from CEMILAC for the baseline configuration of the Air Systems under consideration in accordance with Subpart B. This Certification may be linked with Initial Operational Clearance (IOC) of the Air System where an acceptable baseline configuration with performance limitations concurred by the user services is arrived at.
- c. Method of implementing the changes to ensure compliance with non-compliant performance points, should be finalised prior to the clearance for production by CEMILAC.
- d. In some cases, the number of deliverable units may be limited and it may not be feasible to demarcate certain models as purely development units. Some of the development units may be delivered to user after the completion of flight trials. In such cases procedure for incorporating the modifications, considering the flexibility required during the development phase and also considering the strict configuration control required for the user deliverable units, needs to be arrived at in consultation with CEMILAC and DGAQA.
- e. Baselined documents for the production of Airsystems shall be in accordance with the TCDS explained at Sub part B.
- f. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Acceptance Test and Flight Test Plans and Procedures.
- g. Test Rigs and Jigs used in the Production shall be approved and accepted as per Subpart T.
- h. QA Coverage during the production of Airsystems or Airborne stores shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of

delegating certain inspection/test points to approved personnel in the PO as per provisions provided in POA process at Subpart G.

- i. The type certificate holder must obtain CEMILAC and DGAQA approval before making any changes to the location of any of its manufacturing facilities.
- j. Each of the production Airsystem / Aircraft with Airsystem installed with, shall be issued with a Certificate for Safety of Flight (Form 1090) by DGAQA for conducting the acceptance test flights and subsequent ferry of the Airsystem to user bases.
- k. On completion of Acceptance tests, each Airsystem/Airborne Store shall be issued with a Certificate of Airworthiness (CoA) as per Subpart H.

Guidance Material

- a. Production Organisation Exposition (POE) shall be prepared in accordance with Subpart G2
- b. TCDS for IOC Configuration and Functional Test Plan Documents shall be the basis for finalising the PAT and FTP documents
- c. All information and data specified in TCDS shall be maintained at the place of manufacture.
- d. DGAQA Technical Standing Order (TSO) shall be considered while finalising the QA aspects.

21.F.8 Production of Air Systems under MTC /AMTC /SMTC

Regulation

- a. The production organisation may take up series production of Air Systems after obtaining Military Type Certificate (MTC) for such Air Systems.
- b. Series Production of Air System may also be taken up by the PO after obtaining an Amended MTC (AMTC) or Supplementary MTC (SMTC) for such Air Systems.

Acceptable Means of Compliance

- a. The Production Organisation (PO) shall make an application to CEMILAC & DGAQA as elaborated in 21.F.3. PO shall demonstrate the capability to produce such Air Systems to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA.
- b. PO shall hold a MTC/AMTC/SMTC from CEMILAC for the baseline configuration of the Air Systems under consideration in accordance with Subpart B. This Certification may be linked with Final Operational Clearance (FOC) of the Air System where an acceptable baseline configuration with performance parameters concurred by the user services is achieved with.
- c. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Production Acceptance Test and Flight Test Plans and Procedures.

- d. Test Rigs and Jigs used in the Production shall be approved and accepted as per Subpart T.
- e. QA Coverage for Air Systems shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of delegating certain inspection/test points to approved personnel in the PO as per provisions provided in POA process at Subpart G.
- f. The type certificate holder must obtain CEMILAC and DGAQA approval before making any changes to the location of any of its manufacturing facilities.

Guidance Material

- a. AFQMS document release by DGAQA shall be followed for finalising the QA aspects of the System.
- b. Production Organisation Exposition (POE) shall be prepared in accordance with AFQMS
- c. TDRS for IOC Configuration and Functional Test Plan Documents shall be the basis for finalising the ATP and FTP documents

21.F.9 Production of Air Systems under License Agreement

Regulation

- a. The Production Organisation (PO) may take up the production of Air Systems with an intention to deliver those Air Systems to Indian Military Services under a License agreement with a Foreign / Indian OEM.
- b. The PO shall obtain the necessary Technology Transfer needed to produce such Air Systems.

Acceptable Means of Compliance

- a. The PO should have a formal agreement in place with the appropriate Design Organization to ensure that it has a process in place to reliably use the applicable design data to manufacture a product.
- b. Representatives of CEMILAC and DGAQA should be included in any negotiation by Govt. agencies, PSUs and Non-Government agencies, for entering into Licence Agreements for production of aircraft/aero engines/airborne stores.
- c. The transfer of type record of the equipment and major components from the licensor to CEMILAC shall be negotiated along with the terms and conditions of the licence products. It will be incumbent as far as possible upon these agencies viz., Govt agencies /PSUs / Non-government agencies, to arrange for the transfer of type record or any technical information, the basis for service life/total technical life (flying hours) and

calendar life (calendar years) from their collaborator as deemed essential by CEMILAC and user.

- d. Data on Reliability and the fatigue life of the aircraft/major systems or equipment/LRUs, the basis of life, load spectrum considered for fatigue life, the tests carried out and the assumptions made in support of determination of fatigue life etc., are to be obtained wherever possible as part of the certification data package.
- e. The licensee should furnish the details regarding production plan, source of supply of raw-material, tooling, inspection equipment, nature and place of training of personnel concerned with production and inspection of the store to CEMILAC and DGAQA as and when required. If so desired by CEMILAC and DGAQA, the licensee shall arrange for the training/familiarisation of the personnel from these two agencies at the licensor's works, expenditure for which shall be included in the licence agreement.
- f. Depending upon the technical data available in the type record, master record of documents and importance of the air borne stores, CEMILAC in consultation with DGAQA and Service Headquarters may call for additional or special category tests on a few number/batches of air-borne stores manufactured in India by the contractor.
- g. PO shall demonstrate the capability to produce such Air Systems to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA.
- h. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Acceptance Test and Flight Test Plans and Procedures.
- i. Test Rigs and Jigs used in the Production shall be approved and accepted as per Subpart T.
- j. QA Coverage for Air Systems shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of delegating certain inspection/test points to approved personnel in the PO as per provisions provided in POA process at Subpart G.

Guidance Material

- a. AFQMS document release by DGAQA shall be followed for finalising the QA aspects of the System.
- b. Production Organisation Exposition (POE) shall be prepared in accordance with AFQMS
- c. TDRS for IOC Configuration and Functional Test Plan Documents shall be the basis for finalising the ATP and FTP documents

21.F.10 Production of Airborne Stores under Provisional Clearances

Regulation

- a. The production organisation may take up limited series production of Airborne Stores under Provisional Clearance (PC).
- b. This Provisions shall be applicable only to those Airborne Stores which may be issued with a Type Approval at a later stage.

Acceptable Means of Compliance

- a. Production under Provisional Clearances are applicable for Airborne stores designed and developed as per Subpart C.
- b. The Production Organisation (PO) shall make an application to CEMILAC & DGAQA as elaborated in 21.H.3 as an initiation to the production process.
- c. PO shall hold a Provisional Clearance from CEMILAC for the baseline configuration of the Airborne Store under consideration in accordance with Subpart C. This Certification may be linked with a satisfactory flight performance evaluation of the Airborne Store or associated sub-system, where an acceptable baseline configuration concurred by the user services is arrived at. However, the method of implementing the changes to arrive at the final configuration, if any, needed to ensure compliance with those performance points, shall be finalised prior to the clearance.
- d. PO shall demonstrate the capability to produce such Airborne Store to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA.
- e. In some cases, the number of deliverable units may be limited and it may not be feasible to demarcate certain models as purely development units. In such cases some of the development units may be delivered to user after the completion of flight trials. In such cases it shall be ensured that the hardware configuration of the Airborne Store shall be final and frozen, whereas software, if any, may be allowed to undergo changes. Configuration control procedure explained in Subpart C1 shall be followed for such changes during development trials.
- f. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Acceptance Test and Flight Test Plans and Procedures.
- g. PO shall obtain Approval for the Specifications of the Test Rigs and Jigs used in the Production of Such Airborne Stores from CEMILAC.
- h. Acceptance of Test Rigs and Jigs shall be carried out by DGAQA prior to the utilisation of such items. All the standard test equipment shall be in a valid state for usage.
- i. QA Coverage for Air Systems shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of delegating certain inspection/test points to approved personnel in the PO as per provisions provided in POA process at Subpart G.
- j. The PCC holder must obtain CEMILAC and DGAQA approval before making any changes to the location/process of any of its manufacturing facilities.

Guidance Material

- a. AFQMS document release by DGAQA shall be followed for finalising the QA aspects of the System.
- b. Production Organisation Exposition (POE) shall be prepared in accordance with AFQMS
- c. TTADS for IOC Configuration and Functional Test Plan Documents shall be the basis for finalising the ATP and FTP documents
- d. Maintain at the place of manufacture all information and data specified in TADS

21.F.11 Production of Airborne Stores Under TA/LoA/IMTSOA

Regulation

A production organisation may take up series production of Airborne Stores Systems after obtaining Type Approval (TA)/LoA/IMTSOA for such Airborne Stores.

Acceptable Means of Compliance

- a. The Production Organisation (PO) shall apply to CEMILAC & DGAQA as elaborated in 21.F.3.
- b. PO shall demonstrate the capability to produce such Airborne Store to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA
- c. The PO, who is a TA/LoA/IMTSOA holder may utilize same manufacturing facilities used for the design and development for the prototype models of Airborne Stores which has led to the final approvals. Production in such cases doesn't call for any repetition of qualification tests.
- d. PO shall hold a TA/LoA/IMTSOA from CEMILAC for the baseline configuration of the Airborne Store under consideration in accordance with Subpart C. This Certification may be linked with a flight trial evaluation of the Air System by the user services, where an acceptable baseline configuration with performance parameters concurred by the user services is achieved with.
- e. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Acceptance Test and Flight Test Plans and Procedures.
- f. PO shall obtain Approval for the Specifications of the Test Rigs and Jigs used in the Production of Such Airborne Stores from CEMILAC.
- g. Acceptance of Test Rigs and Jigs shall be carried out by DGAQA prior to the utilisation of such items. All the standard test equipment shall be in a valid state for usage.
- h. QA Coverage for Airborne Stores shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of delegating certain inspection/test

points to approved personnel in the PO as per provisions provided in POA process at Subpart G.

- i. The TA/LoA/IMTSOA holder shall obtain CEMILAC and DGAQA approval before making any changes to the location of any of its manufacturing facilities. Certain or all of the Qualifications tests may be repeated to validate the production under new facilities and processes.
- j. Each manufacturer of a product being manufactured under a type certificate must
 - i. Maintain at the place of manufacture all information and data specified in Type Record at subpart C.
 - ii. Make each product and article thereof available for inspection by the DGAQA or its authorised representative.
 - iii. Maintain records of the completion of all inspections and tests required by for at least 15 years for the products and articles thereof manufactured under the approval and at least 25 years for critical components identified.
 - iv. Allow the TAA to make any inspection or test, including any inspection or test at a supplier facility, necessary to determine compliance with this sub part.
 - v. Mark the product in accordance with Subpart Q.
 - vi. Identify any portion of that product (e.g., sub-assemblies, component parts, or replacement articles) that leave the manufacturer's facility as approved with the manufacturer's part number and name, trademark, symbol, or other TAA-approved manufacturer's identification.

21.F.12 Production of Airborne Stores under License Agreement

Regulation

- a. The Production Organisation (PO) may take up the production of Air Systems with an intention to deliver those Air Systems to Indian Military Services under a License agreement with a Foreign / Indian OEM.
- b. The PO shall obtain the necessary Technology Transfer needed to produce such Air Systems.

Acceptable Means of Compliance

- a. The PO should have a formal agreement in place with the appropriate Design Organization to ensure that it has a process in place to reliably use the applicable design data to manufacture a product.

- b. Representatives of CEMILAC and DGAQA may be included in any negotiation by Govt. agencies, PSUs and Non-Government agencies, for entering into Licence Agreements for production of aircraft/aero engines/airborne stores.
- c. The transfer of type record of the equipment and major components from the licensor to CEMILAC shall be negotiated along with the terms and conditions of the licence products. It will be incumbent as far as possible upon these agencies viz., Govt agencies / PSUs / Non-government agencies, to arrange for the transfer of type record or any technical information, the basis for service life/total technical life (flying hours) and calendar life (calendar years) from their collaborator as deemed essential by CEMILAC and user.
- d. Data on Reliability and the fatigue life of the systems or equipment/LRUs, the basis of life, load spectrum considered for fatigue life, the tests carried out and the assumptions made in support of determination of fatigue life etc., are to be obtained wherever possible as part of the certification data package.
- e. PO shall demonstrate the capability to produce such Air Systems to DGAQA and CEMILAC as per provisions provided in Subpart G. PO shall obtain the QMS approved by DGAQA.
- f. The licensee should furnish the details regarding production plan, source of supply of raw-material, tooling, inspection equipment, nature and place of training of personnel concerned with production and inspection of the store to CEMILAC and DGAQA as and when required. If so desired by CEMILAC and DGAQA, the licensee shall arrange for the training/familiarisation of the personnel from these two agencies at the licensor's works.
- g. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones and applicable Acceptance Test and Flight Test Plans and Procedures.
- h. Depending upon the technical data available in the type record, master record of documents and importance of the air borne stores, CEMILAC in consultation with DGAQA and Service Headquarters may call for additional or special category tests on a few number/batches of air-borne stores manufactured in India by the contractor.
- i. PO shall obtain Approval for the Specifications of the Test Rigs and Jigs used in the Production of Such Air Systems from CEMILAC.
- j. Acceptance of Test Rigs and Jigs shall be carried out by DGAQA prior to the utilisation of such items. All the standard test equipment shall be in a valid state for usage.
- k. QA Coverage for Air Systems shall be provided by DGAQA or its authorised representative. DGAQA may exercise the option of delegating certain inspection/test points to approved personnel in the PO as per provisions provided in POA process at Subpart G.

Guidance Material

- a. AFQMS document release by DGAQA shall be followed for finalising the QA aspects of the System.
- b. Production Organisation Exposition (POE) shall be prepared in accordance with AFQMS
- c. Type Record for IOC Configuration and Functional Test Plan Documents shall be the basis for finalising the ATP and FTP documents

21.F.13 Manufacturing Deviations

Regulation

There shall be a strict control mechanism to accept or reject any deviations found during the Air Systems / Airborne Stores or its components

Acceptable Means of Compliance

- a. During the production, Quality Assurance authority will ensure that the product is in accordance with norms and standards laid down in the documents. The product with deviations from the laid down norms and standards shall be liable for rejection. However, such product may be accepted or salvaged in accordance with the procedure laid down.
- b. Deviations on the manufactured components and assemblies involving Quality aspects shall be disposed off by the CRI, DGAQA Deviations, which in the opinion of CRI are likely to affect the airworthiness of the product, shall be referred to RCMA in form of Concession/Production Permit in the format placed at Annexure B. Once a deviation is referred to CEMILAC for grant of Concession/Production Permit, CEMILAC decision shall be treated as final.

Guidance Material

Form for production deviations as per format Annexure D

21.F.14 Documentation and Language

Regulation

The PO shall deliver all applicable user manuals, operating instructions, service instructions and other applicable documents to the user services

Acceptable Means of Compliance

- a. The manuals, placards, listings, and instrument markings and other necessary information required by applicable airworthiness codes shall be presented in a language in accordance with user service practices
- b. User service shall specify the list and format of such documents to the PO.

Guidance Material

Manuals released by user services

21.F.15 Identification

Regulation

Each Air Systems and Airborne Stores shall be identified with its Type, Serial Number and Modification Statuses if any in a manner legible and acceptable to all stake holders.

Acceptable Means of Compliance

- a. Each Air Systems and Airborne Stores shall be identified as per Sub Part Q, identification.
- b. PO shall in consultation with the design agency shall finalise a document in this regard. A logbook format for each product shall be finalized.
- c. All sub-assemblies also shall be uniquely identified. The details of sub-assemblies shall be included in the next higher assembly.

Guidance Material

Subpart Q - identification.

21.F.16 Packaging

Regulation

Each Airborne Store produced shall be packaged in a manner such that the store can be safely transported to its intended destinations.

Acceptable Means of Compliance

- a. The development agency shall finalise the package specifications for Airborne stores, make prototype of the package and test the same. Details shall be handed over to the PO.
- b. Package details shall be included in the baseline configuration of the store.

Guidance Material

- a. Package requirements should give consideration to storage requirements in addition to transportation especially for armaments and weapons
- b. Packaging standards.

21.F.17 Application for CoA

Regulation

On completion of the production and testing activities of each Air System/Airborne Store, the PO shall make an application to DGAQA for the issue of CoA

Acceptable Means of Compliance

- a. PO shall compile all the inspection and acceptance test report and submit those details along with a statement of conformity in a form finalised in consultation with DGAQA.
- b. Application shall be in accordance with provisions given in subpart H

Guidance Material

Nil

21.F.18 Issue of CoA

Regulation

Every Air System or Airborne Store, by serial number, prior to the delivery to the user services shall be issued with a valid certificate of Airworthiness (CoA) by DGAQA in accordance with Sub Part H, Certificate of Airworthiness.

Acceptable Means of Compliance

- a. Statement of conformity to approved baseline configuration shall be produced by PO to DGAQA.
- b. The DGAQA shall conduct necessary inspection and acceptance tests, as laid out in the quality system documents to ensure the conformity to approved configuration and performance of Air Systems / Airborne Stores prior to Release to Services.
- c. Release shall be endorsed by appropriately authorized certifying staff on behalf of the organization when it has been verified that all Maintenance has been properly carried out by the organization in accordance with approved procedures, taking into account the availability and use of the Technical Information, and that there are no non-compliances which are known to endanger Air Safety.

Guidance Material

21.F.19 Spares

Regulation

Every Airborne Store supplied as spares to the user services shall also have a CoA at appropriate level.

Acceptable Means of Compliance

- a. The PO in consultation with user services shall identify the spares to be supplied depending on the maintenance activities carried out at user services.
- b. Each spare at appropriate assembly level shall be uniquely identified in accordance with subpart Q.

Guidance material

- a. PO in consultation with CEMILAC and DGAQA shall finalise an acceptance mechanism for the spares.
- b. The DGAQA shall conduct necessary inspection and acceptance tests, at the appropriate level.
- c. DGAQA shall issue a CoA for the spare in a manner finalised with user services and CEMILAC.

21.F.20 Periodic Quality Tests

Regulation

Periodic Quality Test shall be carried out to ensure product quality and performance compliance with baseline configuration

Acceptable Means of Compliance

Periodic Quality Tests (PQT) for all Airborne stores shall be carried out as laid down in the licensors' documents. In the absence of such requirements in the licensors' documents, the same shall be evolved based on the existing standards/specifications. Alternately, the modalities for Production Quality Tests could be evolved jointly between the Design, Production and QA agencies and carried out periodically.

Guidance Material

- a. If the number of units produced per year exceeds 100, one unit shall be subjected to PQT every year.

- b. If the number of units are less than 100 per year, every 100th unit or one unit in every 10 years, whichever is earlier, shall be subjected to PQT.
- c. PQT shall be finalized based on the unit qualification test schedule. All tests except those treated as long term tests shall be carried out as a part of PQT. However, the final list of tests shall be finalized in consultation with DGAQA.
- d. Any failure during PQT which calls for a design modification shall be referred to CEMILAC.

21.F.21 Amendment or modification

Regulation

Any amendment to Air Systems and Airborne Stores from its approved configurations after commencement of production shall be carried out through a formal process

Acceptable Means of Compliance

- a. Any amendment to approved configuration of the Air System after the commencement of production shall be carried out as per the Subpart D
- b. Any amendment to approved configuration of the Airborne Stores after the commencement of production shall be carried out as per the Subpart E
- c. In cases where the development units (Air Systems or Airborne Stores) are delivered to the user services on completion of Flight Trials, the modifications on the baseline configuration shall be carried out in accordance with the configuration control procedure referred at Subpart B and Subpart C for Air Systems and Airborne Stores respectively.

21.F.22 Deviations During Production

Regulation

There shall be a mechanism to address and regularise the deviations observed during the production of Airsystems/ Airborne Stores.

Acceptable Means of Compliance

- a. The main contractor shall raise the deviation report to document the Deviations / Defects noticed during production/repair/overhaul phase.
- b. The main contractor shall maintain a "Minor deviation" register listing components with minor deviations.
- c. Deviations which are not minor in nature shall be referred to the Defect Investigation Committee.
- d. A defect investigation mechanism shall be set up at manufacturers/designers premises to establish the reason for the defects reported.

Guidance material

- e. The components with minor deviations can be used on the aircraft/engine/LRU only with prior approval of DGAQA.
- f. Salvaging of items with minor deviations is allowed only for non-serially numbered items.
- g. All deviations on the serially numbered components on the production airtsystem and airborne stores, shall be forwarded by the contractor to DGAQA & CEMILAC for acceptance in a production permit format.

21.F.23 Concessions

Regulation

Concessions for non-compliance of any modifications and service instructions have to be accepted by the concerned Service HQrs and/or CEMILAC before the aircraft can be cleared for service use.

Acceptable Means of Compliance

- a. Granting of concessions depends upon the classification and criticality of the modification and service instructions.
- b. A Local Concession Committee (LCC) shall be formed at each contractor firm for discussion on the non-compliance of modifications and service instructions.

Guidance Material

The LCC shall be chaired by an officer at the level of Regional Director / Group Director from CEMILAC and shall have members from DGAQA, Design and Quality Departments of the PO and user representative.

21.F.24 Defects in Service

Regulation

There shall be a mechanism to carry out the investigation of defects of Air Systems/ Airborne Stores in service

Acceptable Means of Compliance

- a. User services shall raise a defect report in an appropriate format and shall be circulated to designers, production agency, CEMILAC and DGAQA.
- b. A defect investigation mechanism shall be set up at manufacturers/designers premises to establish the reason for the defects reported through F 1022.

- c. The field defect report shall be considered in establishing the reliability parameters of the Air Systems / Airborne Stores.

Guidance material

- a. Form 1023 (PWR)
- b. Form 1022 for the defect report
- c. DIR Format placed at Annexure C

21.F.25 Lifing aspects

Regulation

Life of Air Systems and Airborne Stores shall be estimated to determine the maintenance, overhaul period of such stores and also to determine on the spares.

Acceptable Means of Compliance

- a. A Lifing Committee shall be set up at POs premises. The committee shall be chaired by an officer at the level of Regional Director / Group Director from CEMILAC and shall have members from DGAQA, Design and Quality Departments of the PO and user representative.
- b. Based on the inputs from stores qualification, field feedback reports and other analysis mechanism, life shall be estimated and the recommendations shall be discussed at the lifing committee.
- c. The inputs shall be considered for arriving at the maintenance and overhaul schedules.
- d. Spares shall also be positioned at user bases accordingly

Guidance material

Lifing aspects of Airsystems and Airborne Stores shall be considered in accordance with Subpart L

SUBPART -G :ORGANISATION APPROVALS

Rationale

To ensure that, the organizations taking up Design, Development, Production and Maintenance of Airsystems/Airborne Stores, possesses the requisite capability to undertake such activities, different types of organization approval schemes are established. The Organisation approval ensures that the Firms participating in Indian Military Aviation will perform quality tasks befitting the standards required for a military aviation product.

Three types of organization approval schemes are proposed. An organization involved in or intended to take up Design and Development activities of Military AirSystems and Airborne Stores shall be assessed through a design approved organization Scheme. Organizations involved in Production of AirSystems and Airborne Stores shall be assessed through a Production approved organization Scheme. Organizations involved in Maintenance and repair of AirSystems and Airborne Stores shall be assessed through a Maintenance approved organization Scheme. It is mandatory that the organization shall possess the necessary approvals prior to taking up the defined activities.

Applicability

This subpart is applicable for the following types of Organizations involved in for the Design & development, Production and Maintenance of Air System/Airborne stores in Indian Military Aviation.:

- i. Organizations taking up Design, Development, Repair and Modification of Air Systems/Airborne Stores. The regulations for Approval of Such Organisations are covered under 21.G1.
- ii. organizations taking up Production of Air Systems/Airborne Stores. The regulations for Approval of Such Organisations are covered under 21.G2.
- iii. organizations involved in Maintenance, Repair, Overhaul of Air Systems/Airborne Stores. The regulations for Approval of Such Organisations are covered under 21.G3.

Contents:

- i. 21.G1 - Design Approved Organisation Scheme (DAOS)
- ii. 21.G2 - Production Approved Organization Scheme (PAOS)
- iii. 21.G3 - Maintenance Approved Organisation Scheme (MAOS)

SUBPART -G1: DESIGN APPROVED ORGANISATION SCHEME (DAOS)

Rationale:

As airworthiness assurance is a process driven approach, introducing checks and balances at appropriate stages of product development life cycle is mandatory. The Design Organisation Approval (DOA) is one such means which ensures the correctness of process and procedures followed for development of airworthy Air System or airborne store by the organisation. To ensure that, the organizations taking up Design, Development, Repair and Modification of Air Systems/Airborne Stores, possesses the requisite technical capability, Infrastructure and Human resources to undertake such activities, a Design Approved Organisation scheme (DAOS) is established. Two categories of Organisations are proposed under Design Approved Organizations schemes, namely Air System Design Organizations (ASDO) and Design Organizations (DO). ASDO is an Organizations involved in Design & Development, Repair and Modification of an Air System. DO is an Organization is involved in the Design & Development, Repair and Modification of airborne stores used in an Air system.

Contents:

- 21.G1.1. Responsibilities of a Design Organization**
- 21.G1.2. Scheme Inclusion and Approval Award**
- 21.G1.3. Design Assurance System**
- 21.G1.4. Design Organization Exposition (DOE)**
- 21.G1.5. Approval Requirements**
- 21.G1.6. Changes in Design Assurance System.**
- 21.G1.7. Investigations and Inspections.**
- 21.G1.8. Findings**
- 21.G1.9. Validity of Approval**
- 21.G1.10. Privileges**
- 21.G1.11. Record Keeping**
- 21.G1.12. Instructions for Sustaining Type Airworthiness**
- 21.G1.13. Suspension or Cancellation of approvals**

21.G1.1. Responsibilities of the Organization

Regulation

The Organisation shall fulfil the defined design and development responsibilities under their Terms of Approval.

Acceptable Means of Compliance:

- a. The Organisation should Determine that the design of Air system & airborne store or changes or repairs thereof, as applicable, comply with applicable airworthiness requirements and have no feature that may lead to an unsafe condition.
- b. The Organisation should ensure preparation and custody of Type Record, instructions for maintaining the design of the Air System & airborne stores (Aircrew & Ground crew Publications), and any other supporting data associated with the design.
- c. The Organisation should provide to CEMILAC the statements and associated documentation confirming compliance for getting the approval from CEMILAC, except for minor changes or repairs approved under their privilege,
- d. The Organisation should make appropriate provisions to report to the CEMILAC in a timely manner any failure, malfunction, defect or other occurrence related to an Air system and airborne store which has resulted in or may result in an unsafe condition/Operation.
- e. The Organisation should ensure that any notified design-related occurrence is investigated with provision of advise to CEMILAC in a timely manner detailing appropriate recovery action (eg modifications, repair schemes, Technical Instructions) to restore and maintenance of Type Airworthiness.
- f. The Organisation should ensure that, where the organization's DAOS approval scope does not adequately cover a sub-system, the relevant competent sub-contracted organization is consulted in respect of airworthiness decisions regarding that sub-system.
- g. The Organisation shall provide appropriate sub-system and interface data in the form of specifications and drawings for those aspects of the system or equipment that are designed by another DO.
- h. The Organisation should maintain its Design Organization Exposition (DOE) in conformity with the design assurance system.
- i. The Organisation should Ensure that the DOE references the basic working documents within the organization.
- j. In addition to the above, ASDO should be responsible for the overall design or through-life configuration management of the design of the Air System, and for co-ordinating the design and integration of the products, parts and appliances designed by other DO(s).

- k. ASDO also should Provide support to the CEMILAC in ensuring Structural, Propulsion and Systems Integrity of the Air System type design through-life. These activities will include, but are not limited to, attendance at Lifting Committee and Defect Investigation review by the User Services.

21.G1.2. Scheme Inclusion and Approval Award

Regulation

An organization shall be included in the DAOS and awarded approval for a defined range of airborne stores and Air Systems only when the organization has been assessed and accepted by CEMILAC.

Acceptable Means of Compliance

- a. An organization seeking inclusion in the scheme should apply using CEMILAC Form TBD, which can be found on the CEMILAC website under Approval Schemes, through the MOD sponsor to the CEMILAC. The completed form, an outline of the design organisation exposition, and details of the proposed scope and terms of approval are to be forwarded to CEMILAC.
- b. Before a review of the organization's capability in design, development and post-design support is undertaken, Organisation should satisfy the CEMILAC that:
 - i. It is in the interests of MoD to include the organization in the Scheme. ie: An Organisation seeking DOA approval of CEMILAC should provide evidence that either the firm is in possession or likely to receive an order from user services or MoD for design & development/Modification of military Air systems/airborne stores.
 - ii. The organization shall hold Quality Management System (QMS) certification (as defined by the DGAQA-AFQMS) to AS 9100, or to ISO 9001 providing the scope of certification covers the proposed Design Organisation Terms of Approval.
 - iii. The organisation demonstrates to CEMILAC that it has the prerequisite know how, Infrastructure and resources to undertake design related activities for Air Systems /airborne stores.

Guidance Material

- a. This regulation applies to both service and civil organizations conducting design activities according to the military airworthiness requirements.
- b. Inclusion in DAOS is normally not an essential pre-requisite for the award of design and development contracts for Air Systems and airborne stores.
- c. In case, the design contract with a non-approved design Organisation is placed directly by the Ministry of Defence, the procedure for check points would be laid down by Chief Executive, CEMILAC in each individual case, defining the extent and scope of control to be maintained by one of the Chief Resident Engineers/Regional Directors of RCMA or

Group Directors of CEMILAC during Airworthiness Certification Process. Necessary Organisation approval shall be obtained by the Organisation at the beginning of the Airworthiness Certification Process or at any other Certification stage as agreed by CEMILAC.

- d. When evidence presented by the organization demonstrates that it satisfies the requirements of these regulations, a DAOS approval will be issued by the CEMILAC.
- e. A list of organizations that have been granted approval will be published by the CEMILAC.

f. Scope and Terms of Approval

i. The Scope and Terms of Approval will identify the types of design work, categories of Air System & airborne stores for which the designer can operate as a Design Organisation, and the functions and duties that the organization is approved to perform in regard to the airworthiness of Air System & airborne stores. Those Scope and terms will be issued as part of the Organisation approval. The Organisation Approval encompass the Certificate and Schedule issued by the CEMILAC with the following details:

ii. The Certificate identifies the approved organization and its design locations.

iii. The Schedule includes

1. The scope of work (development, modification and/or repair, and post design services unless otherwise stated), with any appropriate limitations against which the approval has been granted.
2. The categories of Air Systems and airborne stores for approval under ASDO & DO respectively is given below.
 - a. Air System: - Fixed Wing Aircraft, Rotary Wing Aircraft, UAS, ALM and Engines.
 - b. Air borne stores: - Avionics Systems, Electrical Systems, Airborne Software development, Mechanical Systems, Mission Sensors & Air launched Weapons.
3. Airworthiness and Design signatories.
4. FCN/ FPCM signatories.
5. Privileges that can be invoked by CEMILAC under relevant conditions.
6. Validity and Periodic Audit of the DOA.

g. Changes to the Terms of Approval

- i. An application for a change to the Terms of Approval is to be made on CEMILAC Form ---TBD---, which can be found on the CEMILAC website under Approval Schemes.
- ii. Approval of a change in the Terms of Approval will be confirmed by an appropriate amendment of the Certificate and Schedule.

21.G1.3. Design Assurance System

Regulation

The Design Organisation shall demonstrate that it has established and is able to maintain a design assurance system for the control and supervision of the design & design changes of Air Systems & airborne stores covered by the application.

Acceptable Means of Compliance

- a. The design assurance system should be such as to enable the organization:
 - i. To ensure that the design of the Air System & airborne stores or the design change or repair solution thereof, comply with the applicable airworthiness Certification requirements and establish the extent of compliance with the requirements by Inspection, Demonstration, Analysis and Test.
 - ii. To ensure that its responsibilities are properly discharged in accordance with the IMTAR-21 series as required by the organization's contract with MOD, in particular:
 1. The appropriate provisions of IMTAR-21
 2. The Scope and Terms of Approval of the Design Organisation.
 3. Certificate of Design (CoD)
 4. Configuration Management of Design including formation of LMC
- b. To independently monitor the organisational compliance with, and adequacy of, the documented procedures of the system. This monitoring should include a feedback system to a person or a group of persons having the responsibility to ensure corrective actions are introduced.
- c. The Organisation should organise regular design reviews along with all the stake holders to validate the design proposals vis-à-vis the Airworthiness certification plan.
- d. The design assurance system should include an independent checking function for demonstration of compliance with design requirements on the basis of which the organization submits a CoD and associated documentation to the CEMILAC.
- e. The Organisation should specify and document the manner in which the design assurance system accounts for the acceptability of the airborne stores designed or the tasks performed by partners or subcontractors.

Guidance Material

- a. The system monitoring function may be undertaken by the existing quality assurance organization when the DO is part of a larger organization. For an explanation of the terms used within a Design Assurance System refer to Annex A.
- b. The independent checking function is undertaken by Compliance Verification Engineers (CVE), as detailed within **Annex A**; this is a DO focussed role to ensure compliance with the applicable certification requirements. This is not to be confused with the role of Officers of CEMILAC, who conduct the Independent Technical Evaluation as and when required.
- c. When the approved ORGANISATION is introducing a minor change to the Air System under privilege, the AWG is authorised to accept the change upon satisfied by the independent assessment conducted by the CVE.
- d. The satisfactory integration of the Partner/Sub-contractor and applicant's design assurance systems should be demonstrated for the activities covered under the applicant's terms of approval.
 - i. In the event that a Partner/Sub-contractor holds a military design organisation approval (MDOA), then in accordance with Subpart G1, the applicant may take this into account in demonstrating the effectiveness of this integrated system.
 - ii. When any Partner/Sub-contractor does not hold a MDOA then the applicant will need to establish to its own satisfaction and the satisfaction of the Authority, the adequacy of that partner's/sub-contractor's design assurance system is in accordance with 21.G1.3

21.G1.4. Design Organization Exposition (DOE)

Regulation

The Design Organisation shall furnish a DOE to the CEMILAC describing, directly or by cross-reference with the Organisation Manual, the relevant procedures required for design, Modifications or repair of Air systems & airborne stores.

Acceptable Means of Compliance

- a. The DOE should be produced with the inclusion of the contents as detailed in **Annex B**. The DOE should be concise with sufficient information that is relevant to the Scope & Terms of Approval sought by the Organisation. If the DOE is to be completely or partially integrated into the company organization manual, identification of the information required by the regulations should be provided by giving appropriate cross references, and these documents should be made available, to the CEMILAC. However, the focus of DOE shall be on the scope of the specific aeronautical project intended to execute.

- b. Whenever any activities of design or Modification or Repair are undertaken by partner organizations or subcontractors, the DOE should articulate how the ASO/DO is able to give, for all Air Systems and airborne stores, the assurance of compliance required by Regulation 21.G1.3 above. The statement should contain, directly or by cross reference, descriptions and information on the design activities and organization of those partners or subcontractors, as necessary to establish this statement.
- c. To maintain DAOS approval, the DOE should remain an accurate reflection of the organization with any amendment submitted to the CEMILAC for approval. Amendment submission should not be taken to confer that DAOS approval is in place.
- d. To demonstrate compliance with 21.G1.4, a ASDO/DO should submit its DOE, providing it covers the required Scope and Terms of Approval.
- e. The DOE should show that:
 - i. The Head of the Design Organisation for which an application for approval has been made, has the direct or functional responsibility for all departments of the organization which are responsible for the design of the Air system and airborne stores. If the departments responsible for design are functionally linked, the Head of the Design Organisation still carries the ultimate responsibility for compliance of the organization with this Sub part G1
 - ii. The manager responsible for design has the direct or functional responsibility for all departments of the organisation which are involved in the design of minor changes to Type Design or minor repairs to products.
 - iii. An Airworthiness Group (AWG), or equivalent function, has been established and staffed on a permanent basis to act as the focal point for co-ordinating airworthiness matters. AWG shall maintain independency and reports directly to the Head of the Design Organisation in the same lines as the independent quality assurance organization reporting to the Head of the Design Organisation. Person(s) have been nominated to liaise with the Authority and to coordinate airworthiness matters. Their position in the organisation should allow direct interaction with the manager responsible for design.
 - iv. Responsibilities for all tasks related to the design and approval of minor changes to Type Design or minor repairs to products are assigned to ensure that all areas are covered.
 - v. Responsibilities for all tasks related to Design Investigations are assigned in such a way that gaps in authority are excluded.
 - vi. The responsibility for a number of tasks may be assigned to one person especially in the case of simple projects.

vii. Co-ordination between technical departments and the persons in charge of the system monitoring required by this Subpart G1 has been established:

1. To ensure quick and efficient reporting and resolution of difficulties encountered using the Design Organisation handbook and associated procedures.
2. To maintain the design assurance system.
3. To optimise auditing activities.

Guidance Material

Nil

21.G1.5. Approval Requirements

Regulation

The Organisation shall demonstrate that staff in all technical departments are of sufficient numbers and relevant experience and have been given appropriate authority to discharge their allocated responsibilities.

Acceptable Means of Compliance

a. General

- i. The Organisation should ensure that the accommodation, facilities and equipment are adequate to enable the staff to satisfy the airworthiness requirements for the Air system, subsystem, accessories or LRUs .
- ii. The data submitted in accordance with 21.G1.4 should show that sufficient skilled personnel are available and suitable technical and organizational provisions have been made for carrying out the Design Investigation defined under 21.G1.3.

b. Personnel

The Organisation should show that sufficient number of Qualified personnel are available to comply with this subpart G1 and they are able to provide assurance of the design, modification or repair of Air Systems and airborne stores, as well as the compilation and verification of all data needed to meet the applicable airworthiness codes while taking into account the present state of the art and new experience.

c. Technical

- i. The Organisation should have access to:
 1. Workshops and production facilities which are suitable for manufacturing prototype models and test specimens.
 2. Accommodation and accredited test facilities which are suitable for carrying out tests and measurements needed to demonstrate compliance with the applicable

airworthiness codes. The test facilities may be subjected to additional technical conditions related to the nature of tests performed.

3. Test facilities owned by ASDO/DO or hired by ASDO/DO in connection with testing of systems developed by the Organisation independently or jointly with the development partners.

Guidance Material

Nil

21.G1.6. Changes in Design Assurance System

Regulation

After the issue of a Design Organisation Approval, each change to the design assurance system that is significant to the showing of compliance or to the airworthiness of the Air systems and airborne stores shall require approval by the CEMILAC.

Acceptable Means of Compliance

An application for approval of a change to the Design Organisation should be made using CEMILAC Form ___TBD___ and submitted in writing to the CEMILAC. Before implementation of the change the Design Organisation should demonstrate to the CEMILAC, on the basis of submission of proposed changes to the DOE that it will continue to comply with this subpart G1 after implementation.

Guidance Material

In addition to a change in ownership, the following changes to the design assurance system are to be considered as 'significant' to the showing of compliance or to the airworthiness of the Air systems and airborne stores.

- a. Organization
 - i. Change in the industrial organization (Ownership, partnership, suppliers, design work-sharing) unless it can be shown that the independent checking function for demonstration of compliance is not affected.
 - ii. Change in the parts of the organization that contribute directly to the airworthiness (independent checking function, Airworthiness Group (or equivalent)).
 - iii. Change to the independent monitoring principles.
 - iv. Change in the scope of approval or addition in the scope of approval granted
- b. Responsibilities
 - i. Change of the management staff assessed for airworthiness competence.

- ii. The Head of the Design Organisation.
 - iii. The Chief of the Airworthiness Group.
 - iv. The Chief of the independent monitoring function of the design assurance system.
 - v. New distribution of responsibilities affecting airworthiness.
- c. Procedures
- i. Change to the principles of procedures related to:
 - 1. The design certification.
 - 2. The classification of changes and repairs as alteration/amendment or modification.
 - 3. The approval of the design of alteration/amendment and minor repairs.
 - 4. The issue of information and instructions.
 - 5. Documentary changes to the Aircraft Flight Manual.
 - 6. Type airworthiness.
 - 7. The configuration control, when airworthiness is affected.
 - 8. The acceptance of design tasks undertaken by partners or sub-contractors.
 - 9. Flight Clearance Note (FCN)/Flight Plan Coordination Memo (FPCM)
- d. Resources
- Substantial changes in the number and/or experience of staff.

21.G1.7. 21.G1.7 Investigations and Inspections

Regulation

The Design Organisation shall make provisions for CEMILAC to make any investigations, inspection, or review any report necessary to determine compliance with this Subpart G1.

Acceptable Means of Compliance

Arrangements should be made to allow the CEMILAC to make investigations of the Design Organisation including partners, subcontractors and suppliers. This includes assisting and cooperating with the CEMILAC in performing inspections and audits conducted during initial assessment and subsequent surveillance.

Guidance Material

Assistance to the CEMILAC includes all appropriate means associated with the facilities of the Design Organisation such as a meeting room and office support to allow the CEMILAC to perform these inspections and audits,

21.G1.8. Findings

Regulation

After receipt of notification of findings, the Organisation shall demonstrate corrective action appropriate to the level of the finding.

Acceptable Means of Compliance

- a. After receipt of notification of findings under the applicable administrative procedures established by the CEMILAC:
 - i. In case of a level 1 finding, the ASDO/DO should demonstrate corrective action to the satisfaction of the CEMILAC within a period of no more than 21 working days after written confirmation of the finding.
 - ii. In case of level 2 findings, the corrective action period granted by the CEMILAC should be appropriate to the nature of the finding but in any case initially not be more than 3 months. In certain circumstances and subject to the nature of the finding, the 3-month period could be extended subject to a satisfactory corrective action plan agreed by the CEMILAC.
 - iii. An Observation (or level 3 finding) should not require immediate action by the DO. If appropriate, the CEMILAC will specify a compliance time.
- b. In case of level 1 or level 2 findings, the Organisation may be subject to a partial or full suspension or revocation of its approval. The Organisation should provide confirmation of receipt of the notice of suspension or revocation of the ASDO/DO Approval in a timely manner.
- c. When objective evidence is found showing non-compliance of the ASDO/DO with the applicable requirements of the DDPMAS Policy and IMTAR 21, the finding will be classified as follows:
 - i. A level 1 finding is any non-compliance with the relevant DDPMAS Policy/IMTAR 21 which could lead to uncontrolled non-compliances with applicable requirements and which could lead to a major risk affecting the Air Safety.
 - ii. A level 2 finding is any non-compliance with the relevant DDPMAS Policy/IMTAR 21 which is not classified as level 1. Where the combination of several level 2 findings together produces a major risk affecting the Air Safety, they may be grouped as a level 1 finding.
 - iii. An Observation (or level 3 finding), which may also be referred to as an 'observation' is an item where it has been identified to contain problems that could lead to a non-compliance only and will not lead to any flight safety.
- d. CEMILAC will inform the relevant User Services of level 1 & level 2 findings and the proposed corrective action.

21.G1.9. Validity of Approval

Regulations

A design organisation approval can be issued for an unlimited duration. It shall remain valid unless:

- a. The design organisation fails to demonstrate compliance with the applicable requirements of this Subpart; or
- b. The Authority is prevented by the holder or any of its partners or subcontractors to perform the investigations in accordance with 21.G1.7; or
- c. There is evidence that the design assurance system cannot maintain satisfactory control and supervision of the design of Air systems & airborne stores or changes thereof under the approval; or
- d. The certificate has been surrendered or revoked under the applicable administrative procedures established by the Authority or
- e. DOE is not updated for a period more than 3 years
- f. In Case of adverse feedback from the users with regard to maintenance support for ensuring Continuing airworthiness of the product.

Acceptable Means of Compliance

The Organisation should confirm in writing prior to any formal CEMILAC surveillance or not later than every 3 years from the last notification that the contents of their approval Certificate and DOE remain valid. Failure to provide the required confirmation may result in the suspension of the approval.

Guidance Material

ASDO/DO shall intimate CEMILAC as and when significant changes are made in the DOE. However once in 3 years a consolidated updation of DOE to be communicated to CEMILAC to keep the approval valid

21.G1.10. Privileges

Regulation

Organisation shall operate privileges granted only when they have been invoked by the appropriate CEMILAC Audit team and same is provided in the Approval Certificate.

Acceptable Means of Compliance

Invoking specific privileges

- a. The Organisation should only operate privileges when the assigned personal have undergone stipulated training in airworthiness course and had their competence

assessed by the CEMILAC audit team, explicitly providing Terms of Approval containing the relevant provision.

- b. Once invoked, the Organisation should be entitled, within its Terms of Approval and under the relevant procedures of the design assurance system, to operate the following privileges:
 - i. During Design & Development:
 1. To apply for the MTC/RMTC for an Air System and to apply for TA/LoA/IMTSOA for an airborne store.
 2. To declare that design conforms to the approved Technical specification in the form of a Certificate of Design (CoD) for an airborne store /Air System.
 3. Issue information and Service Instructions, containing the following statement: “The technical content of this documentation is approved under the authority of CEMILAC DAOS.....”.
 4. To approve the Flight Plan Coordination Memo (FPCM) issued in accordance with Regulations on Flight testing (regular flights for accumulating flying experience), except for initial flights of a new type of Air System; or an Air System modified by a major change;
 - ii. During Production & in Service phase:
 1. Classify changes to Type Design as Modifications or alteration/amendment and repairs as minor or major.
 2. Approve alteration/amendment to Type Design and minor repairs.
 3. Issue Service instructions, containing the following statement: “The technical content of this documentation is approved under the authority of CEMILAC DAOS.....”.
- c. The Organisation should develop its own internal procedures for the relevant privileges, based on the requirements of **Annex C**.
- d. The Organisation should assure the CEMILAC that any changes approved under the provision of any privilege that has been invoked are accurately classified.
- e. The Organisation should assure the CEMILAC that there is a robust mechanism for managing the configuration control of the Air System or equipment for any changes approved under the provisions of any privilege that has been invoked.

Guidance Material

Invoking Specific Privileges

- a. In relation to the privileges identified, it is the responsibility of the organization to detail in their DOE, the process to determine the classification of changes and how they manage the process for approval of minor change.
- b. The CEMILAC must be notified of changes or repairs approved under this privilege by submission of a CoD, for subsequent acknowledgement by CEMILAC

- c. CEMILAC must make appropriate arrangements for configuration management in conjunction with the Design Organisation, in particular to ensure that the application of design or service modifications, including any Special Instructions (Technical) (SI(T)) or Service Bulletins (SB) to the same Air System or equipment, is managed effectively and is transparent to the User Services.
- d. CEMILAC holds the ultimate sanction of limiting the scope of an organization's approval if it is deemed the organization is not fully compliant with this Regulatory article.
- e. The information and instructions, including the necessary data, are issued by the Design Organisation to the User Services to implement a change, a repair, or an inspection. Some are also issued to provide maintenance organizations with all necessary maintenance data for the performance of maintenance, including implementation of a change, a repair, or an inspection.
- f. The preparation of this data involves design, production and inspection. As the overall responsibility, through the privilege, is allocated to the Organisation, these aspects must be properly handled by the ASDO/DO to obtain the privilege "to issue information and instructions containing a statement that the technical content is approved", and a procedure must exist.

21.G1.11. Record Keeping

Regulation

All relevant design information, drawings and test reports, including inspection records, shall be held by the appropriate Organisation.

Acceptable Means of Compliance

- a. Such documentation should be held in order to provide the information necessary to ensure the type airworthiness of an Air System and should be retained for a minimum of 5 years beyond the aircraft's Out-of-Service date.
- b. Any alterations to the records to be duly authenticated and shall be traceable.

Guidance Material

- a. International or collaborative programmes will be required to co-ordinate custodianship of appropriate documentation.
- b. ASDO/DO shall obtain all the airworthiness related documents from their design and development partners so that the continued airworthiness coverage can be provided throughout the life cycle of the product.

21.G1.12. Instructions for Sustaining Type Airworthiness

Regulation

Organisations shall provide the complete Instructions for Sustaining Type Airworthiness (ISTA) to the User Services.

Acceptable Means of Compliance

- a. Organisations should make available to the User Services the complete Instructions for Sustaining Type Airworthiness (ISTA) for use by Indian Defence Services.
- b. Any changes to the ISTA should be made available to the User Services
- c. A programme showing how changes to the ISTA are distributed should be submitted to the User Services and CEMILAC
- d. The availability of some manual or portion of the changes to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into service, but should be available before any of the Air System/airborne store reaches the relevant maintenance or overhauling activities.

Guidance Material

- a. The ISTA, comprising of descriptive data and accomplishment instructions, ensures the type certification airworthiness standard is maintained throughout the operational life of the Air System. Typically, the instructions are in the form of manuals covering, but not limited to:
 - i. The Design description covering:
 1. Handling instructions.
 2. Control and operating information.
 3. Servicing information.
 - ii. Maintenance instructions covering:
 1. Maintenance Scheduling information.
 2. Maintenance instructions.
 3. Repair instructions.
 4. Trouble-shooting (fault-finding) information.
 5. Information describing the removal and replacement of parts.
 6. Procedural instructions for systems testing.
 7. Decontamination instructions and Special Packaging instructions if any.
 - iii. Diagrams and instructions for inspections including:
 1. Details for the application of special inspection techniques.
 2. Information needed to apply protective treatment.
 3. Data relative to structural fasteners.
 4. A list of special Tools Testers & Ground equipment (TTGE) needed.
 - iv. Airworthiness limitations (including where appropriate any Airworthiness Directives (AD), SB or SI(T).

v. Electrical Wiring Interconnection Systems.

b. ASDO/DO shall collect the operational utilisation in terms of number of cycles consumed, operational performance feed back etc for the life extension studies and issuing the guidance on improving the fleet management activities.

21.G1.13. Suspension or Cancellation of approvals

Regulation

If any ASDO/DO is failed to comply with or Misuse, the conditions stipulated for approval, CEMILAC may suspend or cancel the approval granted.

Acceptable Means of Compliance

a. If CEMILAC is convinced that there is sufficient ground for doing so or, during investigation it revealed that suspension of approval is necessary in the interest of flight safety, for reasons to be recorded in writing – CEMILAC may

- i. suspend approval or any or all of the privileges, for any specified period;
- ii. suspend approval or any or all of the privileges, during the investigation of any matter;
- iii. cancel approval or any or all of the privileges, where any ASDO/DO contravenes or fails to comply with these rules or any direction issued by CEMILAC

b. The decision of CEMILAC as to whether any ground constitutes sufficient ground for suspension of any authorisation or approval in the public interest under this regulation shall be final and binding.

Guidance Material

Nil

ANNEX A
DESIGN ASSURANCE SYSTEM (DAS)

A. General/Definitions

1. The design assurance system is the organizational structure, responsibilities, procedures and resources to ensure the proper functioning of the design organization.
2. Design assurance means all those planned and systematic actions necessary to provide adequate confidence that the organization has the capability:
 - a. To design Air Systems and airborne stores in accordance with the applicable airworthiness Certification Criteria. Evidence for having resources /access to resources for design/manufacture/test the air systems and airborne stores to be clearly shown.
 - b. To show and verify the compliance with the applicable airworthiness Airworthiness Certification Criteria.
 - c. To demonstrate to CEMILAC this compliance for the purposes of DAOS approval.
3. 'Design Investigation' means the tasks of the organization in support of the Military Type Certificate or other design approval processes necessary to show and verify and to maintain compliance with the applicable airworthiness codes/Airworthiness Certification Criteria.

B. DESIGN ASSURANCE

4. Design Assurance is the complete process that starts with the airworthiness Certification criteria and air systems/airborne stores Specifications and culminates in Type Certification/Type Approval is shown in figure 1. It establishes the relationship between the design, the Design Investigation and design assurance processes.
5. Effective design assurance demands a continuing evaluation of factors that affect the adequacy of the design for intended applications, in particular that the air systems or airborne stores, complies with applicable airworthiness standard and will continue to comply after any change.

Two main aspects are to therefore be considered: (a) How the planned and systematic actions are defined and implemented, from the very beginning of design activities up to type airworthiness activities; (b) How these actions are regularly evaluated and corrective actions implemented as necessary.

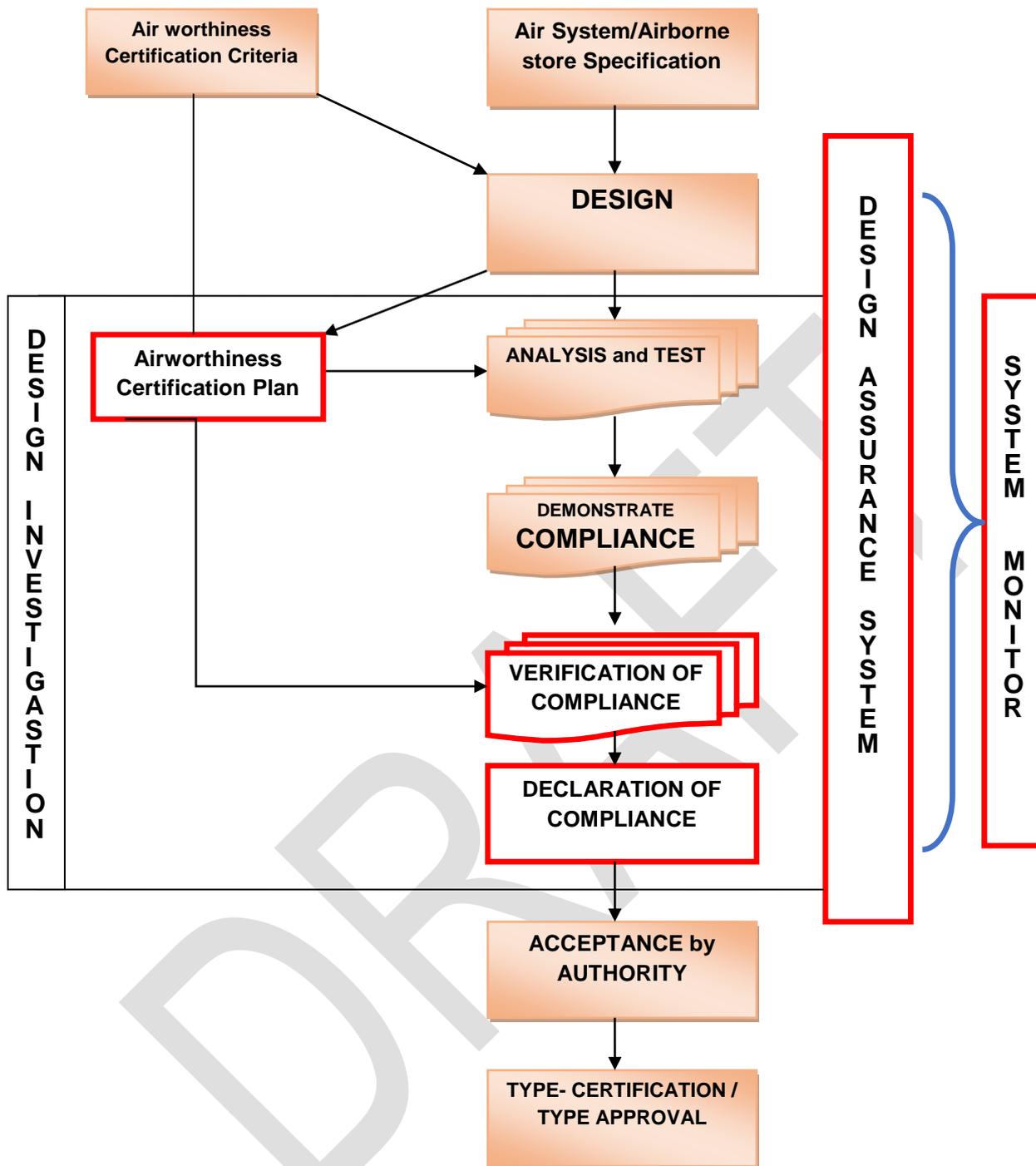


Figure 1: Design Assurance System Components

B.1 Planned and Systematic Actions

6. For the ASDO/DO carrying out Design Investigation of air systems and airborne stores, planned and systematic actions should cover the following tasks & procedures and the same must be defined accordingly.

- (a) To issue or, where applicable, supplement or amend the DOE in particular to indicate the initiation of design activities on an air systems and airborne stores

- (b) To assure that all instructions of the DOE are adhered to.
- (c) To conduct Design Investigation
- (d) To nominate staff as “Compliance Verification Engineers” responsible to approve compliance documents.
- (e) To nominate personnel belonging to the Office of Airworthiness/Airworthiness Group (AWG) with appropriate responsibilities.
- (f) In the case of an applicant for a supplemental type-certificate, to obtain the agreement of the type-certificate holder for the proposed supplemental type-certificate to the extent defined in Subpart D2 of IMTAR.
- (g) To ensure full and complete liaison between the ASDO/DO and related organizations having responsibility for products manufactured to the Military Type Certificate.
- (h) To provide the assurance to CEMILAC that prototype models and test specimens adequately conform to the Type Design.

B. 1.1 Office of Airworthiness/Airworthiness Group (AWG)

7. AWG shall have independent Functional authority and reporting directly to the head of the Organisation.
8. Ensuring that a DOE is prepared and updated as required in 21. G1.4.
9. AWG shall Liaison between the ASDO/DO and CEMILAC with respect to all aspects of Airworthiness Certification Plan (ACP).
10. Co-operation with the CEMILAC in developing procedures to be used for the design, manufacturing and testing for certification process.
11. Issuing of guidelines for documenting compliance. AWG shall conduct periodic audit of the ASDO/DO and report non-compliances to CEMILAC.
12. Co-operation in issuing guidelines to ensure compliance with the regulations for the preparation of the manuals, SB, SI(T), modifications, drawings, specifications, and standards.
13. Ensuring distribution of applicable airworthiness codes and other specifications to all the Designers and CEMILAC.
14. Advising of all departments of the ASDO/DO in all questions regarding airworthiness approvals and certification.
15. Regular reporting to the CEMILAC about Design Investigation progress & co-ordination of all tasks related to Design Investigation in concurrence with CEMILAC and announcement of scheduled tests in due time.
16. Ensuring co-operation in preparing inspection and test programmes needed for demonstration of compliance.
17. Establishing and maintaining the compliance checklist to provide evidence underpinning the Compliance Statement.
18. Providing verification to the Head of the ASDO/DO that all activities required for Design Investigation have been properly completed.
19. Approving the classification of changes in accordance with SUBPART D and granting the approval for minor changes in accordance with SUBPART D (when appropriate).

20. Monitoring of significant events on other aeronautical product, parts and appliances as far as relevant to determine their effect on airworthiness of products, parts and appliances being designed by the DO.
21. Ensuring co-operation in preparing SB, SI(T) and the Structural Repair Manual, and subsequent revisions, with special attention being given to the manner in which the contents affect airworthiness codes for subsequent approval by CEMILAC.
22. Ensuring the initiation of activities as a response to failure (accident/ incident/ in-service occurrence) evaluation and complaints from the operation and providing of information to CEMILAC in case of airworthiness impairment.
23. The AWG shall carry out the design evaluation in accordance with the norms set by CEMILAC. The AWG shall carry out the following activities in evaluating the design:
 - a) Identify the applicable airworthiness Code/Standards for the project in consultation with CEMILAC and Co-operating with CEMILAC in proposing the Type certification basis (TCB).
 - b) Preparation of the Airworthiness Certification Plan (ACP) in Consultation with CEMILAC and Interpretation of airworthiness codes & requesting for decisions of CEMILAC
 - c) Ensure the conformance of the design with respect to the applicable requirements, Standards and Specifications.
 - d) Ensure system, sub system and LRU specifications are adequate and comply with Airworthiness requirements. Ensure adequacy of Interface / Integration requirements, both hardware and software and obtain CEMILAC approval for the specifications.
 - e) Study drawings, Build Standard (SOP) and Drawing Applicability List and ensure their completeness in all respects.
 - f) Identify list of documents that need to be generated and submitted for evaluation of the design for each system / subsystem / LRU integration / interface for further approval CEMILAC.
 - g) Ensure adequacy of all analysis reports (Aerodynamics, Performance, Stressing, Weight and CG, Flight Mechanics and Systems Performance including dynamic analysis.
 - h) Examine the test plans and test schedules (structural, system/sub- system/ LRU and Integration): ensure their adequacy with respect to specifications and airworthiness requirements and obtain CEMILAC approval for the test plan and participation of CEMILAC scientists in tests of LRU/system/ components wherever considered necessary
 - (h) Compare test results/reports with approved test schedules and comment on shortcomings/non- compliance, if any, and the action plan.
 - (i) Examine flight test plan and schedules and obtain CEMILAC approval for the same. Individual flight clearance within the approved test plan is given by AWG.
 - (j) Study the flight test results and their analysis.
 - (k) Examine FMEA / FMECA, Reliability and Maintainability analysis reports and Hazard and Safety analysis reports for completeness and adequacy.
 - (l) Ensure that safety analysis of the design is carried out.
 - (m) Ensure that critical components are identified and listed.

- (n) Examine configuration control procedures in consultation with CEMILAC.
- (o) Ensure that Software Independent Verification / Validation (IV&V) activities are done. The procedure carrying out IV&V is to be evolved in consultation with CEMILAC.
- (p) Ensure preparation of Compliance Document with respect to requirements (Customer / Product and Airworthiness); examine its completeness and present to CEMILAC along with comments on non-compliance /shortcomings and design limitations.
- (q) Advise designers in writing of the technical evaluation including short comings if any, in the technical specification, design, test schedule or tests and the necessity for improvement if any, based on evaluation.
- (r) Submit type record/ type certificate data sheet including compliance report along with Certificate of Design (COD) / Declaration of Design Performance (DDP) to CEMILAC for issue of Certificate.
- (s) Examine the test schedules and test results for issue of FCN/FC
- (t) AWG of ASDO to assess, approve and audit the DO, who are designing sub system for the ASDO.

B.1.2 Chief Executive and Head of DO (or their Deputy)

- 24. The Head the organisation designated as Executive Director/General Manager/CEO etc (or their Deputy) will provide the necessary resources for the proper functioning of the DO.
- 25. The Head of the ASDO/DO, or an authorized representative, is to sign a CoD (refer to sections on CoD in DDPMAS) stating compliance with the applicable airworthiness codes after verification of satisfactory completion of the Design Investigation. In accordance with sections on CoD in DDPMAS, his or her signature on the CoD confirms that the procedures as specified in the DOE have been followed.
- 26. The functions of Chief Executive and Head of the ASDO/DO preferable may not be performed by the same person so as to maintain the independence of the assurance activity.

B.1.3 Independent checking function of the showing of compliance

- 27. The independent checking function of the showing of compliance is the verification by an independent person who is not responsible for creating the compliance data. Such person may work in conjunction with the individuals who prepare compliance data.
- 28. The verification is to be shown by signing compliance documents, including test Specification and reports. In case of paperless organisations digital signature is acceptable.
- 29. There is normally only one Compliance Verification Engineers (CVE) nominated for each discipline for a given design activity. The CVE shall report to AWG till the activity is completed.
- 30. Approval by signing of all compliance documents, including test specification and reports, necessary for the verification of compliance with the applicable airworthiness codes as defined in the Air Worthiness Certification Plan (ACP).

31. Internal approval of the technical content (eg completeness, technical accuracy), including any subsequent revisions, of the manuals for the subsequent release to the User services.

B.1.4 Maintenance and Operating Instructions

32. Ensuring the preparation and updating of all maintenance and operating instructions needed to maintain airworthiness in accordance with relevant airworthiness codes. For that purpose, the ASDO/DO must:

- a. Establish the list of all documents it is producing; and
- b. Define procedures and organization to produce and issue these documents to User Services.
- c. Issue the Instructions for Sustaining Type Airworthiness (ISTA)

B.2 Continued Effectiveness of the Design Assurance System

33. The organization is to establish the means by which the continuing evaluation (system monitoring) of the design assurance system will be performed in order to ensure that it remains effective.

34. To ensure that its responsibilities are properly discharged in accordance with:

- a. The appropriate provisions of this IMTAR; and
- b. The terms of approval issued under 21. G1.2.

35. The system monitoring function may be undertaken by the existing quality assurance organization when the ASDO/DO is part of a larger organization.

ANNEX B
DESIGN ORGANIZATION EXPOSITION (DOE) REQUIREMENTS

Part 1 – Organization

1. Document title, and Organizations document reference number.
2. Organization name, address, telephone, telex, facsimile numbers, e-mail address.
3. Index.
4. List of effective pages with revision/date/amendment identification for each page.
5. Distribution list.
6. Objective of DOE and binding statement.
 - a. The DOE should be signed by both the Chief Executive and the Head of the DO and declared as a binding instruction for all personnel charged with the development and Design Investigation of products, parts and appliances.
7. Responsible person(s) for administration of the DOE
8. Amendments.
 - a. Amendment record sheet.
 - b. A system should be clearly laid down for carrying out amendments and modifications to the DOE, including how amendments are identified within the document.
9. Presentation of ASDO/DO (including locations):

An introduction, or foreword, explaining the purpose of the document for the guidance of the organization's own personnel. Brief general information concerning the history and development of the organization and, if appropriate, relationships with other organizations which may form part of a group or consortium, should be included to provide background information for the CEMILAC.
10. Scope of work: (with identification of type and models of Airsystems and Airborne stores) which can be performed under the approval, according to the following classification:
 - a. General areas, like turbojet and turbo-propeller aircraft, small aircraft, Remotely Piloted Air System and rotorcraft, aeroengines.
 - b. Technologies handled by the organization (materials- metallic, non metallic and composite, electronic systems, software, etc.).
 - c. A list of types and models for which the design approval has been granted and for which privileges may be exercised, supported by a brief description for all products, parts and appliances.
 - d. For repair design, classification and (if appropriate) approval activities it is necessary to specify the scope of activity in terms of structures, systems, engines, etc.
11. Organization structure.
 - a. A description of the organization, its departments, their functions and the names of those in-charge. (Any change shall be intimated to CEMILAC as and when it arises)
 - b. A description of functional relationships between departments.
 - c. A chart indicating the functional and hierarchical relationship of the design assurance system to Management and to other parts of the organization.

12. Human resources.

- a. A description of the human resources, facilities and equipment, which constitutes the means for design, and where appropriate, for ground and flight testing.
- b. An outline of the system for controlling and informing the Staff of the organization of current changes in engineering drawings, specifications and design assurance procedures.

13. Management staff.

- a. A description of assigned responsibilities and delegated authority of all parts of the organization which, taken together constitute the organization's design assurance system;
- b. also the chains of responsibilities within the design assurance system, and the control of the work of all partners and subcontractors.

14. Certifying personnel.

- a. The names of the ASDO/DO authorized signatories. Nominated persons with specific responsibilities should be listed.
- b. A clear definition of the tasks, competence and areas of responsibility of the Office of Airworthiness.
- c. A statement of suitable qualified and experienced personnel (SQEP) responsible for making decisions affecting airworthiness in the organization.

15. Independent system monitoring.

A description of the means by which the continuing evaluation of the design assurance system will be performed in order to ensure that it remains independent and effective.

16. Evidence of a QMS certification as defined by the DGAQA AFQMS OR AS 9100, OR ISO 9001 providing the scope of certification covers the proposed ASDO/DO Terms of Approval.

Part 2 - Procedures

17. A general description of the way in which the organization performs all the design functions in relation to airworthiness approvals including:

- a. The procedures followed and forms used in the Design Investigation process to ensure that the design of, or the change to the design of, Air systems and airborne stores as applicable is identified and documented, and complies with the applicable airworthiness requirements, including specific requirements for import by importing authorities.
- b. The procedures for classifying design changes as major or minor and for the approval of minor changes.
- c. The procedures for classifying and approving unintentional deviations from the approved design data occurring in production (concessions or non-conformances).
- d. The procedure for classifying repairs as major or minor and for the approval of minor repairs.
- e. The procedures for the establishment and the control of the maintenance and operating instructions
- f. The procedures for the establishment and the control of the CoD/ Flight Clearance Note (FCN) and Flight Plan Coordination Memo (FPCM)

18. In addition, the organization controls and records the design documentation and means of compliance for:

- a. Design and development of the basic Air Systems/ airborne stores.
 - b. Modifications to the Air Systems / airborne stores.
 - c. The design schemes for Air Systems / airborne stores repairs.
 - d. The reporting and response to Air Systems / airborne failures/malfunctions and defects.
19. The organization will identify (by reference or explicit description) the procedures it uses to select subcontractors and manage the design of airborne stores produced.
20. Control of design subcontractors.
21. The organization will identify (by reference or explicit description) the procedures it uses to control design production, including production by subcontractors entrusted with the design and production of airborne stores, and subcontractors entrusted with production of the approved design.
22. Co-ordination with production.
23. Continuing Airworthiness:
A description of the way in which the organization performs its functions in relation to the continuing airworthiness of the Air Systems / airborne stores it designs.
24. Collecting/Investigating failures, malfunctions and defects:
A description of the means by which the organization monitors and responds to problems affecting the airworthiness of its Air Systems / airborne in particular to comply with relevant SUBPART of IMTAR

Part 3 - Statement of Qualifications and Experience

25. Different types of functions are named or implicitly identified, using qualified and experienced personnel:
- a. The management staff related to Airworthiness:
 - (1) The Head of the ASDO/DO.
 - (2) The Chief of the Office of Airworthiness/AWG.
 - (3) The Chief of the independent monitoring function of the design assurance system.
 - b. Personnel making decisions affecting airworthiness:
 - (1) Compliance Verification Engineers (CVE)
 - (2) Personnel of the Office of Airworthiness making decisions affecting airworthiness, especially those linked with the Privileges identified in 21.G1.10 approving the classification of changes and repairs, and granting the approval of minor changes.

Head of the Organisation

26. The Chief Executive Officer / Head of the Organisation is to provide the necessary resources for the proper functioning of the ASDO/DO.

Other Management Staff

27. The nominated managers are to be identified and their credentials furnished to the CEMILAC on CEMILAC Form -----TBD---- in order that they may be seen to be appropriate in terms of relevant knowledge and satisfactory experience related to the nature of the design activities as performed by the organization.

28. The responsibilities and the tasks of each individual manager are to be clearly defined, in order to prevent uncertainties about the relations, within the organization. Responsibilities of the managers must be defined in a way that all responsibilities are covered.

Personnel making decisions affecting airworthiness

29. For personnel making decisions affecting airworthiness, no individual statement is required. The applicant is to show to the CEMILAC that there is a system to select, train, maintain and identify them for all tasks where they are necessary. The following guidelines for such a system are proposed:

- a. These personnel are to be identified in the DOE, or in a document linked to the DOE. This and the corresponding procedures are there to enable them to carry out the assigned tasks and to properly discharge associated responsibilities.
- b. The needs, in terms of quantity of these personnel to sustain the design activities, are to be identified by the organization.
- c. These personnel are to be chosen on the basis of their knowledge, background and experience.
- d. When necessary, complementary training is to be established, to ensure sufficient background and knowledge in the scope of their authorization. The minimum standards for new personnel to qualify in the functions are to be established. The training is to lead to a satisfactory level of knowledge of the procedures relevant for the particular role.
- e. Training policy forms part of the design assurance system and its appropriateness forms part of the investigation by the CEMILAC within the organization approval process and subsequent surveillance of persons proposed by the organization.
- f. This training is to be adapted in response to experience gained within the organization. The organization must maintain a record of these personnel which includes details of the scope of their authorization. The personnel concerned are to be provided with evidence of the scope of their authorization.

30. The following minimum information is to be kept on record:

- a. Name.
- b. Experience and training.
- c. Position in organization.
- d. Scope of the authorization.
- e. Date of first issue of the authorization.
- f. If appropriate, date of expiry of the authorization.
- g. Identification number of the authorization.

31. The record may be kept in any format and is to be controlled:

- a. Persons authorized to access the system are to be kept to a minimum to ensure that records are not altered in an unauthorized manner or that such confidential records do not become accessible to unauthorized persons.
- b. Personnel must be given access to their own record.
- c. Under the provision of 21.G1.7 the CEMILAC is to have access to the data held in such a system.
- d. The organization is to keep the record for at least two years after a person has ceased employment with the organization or revocation of the authorization, whichever is the sooner.

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ANNEX C

INTERNAL PROCEDURES FOR OPERATING SPECIFIC PRIVILEGES

Privilege A: Classify changes to Type Design as “alteration/amendment” & “Modification” and repairs as minor or major

Intent

1. The ASDO should develop its own internal procedure for the classification of changes to Type Design as “alteration/amendment” & “Modification and repairs as minor or major in order to obtain the associated privilege.

Content

2. The procedure should address the following points:

a. The identification of changes to Type Design or repairs.

b. Classification.

c. Justification of the classification.

d. Authorized signatories.

e. Supervision of changes to Type Design or repairs initiated by subcontractors.

3. For changes to Type Design, criteria used for classification should be in compliance with SUBPART D

4. For repairs, criteria used for classification should be in compliance with SUBPART M

5. The procedure should indicate how the following are identified:

a. Modifications to Type Design or major repairs.

b. Those alteration/amendment to Type Design or minor repairs where additional work is necessary to show compliance with the applicable airworthiness codes.

c. Other Alteration/amendment to Type Design or minor repairs requiring no further showing of compliance.

Classification

6. The procedure should show how the effects on airworthiness are analysed, from the very beginning, by reference to the applicable certification requirements.

7. If no specific airworthiness codes are applicable to the change or repairs, the above review should be carried out at the level of the part or system where the change or repair is integrated and where specific airworthiness codes are applicable.

Justification of the classification

8. All decisions of classification of changes to Type Design or repairs should be recorded. These records should be easily accessible to the CEMILAC for sample check.

Authorized signatories

9. All classifications of changes to Type Design or repairs should be accepted by an appropriate authorized signatory.

10. The procedure should indicate the authorized signatories for the various products listed in the Terms of Approval.

11. For those changes or repairs that are handled by subcontractors, it should be described how the DO manages its classification responsibility.

Supervision of changes to Type Design or repairs initiated by subcontractors

12. The procedure should indicate, directly or by cross-reference to written procedures, how changes to Type Design or repairs may be initiated and classified by subcontractors and are controlled and supervised by the DO.

Privilege B: Approve “Alteration/amendment to Type Design” and “minor repairs “

Intent

13. The ASDO should develop its own internal procedure for the approval of alteration /amendment to Type Design or minor repairs in order to obtain the associated privilege.

Content

14. The procedure should address the following points:

- a. Compliance documentation.
- b. Approval under the ASDO privilege.
- c. Authorized signatories.
- d. Supervision of minor changes to Type Design or minor repairs handled by subcontractors.

Compliance documentation

15. For those minor changes to Type Design or minor repairs where additional work to show compliance with the applicable airworthiness codes is necessary, compliance documentation should be established and independently checked as required by 21.G1.3

16. The procedure should describe how the compliance documentation is produced and checked.

Approval under the ASDO privilege

17. For those alteration/amendment to Type Design or minor repairs where additional work to show compliance with the applicable airworthiness codes is necessary, the procedure should define a document to formalise the approval under the DO privilege.

18. This document should include at least:

- a. Identification and brief description of the change to Type design or repair and reasons for change or repair.
- b. Applicable airworthiness codes and methods of compliance.
- c. Reference to the compliance documents.
- d. Effects, if any, on limitations and on the approved documentation.
- e. Evidence of the independent checking function of the showing of compliance.
- f. Evidence of the approval under the privilege of 21.G1.10 by an authorized signatory.
- g. Date of the approval.

19. For the other Alterations/amendment to Type Design or minor repairs, the procedure should define a means to identify the change or repair and reasons for the change or repair, and to formalise its approval by the appropriate engineering authority under an authorized signatory. This function may be delegated by the Office of Airworthiness but should be controlled by the Office of Airworthiness, either directly or through appropriate procedures of the ASDO design assurance system.

Authorized signatories

20. The persons authorized to sign for the approval under privilege should be identified (name, signature and scope of authority) in appropriate documents that are linked to the ASDO handbook.

Supervision of minor changes to Type Design or minor repairs handled by subcontractors

21. For the Alteration/amendment to Type Design or minor repairs that are handled by subcontractors, the procedure should indicate, directly or by cross-reference to written procedures how these minor changes to Type Design or minor repairs are approved at the subcontractor level and the arrangements made for supervision by the DO. The individual responsible for the supervision to be identified.

Privilege C: Issue of information and instructions

Intent

22. The ASDO/DO should develop its own internal procedure for the issue of information and instructions.

Content

23. For the information and instructions issued under this privilege, the ASDO/DO should establish a procedure addressing the following points:

- a. Preparation.
- b. Verification of technical consistency with corresponding approved change(s), repair(s) or approved data, including effectively, description, effects on airworthiness, especially when limitations are changed.
- c. Verification of the feasibility in practical applications.
- d. Authorized signatories.

24. The procedure should include the information and instructions prepared by subcontractors or vendors and declared applicable to its products, parts and appliances by the DO.

Statement

25. The statement provided in the information and instructions should also cover the information and instructions prepared by subcontractors or vendors and declared applicable to its products, parts and appliances by the DO.

26. The technical content should be related to the design data and accomplishment instructions, and its approval should mean that:

- a. The design data has been appropriately approved.
- b. The instructions provide for practical and well defined installation/inspection methods, and, when accomplished, the products, parts and appliances are in conformity with the approved design data.

27. Where appropriate, this technical data should be clearly identified with reference to the CoD to be communicated to CEMILAC.

28. Information and instructions related to required actions issued under an AD or SI(T) should be submitted to the CEMILAC to ensure compatibility with the AD or SI(T) content, and should contain a statement that they are, or will be, subject to an AD or SI(T) issued.

Privilege D: To approve the flight Plan Coordination Memo (FPCM)

Intent

29. The ASDO should develop its own internal procedure to determine and approve that an Air System can fly under the appropriate restrictions compensating for the lack of an extant RTS.

Content

30. The procedure should address the following points:

- a. Decision to use the privilege.
- b. Management of the aircraft configuration.
- c. Determination of the conditions that should be complied with to perform safe flight.
- d. Documentation of flight conditions substantiations.
- e. Approval under the approved DO privilege, when applicable.
- f. Authorized signatories.

31. The procedure should include a decision to determine:

- a. Flights for which this privilege will be exercised.
- b. Flights for which the approval of FPCM by the CEMILAC will be required.

32. The procedure should describe the process used by the ASDO to justify that an Air System can perform the intended flight. The process should include:

- a. Identification of deviations from the extant FCN or applicable airworthiness requirements.
- b. Analysis, calculations, tests or other means used to determine the conditions or restrictions under which the Air System can perform safe flight.
- c. The establishment of specific maintenance instructions and conditions to perform these instructions.
- d. Independent technical verification of the analysis, calculations, tests or other means used to determine under which conditions or restrictions the Air System can perform the intended flight(s) safely.
- e. Statement by the office of airworthiness (or equivalent), that the determination has been made in accordance with the procedure and that the Air System has no features and characteristics making it unsafe for the intended operation under the identified conditions and restrictions.
- f. Approval by an authorized signatory.

Documentation of flight conditions substantiations

33. The analysis, calculations, tests, or other means used to determine the conditions or restrictions under which the Air System can perform in flight safely, should be compiled in compliance documents. These documents should be signed by the author and by the person performing the independent technical verification.

34. Each compliance document should have a number and issue date. The various issues of a document should be controlled.

Authorized signatories

35. The person(s) authorized to sign the approval form should be identified (name, signature and scope of authority) in the procedure, or in an appropriate document linked to the DOE.

SUBPART —G 2: PRODUCTION APPROVED ORGANISATION SCHEME

Rationale

Directorate General of Aeronautical Quality Assurance (DGAQA) is the Quality Assurance Authority & Regulatory Body for Military Aircraft, Aero engines and Airborne /Aviation Stores (Including it's Associated Systems/ Accessories/Armaments and Ground Support / Handling Equipment) under the aegis of Department of Defence Production, Ministry of Defence, Government of India. Quality, Safety and Reliability is of paramount importance in Military Aviation as it demands highest performance under extreme as well as adverse conditions involving precious human life, costlier flying machines and approaching engineering limits of man, machine, materials etc. Therefore, firms dealing in Military Aviation should be competent and able to manage its Quality Management System effectively to deliver products and services which are meeting desired quality standards and are safe and reliable throughout the life cycle of the Product. To ensure that, the organizations taking up Production of Air Systems/Airborne Stores, possesses the requisite technical capability, Infrastructure and Human resources to undertake such activities, a Production Approved Organisation scheme (PAOS) is established.

To demonstrate its competence and enhanced assurance towards compliance to the quality requirements for military aviation store intended for user services, Firms/Organisations (R&D Labs, OFs, PSUs, Public/Private firms) dealing with Design & Development, Production, Maintenance, Repair, Overhaul, Servicing and Modification of Military Aviation /Airborne Stores viz Aircrafts (including Helicopter, UAVs) Aero-engines, Air Armaments including missiles and other standalone Electrical & Electronics Ground systems such as Radars, software etc. shall be required to obtain firm's approval from DGAQA for carrying out such regular activities against Defence Supply Orders for which DGAQA has been identified as the QA/Inspection Authority. This Sub part establishes: (a)The procedure for the issuance of a production organization approval for a production organization showing conformity of products, parts and appliances with the applicable design data. (b)The rules governing the rights and obligations of the applicant for, and holders of, such approvals.

The products of an approved firm, before their induction / installation on an aircraft/aero engine/electronic and electrical equipment etc. or issue to another firm, must bear an Inspection Stamp as an evidence of having been produced to the required standards. The inspection stamp may be affixed on the product or/and appropriate inspection document depending upon the type of product.

Contents:

- 21.G2.1. Production Organization (PO) Approval
- 21.G2.2. Quality System
- 21.G2.3. Approval requirements
- 21.G2.4. Certifying Staff
- 21.G2.5. Changes to the approved production organization
- 21.G2.6. Terms of approval
- 21.G2.7. Production Process Verification
- 21.G2.8. Investigations
- 21.G2.9. Validity of Approval
- 21.G2.10. Privileges
- 21.G2.11. Obligations

21. G2.1. Production Organization (PO) Approval

Regulation

PO shall fulfil the Production Organization responsibilities as stipulated by DGAQA.

Acceptable Means of Compliance:

- a. Eligibility: A firm seeking AFQMS approval of DGAQA should provide evidence that either the firm is in possession or likely to receive an order from user services or MoD or any other aviators for development/supply/service of military airborne stores and associated Ground Handling/Ground Support Equipments.
- b. The applicant shall:
 - i. justify that, for a defined scope of work, an approval under this Subpart is appropriate for the purpose of showing conformity with a specific design; and
 - ii. hold or have applied for an approval of that specific design; or
 - iii. have ensured, through an appropriate arrangement with the applicant for, or holder of, an approval of that specific design, satisfactory coordination between production and design.
 - iv. Possess design data for parts and appliances obtained through a licence agreement.
 - v. In case production organization and Design organization are not company of India, then prior to grant of production organization approval, there should be an agreement acceptable to CEMILAC India and state of Design that the manufacturing organization cooperates with the organization responsible for type design in assessing information on the design, manufacture and operation of the aircraft, engine or other accessories/LRUs.

- c. Application: The firm seeking approval should apply to DGAQA Ministry of Defence, New Delhi through Regional office (wherever available) and Subsequently DGAQA detail a Team to assess the firm's capacity with respect to infrastructure, human resources, workshop facilities and existence of Quality Management System. The duty of the assessment team will be to satisfy that the firm has the capacity and resources which will facilitate it to execute the specified class and nature of work satisfactorily as per the requirements

Guidance Material

- a. Any organisation either government or private shall be eligible as an applicant for an approval under this Subpart provided the applicant shall justify that, has the capability and infrastructure to carry out the defined scope of work, an approval under this Subpart is appropriate for the purpose of showing conformity with a specific design and hold or have applied for an approval of that specific design or have ensured, through an appropriate arrangement with the applicant for, or holder of, an approval of that specific design, satisfactory coordination between production and design.
- b. An organisation shall be entitled to have a production organisation approval issued by the Authority when it has demonstrated compliance with the applicable requirements under this Subpart. If the infrastructure, resources and existence of an existing Quality Management System are satisfactory, a letter and Certificate of approval will be issued to the firm by DGAQA. It should be understood that the grant of 'Approval' only indicates that at the time of granting approval, the Firm's Organization fulfilled all the requirements for such approval. The Supervising Representative(s) from the DGAQA will carry out periodical assessment of the approved firm(s). The continuation of the approval will be subject to the periodical verifications showing that the required standards are being maintained.
- c. DGAQA/ Resident in-charge shall be responsible for executive Q.A. function & effective supervision on continual basis for assuring that the products/services supplied by the main contractor meet the specified requirements. Level of intervention of DGAQA and Re-verification of stages will be mutually decided based on performance of stores, its criticality and effectiveness of the firm's QMS. Conduct of Quality audits, spot checks by DGAQA shall be based on criticality of stores, areas of concern, priorities and customer complaints.
- d. DGAQA Approval may be granted for the following categories:-
 - i. Manufacture/ Repair/ Overhaul of Aircraft, Aero- engines, Air Armaments, Missiles, UAVs, Electrical and Electronic Equipment, Instrument etc, and their components / accessories /Raw Materials including critical aircraft consumables such as Fuel, Oils & Lubricants produced indigenously.

- ii. Process workshops (Protective Treatment, Heat Treatment, Plating, Surface Treatment, Painting etc.).
 - iii. Stockists of the above, for Certification that they are re-consigning parts or materials received from approved sources including foreign origin in the condition in which received & storage in specified environment conditions and periodic servicing as per requirement.
 - iv. Test Houses or Laboratories for testing to specific requirements/specifications.
 - v. Any other category of approval not mentioned above may also be considered on as required basis.
- e. Personnel carrying out special processes such as Welding, NDT etc shall be approved by DGAQA after assessing their education, training, experience, competence and special tests if any. Only personnel approved by DGAQA or other Govt. Approved agency shall be authorised to carry out and certify such activities. There will be provision for periodical review by DGAQA of all the special processes for renewal of these approvals.

21.G2.2. Quality Management System

Regulation

The production organization shall demonstrate that it has established and is able to maintain a quality management system

Acceptable Means of Compliance

- a. The production organization shall demonstrate that it has established a Quality system in accordance with the requirements of AFQMS. The quality system shall be documented. This quality system shall be such as to enable the organization to ensure that each product, part or appliance produced by the organization or by its partners, or supplied from or subcontracted to out side parties, conforms to the applicable design data and is in condition for safe operation.
- b. The quality system shall contain the following as applicable with in the scope of approval, control procedures for:
 - i. Document issue, approval, or change.
 - ii. Vendor and subcontractor assessment audit and control.

- iii. Verification that in coming products, parts, materials, and equipment, including items supplied new or used by buyers of products, areas specified in the applicable design data.
 - iv. Identification and traceability.
 - v. Manufacturing processes.
 - vi. Inspection and testing, including production flight tests.
 - vii. Calibration of tools, jigs, and test equipment.
 - viii. Non conforming item control.
 - ix. Airworthiness coordination with the applicant for, or holder of, the design approval.
 - x. Records completion and retention.
 - xi. Personnel competence and qualification.
 - xii. Issue of airworthiness inspection certificates and release documents.
 - xiii. Handling, storage and packing.
 - xiv. Internal quality audits and resulting corrective actions.
 - xv. Work within the terms of approval performed at any location other than the approved facilities.
 - xvi. Work carried out after completion of production but prior to delivery, to Maintain the aircraft in a condition for safe operation.
 - xvii. 'Special Flight Permit' operation and evaluation of associated flight conditions under this operation, as per the procedures agreed with CEMILAC.
- c. The control procedures need to include specific provisions for any critical parts.
 - d. An independent quality assurance function to monitor compliance with, and adequacy of, the documented procedures of the equality system. This monitoring shall include a feedback system to the person or group of persons referred to in ----- and ultimately to the manager referred to in ----- to ensure, as necessary, corrective actions.

Guidance Material

- a. Each manufacturer of a air system, subsystem, accessories, LRUs, parts being manufactured under this Subpart shall:
 - i. Make each product or part available for inspection by the Authority. It is necessary to maintain the technical data and drawings necessary to determine whether the product conforms to the applicable design data at the place of manufacture.
 - ii. The production organisation is also expected to maintain the production inspection system that ensures that each product conforms to the applicable design data and is in condition for safe operation.
 - iii. The manufacturer shall be committed to provide assistance to the holder of the type-certificate, restricted type-certificate or design approval in dealing with any continuing airworthiness actions that are related to the products, parts or appliances that have been produced.
 - iv. Establish and maintain an internal occurrence reporting system in the interest of safety, to enable the collection and assessment of occurrence reports in order to identify adverse trends or to address deficiencies, and to extract reportable occurrences. This system shall include evaluation of relevant information relating to occurrences and the promulgation of related information
 - v. Report to the holder of the type-certificate, restricted type-certificate or design approval, all cases where products, parts or appliances have been released by the manufacturer and subsequently identified to have deviations from the applicable design data, and investigate with the holder of the type-certificate, restricted type-certificate or design approval to identify those deviations which could lead to an unsafe condition.
 - vi. Report to the Authority the deviations which could lead to an unsafe condition identified. Such reports shall be made in a form and manner established and accepted by the DGAQA.
 - vii. Where the manufacturer acts as supplier to another production organisation, report also to that organisation all cases where it has already released products, parts or appliances to that organisation and subsequently identified them to have possible deviations from the applicable design data.

- b. The organization shall determine the boundaries and applicability of the quality management system to establish its scope. When determining this scope, the organization shall consider:
 - i. The external and internal issues
 - ii. The requirements of relevant interested parties
 - iii. The products and services of the organization.

- c. The scope of the organization's quality management system shall be available and be maintained as documented information. The scope shall state the types of products and services covered, and provide justification for any requirement of this Standard that the organization determines is not applicable to the scope of its quality management system.
- d. Conformity to this Subpart may only be claimed if the requirements determined as not being applicable do not affect the organization's ability or responsibility to ensure the conformity of its products and services and the enhancement of customer satisfaction. The organization's quality management system shall also address customer and applicable statutory and regulatory quality management system requirements.

21.G2.3. Approval requirements

Regulation

The production organization shall demonstrate its capability to manufacture the air systems/ sub systems/accessories/ LRUs/ Parts (as the case may be) as per the aeronautical practices.

Acceptable Means of Compliance

- a. The production organization shall demonstrate, on the basis of the information submitted to DGAQA with regard to general approval requirements, facilities, working conditions, equipment and tools, processes and associated materials, number and competence of staff, and general organization are adequate to discharge obligations under this subpart
- b. The production organization shall demonstrate compliance with regard to all necessary airworthiness, environmental requirements such as noise, fuel venting and exhaust emissions data.
- c. The production organization shall comply with the rules and regulations promulgated by government authorities regarding establishment and operation of the company/ factory and shall have all the necessary government approvals.
- d. The production organization shall possess the permission from the holder of, or applicant for, the military type-certificate, restricted military type-certificate or design approval, to determine conformity with the applicable design data.

- e. The production organization shall demonstrate that it has established a procedure to ensure that airworthiness, environmental data (pollution levels, noise, fuel venting and exhaust emissions) are correctly incorporated in its production data and available for audit as and when required.
- f. A manager has to be nominated by the production organization, and is accountable to the Govt inspection agencies. His or her responsibility within the organization shall consist of ensuring that all production is performed to the required standards and that the production organization is continuously in compliance with the data and procedures identified in the production organization exposition.
- g. A person or group of persons have been nominated by the production organization to ensure that the organization is in compliance with the requirements of this IMAR, and are identified, together with the extent of their authority. Such person(s) shall act under the direct authority of the accountable manager referred to in subparagraph (4.5) above . The persons nominated shall be able to show the appropriate knowledge, background and experience to discharge their responsibilities.
- h. Staff at all levels have been given appropriate authority to be able to discharge their allocated responsibilities and that there is full and effective coordination within the production organization in respect of airworthiness, and environmental regulations.

Guidance Material

- a. The organisation shall submit to the Authority a Production Organisation Exposition (POE) providing the all the information that are necessary to establish the capability of the production organisation for the scope of approval sought. POE typically include a statement signed by the accountable manager confirming that the production organisation exposition and any associated manuals which define the approved organisation's compliance with this Subpart will be complied with at all times, the title(s) and names of managers competent and accepted by the DGAQA, the duties and responsibilities of the manager(s) including matters on which they may deal directly with the DGAQA on behalf of the organisation etc.
- b. Approval may be granted subject to satisfactory assessment of the firm by DGAQA after ensuring the availability of the following:
 - i. Requisite infrastructure, buildings, workspace and associated utilities, process equipment and supporting devices such as transport, communication etc.
 - ii. Availability of experienced and trained manpower having requisite competency and skill for carrying out specified activities on the aircraft and associated systems/accessories. This shall include organisation for ensuring quality of products/services.

- iii. Inspection / Test facilities, applicable tools and fixtures, Machineries & associated Ground Support Equipment/Systems specified in the technology of proposed activity.
 - iv. Controlled Work environment such as Temperature, Humidity, Lighting, Cleanliness etc, as applicable, to achieve conformity to product/service requirements.
 - v. Implementation & Maintenance of Quality Management System and continuous improvement of its effectiveness.
 - vi. Well defined and documented Quality Manual and Quality procedures for Control of Documents, Control of Records, Internal Audit, Control of Non-Conforming Products, Corrective & Preventive Action, Outsourcing, First Article Inspection Requirements and FOD management in line with Aerospace Recommended Practice (ARP)/Relevant Aerospace Standards
 - vii. It is desirable that the firm should have AS9100 accreditation, NABL accreditation (for Test Laboratory) and NADCAP approval for special processes, as applicable.
 - viii. The firm shall also have the clearances from local authority/ body for registration of the firm to carry out the business and meeting all statutory and safety requirements meant for the type of industry
- c. Primary responsibility for quality of products/ services rests with the main contractor including its sub-contracted / outsourced product/ service (Including chain of sub-contractors).
 - d. A firm may be a Main Contractor for some contracts and Sub-Contractor for others. All the sub-contract / outsourcing activities will be governed as per the DGAQA Guidelines for QA during outsourcing. But whether a firm is acting as a Main Contractor or Sub Contractor, does not affect its status as an Approved Firm, provided it fulfils the necessary conditions. DGAQA involvement in subcontracts/ outsourcing activities of the Main Contractor is generally limited to critical stores.
 - e. The Main Contractor can utilise AFQMS guidance for according approval to its Sub-Contractor and its Quality Management System i.e “Approval of Sub-Contractor and its Quality Management System”. Further, main contractor outsourcing procedure/ documents shall also elaborate guidelines to assess, evaluate and control their sub-sub contractors/ sub vendor i.e subcontractor to their sub-contractor/ vendors.
 - f. Non-conformances with respect to Ground Support Equipment or testing requirements vis a vis specifications are to be controlled as per documented procedure and shall be disposed off/ approved by DGAQA
 - g. Only acceptable products/ services will be offered by the concerned approved QC personnel of the main contractor to DGAQA representative(s) for re-verification as per agreed programme identified in the
 - h. A non – conformity, observed in a stage/ product accepted by DGAQA during the subsequent production build-up or prior to its delivery to the customer, shall be notified

to DGAQA before taking up any action to correct the Non conformity. Main contractor top management should take serious note of the non-conformances reported by DGAQA representatives during their check stages inclusive of observations during spot/surveillance checks as these will be indicative of discrepancies in the Quality Management System of the firm.

21. G2.4. Certifying Staff

Regulation

DGAQA may authorise a person or a group of persons nominated by the production organization as Certifying Staff, authorised to sign the documents for and on behalf of DGAQA under the scope of delegated powers

Acceptable Means of Compliance

- a. The knowledge, background (including other functions in the organization), and experience of the certifying staff are appropriate to discharge their allocated responsibilities.
- b. The certifying staff is authorized to sign the documents testifying the compliance to the quality requirements under the scope or terms of the delegated authority.
- c. The production organization shall maintain a consolidated record of all certifying staff which shall include details of the scope of their authorization.
- d. Organisation will impart necessary training to the identified staff in relation to Inspection and Quality management from time to time.

Guidance Material

- a. The head of QA Department of the firm will be the one approved by DGAQA by name. He shall have an adequate number of QA /QC personnel (approximately 10% of manpower at the firm premises directly involved in production and testing activities) working under him to ensure execution of inspection/QA activities at all the technical work centers of the organisation. He shall also co-ordinate approval of the QA personnel from resident DGAQA office/DGAQA HQ for respective scope of work. He shall be responsible to ensure that only competent & approved QA personnel certify the activity in respective work centers.

- b. Head of the Quality Assurance Department will be placed under the functional control of corporate management/ CMD/ Corporate Quality Head of the firm and not to the local unit head to avoid conflict of interest. He shall be given adequate authority & freedom by the corporate management of the firm to ensure effective functioning of the QA Department, Quality Management System and to resolve matters pertaining to quality. All personnel in the quality department shall be under functional as well as administrative control of the Head of Quality Assurance Department.

21.G2.5. Changes to the approved production organization

Regulation

Any significant change the approved production organization that is concerned with airworthiness aspects shall be notified to DGAQA for their prior concurrence and approval.

Acceptable Means of Compliance

- a. After the issue of a production organization approval, each change to the approved production organization that is significant to the showing of conformity or to the airworthiness and environmental regulations of the product, part or appliance, particularly changes to the quality system, shall be approved by DGAQA. An application for approval shall be submitted in writing to DGAQA and the organization shall demonstrate to DGAQA before implementation of the change that it will continue to comply with this Subpart.
- b. DGAQA shall establish the conditions under which a production organization approved under this Subpart may operate during such changes unless DGAQA determines that the approval should be suspended.
- c. Any change of the location of the manufacturing facilities of the approved production organization shall be deemed of significance and therefore shall comply with 21. G2.6.
- d. Except as a result of a change in ownership, which is deemed significant for the purposes of approval, a production organization approval is not transferable.

Guidance Material

- a. Approved Firm shall inform HQ, DGAQA through resident RDAQA/Officer In- charge for any change in scope of approval required. HQ, DGAQA through their authorized representatives shall have further assessment of firm's facilities and capabilities for the changes sought and decide accordingly.

- b. Any change in the scope of approval of products/personnel should be mandatorily brought to the notice of DGAQA immediately for appropriate action/amendment in the approval letter by DGAQA who will take appropriate action within next one month of receipt of information from the main contractor.
- c. When the organization determines the need for changes to the quality management system, the changes shall be carried out in a planned manner. The organization shall consider:
 - i. the purpose of the changes and their potential consequences;
 - ii. the integrity of the quality management system;
 - iii. the availability of resources;
 - iv. the allocation or reallocation of responsibilities and authorities.

21.G2.6. Terms of approval

Regulation

An organization shall be included in the PAOS and awarded approval for a defined range of airborne stores and Air Systems only when the organization has been assessed and accepted by DGAQA.

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Acceptable Means of Compliance

- a. The terms of approval shall be issued as part of a production organization approval.
- b. The terms of approval shall identify the scope of work, the products or the categories of Air systems and subsystems or both, for which the holder is entitled to exercise the privileges granted under the terms of approval.
- c. Each change to the terms of approval shall be approved by DGAQA. An application for a change to the terms of approval shall be made in a form and manner established by DGAQA. The applicant shall comply with the applicable requirements of this Subpart.

Guidance Material

- a. The organization shall ensure that externally provided processes, products, and services conform to requirements.

- b. The organization shall be responsible for the conformity of all externally provided processes, products, and services, including from sources defined by the customer.
- c. The organization shall ensure, when required, that customer-designated or approved external providers, including process sources (e.g., special processes), are used.
- d. The organization shall identify and manage the risks associated with the external provision of processes, products, and services, as well as the selection and use of external providers.
- e. The organization shall require to ensure that the external providers apply appropriate controls to their direct and sub-tier external providers, to ensure that requirements are met.

21.G2.7. Production Process Verification

Regulation

Production organization shall conduct Production Process Verification to the satisfaction of DGAQA.

Acceptable Means of Compliance

- a. The organization shall implement production process verification activities to ensure the production process is able to produce products that meet requirements. These activities can include risk assessments, capacity studies, capability studies, and Quality control plans. The organization shall use a representative item from the first production run of a new part or assembly to verify that the production processes, production documentation, and tooling are able to produce parts and assemblies that meet requirements.
- b. Production process verification activities shall be repeated when changes occur that invalidate the original results (e.g., engineering changes, production process changes, tooling changes).
- c. Production process verification will be carried out in case there is gap in production activities.
- d. Production process verification activities will be verified after production of a sizeable quantity as per production norms laid down by DGAQA.

Guidance Material

The organization shall retain documented information on the results of production process verification which shall cover all design characteristic mentioned in the drawing & specification. Records of same to be maintained and attached with clearance request to DGAQA for first article clearance. The organization shall use suitable means to identify outputs when it is necessary to ensure the conformity of products and services.

21.G2.8. Investigations

Regulation

A production organization shall facilitate DGAQA to make any investigations and Audit as and when required.

Acceptable Means of Compliance

- a. A production organization shall make arrangements that allow DGAQA to make any investigations and audit, including investigations of partners and subcontractors, necessary to determine compliance and continued compliance with the applicable requirements of this Subpart.
- b. Procedure for non-conformance control of products/services shall be strictly followed (Root cause analysis, Preventive/ Corrective Action) as per defined documentation.
- c. When objective evidence is found showing non-compliance of the holder of a Production organization approval with the applicable requirements of this IMAR, the finding shall be classified as follows:
 - i. A level one finding is any non-compliance with this IMAR which could lead to uncontrolled non-compliances with applicable design data and which could affect the safety of the aircraft/ air system.
 - ii. A level two finding is any non-compliance with this IMAR which is not classified as level one.
 - iii. A level three finding is any item where it has been identified, by objective evidence, to contain potential problems that could lead to non-compliance under level 1.
- d. In case of a level one finding, the holder of the production organization approval shall demonstrate corrective action to the satisfaction of DGAQA with in a period of 7 working days, extendable upto maximum 21 working days depending upon the complexity of the case after written confirmation of the finding.

- e. In case of level two findings, the corrective action period granted by DGAQA shall be within three months. In certain circumstances and subject to the nature of the finding, DGAQA may extend the period from three months to six months, subject to a satisfactory corrective action plan agreed by the DGAQA.
- f. A level three finding shall not require immediate action by the holder of the production organization approval.
- g. In case of level one or level two findings, the production organization approval may be subject to a partial or full limitation, suspension or revocation. The holder of the production organization approval shall provide confirmation of receipt of the notice of limitation, suspension or revocation of the production organization approval in a timely manner.

Guidance Material

The organization's nonconformity control process shall be maintained as documented information including the provisions for:

- a. defining the responsibility and authority for the review and disposition of nonconforming outputs and the process for approving persons making these decisions;
- b. taking actions necessary to contain the effect of the nonconformity on other processes, products, or services;
- c. timely reporting of nonconformities affecting delivered products and services to the customer and to relevant interested parties;
- d. defining corrective actions for nonconforming products and services detected after delivery, as appropriate to their impacts.

21.G2.9. Validity of Approval

Regulation

A production organization approval issued by the DGAQA shall be valid for the specific duration mentioned in the approval unless become invalid due to specific issues.

Acceptable Means of Compliance

- a. A production organization approval shall be issued for a limited duration however typically not exceeding three years. It shall remain valid unless:
 - i. The production organization fails to demonstrate compliance with the applicable requirements of this Subpart ;or

- ii. DGAQA is prevented by the holder or any of its partners or subcontractors to perform the investigations in accordance with RA 008; or
 - iii. There is evidence that the production organization cannot maintain satisfactory control of the manufacture of products, parts or appliances under the approval ; or
 - iv. The production organization no longer meets the requirements of the approval; or
 - v. the certificate has been surrendered or revoked.
 - vi. Found to indulge in any form of malpractice or Misuse of the Approvals
- b. Upon surrender or revocation, the certificate shall be returned to DGAQA

Guidance Material

- a. Validity of the DGAQA approval shall be for a period of 3 years. This would be subject to satisfactory periodic assessment by resident office of DGAQA/HQ, DGAQA.
- b. The validity of approval is subject to satisfactory Periodical Audits by DGAQA. Non-Conformances of minor nature during such audits will need to be corrected at the earliest possible. In case of Major Non-Conformances or not adhering to given time frame for resolution of other non-conformances, issue may need to be taken up with top management for resolution.
- c. For renewal of approval, the firm shall apply at least 4 months in advance through respective Regional Director/Resident Officer-In-Charge, DGAQA with an advance copy to HQ, DGAQA. On receipt of the application, the concerned ADG/ RD should ensure the requisite audit and ensure closure of NC's 60 days prior to the date of expiry of the approval. The case for renewal of approval at HQ will be processed within 30 days on receipt of recommendation from respective Regional Director/Resident Officer-In-Charge, DGAQA.

21.G2.10. Privileges

Regulation

Subsequent to production organization approval, certain privileges are granted to the production organization by DGAQA within the scope of approval.

Acceptable Means of Compliance

- a. Pursuant to the terms of approval issued under 21.G2.7, the holder of a production organization approval may:
 - i. Perform production activities under this IMTAR.
 - ii. In the case of complete aircraft and up on presentation of a Statement of Conformity under subpart F, obtain an aircraft certificate of airworthiness as per Subpart H.
 - iii. Statement of conformity to approved baseline configuration for the Airborne Store.
 - iv. Maintain a new aircraft that it has produced and issue a certificate of release to service(Form ----- TBD-----) in respect of that maintenance.

Guidance Material

- a. Firm's management is responsible for establishment of a system to approve the operators for carrying out a specified job. Selection process will take into account qualification, training, experience and competence level of the personnel. A suitable representative from the firm's Q.A. department shall be a member in the selection process of the operators. Periodic review of such personnel will be part of this system. DGAQA will oversee that the system is in place, effective and adequate records are maintained.
- b. There will be provision for self inspection by operators who are found to be competent by QC department of the main contractor and also meeting the inspection approval requirement of the DGAQA. However suitable guidelines on the procedure to be followed in such cases would need to be prepared by the Main Contractor in co-ordination with DGAQA.
- c. Personnel carrying out special processes such as Welding, NDT etc shall be approved by DGAQA after assessing their education, training, experience, competence and special tests if any. Only personnel approved by DGAQA or other Govt. Approved agency shall be authorised to carry out and certify such activities. There will be provision for periodical review of these approvals. NDT level-II is required for QC personnel certifying the NDT test and level-III is required for QC personnel approving the Test plan/ procedure for NDT test. Such QC personnel should be certified to Level-II & Level-III by ASNT/ISNT
- d. As regards process of Soldering, the firm will have in-house guidelines for assessment and approval of personnel involved in such type of processes. The soldering personnel shall be in possession of valid certificate from Institute of Printed Circuit (IPC)/

Equivalent. There will be provision for periodical review by DGAQA of all the special processes including that of soldering.

- e. The aeronautical products must bear an Inspection Stamp as an evidence of having been produced to the required standards. The design of the inspection stamp shall be submitted to DGAQA for approval and agreed, before the Approval of the firm and its Quality Management System (QMS) is granted.

21.G2.11. Obligations

Regulation

Production organization has obligation to maintain the high standards of production process in the interest of Flight safety.

Acceptable Means of Compliance

- a. The holder of a production organization approval shall:
 - i. Ensure that the production organization exposition furnished in accordance with this Subpart and the documents, to which it refers, are used as basic working documents with in the organization.
 - ii. Maintain the production organization in conformity with the data and procedures approved for the production organization approval.
 - 1. Determine that each completed aircraft is airworthy prior to submitting Statements of Conformity to the DGAQA, or
 - 2. Determine that other products, parts or appliances are complete and conform to the approved design data and are in a condition for safe operation before issuing Form (--TBD--) to certify conformity to approved design data and condition for safe operation, and
 - 3. Additionally in case of engines, determine that completed engine is in compliance with the applicable emissions requirements on the date of manufacture of the engine.
 - 4. Determine that other products, parts or appliances conform to the applicable data before issuing Form (----TBD---) as a conformity certificate;
 - iii. Record all details of work Carried out.

- iv. Establish and maintain an internal occurrence reporting system in the interest of safety, to enable the collection and assessment of occurrence reports in order to identify adverse trends or to address deficiencies, and to extract reportable occurrences. This system shall include evaluation of relevant information relating to occurrences and the promulgation of related information.
 - v. Report to the holder of the military type-certificate or design approval, all cases where products, parts or appliances have been released by the production organization and subsequently identified to have possible deviations from the applicable design data, and investigate with the holder of the military type-certificate or design approval in order to identify those deviations which could lead to an unsafe condition.
- b. The deviations which could lead to an unsafe condition to be identified and communicated to DGAQA
 - c. Where the holder of the production organization approval is acting as a supplier to another production organization, report also to that other organization all cases where it has released products, parts or appliances to that organization and subsequently identified them to have possible deviations from the applicable design data.
 - d. Provide assistance to the holder of the military type-certificate or design approval in dealing with any continuing airworthiness actions that are related to the products parts or appliances that have been produced.
 - e. Establish an archiving system incorporating requirements imposed on its partners, suppliers and subcontractors, ensuring conservation of the data used to justify conformity of the products, parts or appliances. Such data shall be held at the disposal of DGAQA and be retained in order to provide the information necessary to ensure the continuing airworthiness of the products, parts or appliances.
 - f. The main contractor shall make available internal audit reports to DGAQA when requested. When conducting internal audits, performance indicators can be evaluated to determine whether the quality management system is effectively implemented and maintained.

Guidance Material

- a. The organization shall:
 - i. plan, establish, implement, and maintain an audit program(s) including the frequency, methods, responsibilities, planning requirements, and reporting, which

shall take into consideration the importance of the processes concerned, changes affecting the organization, and the results of previous audits;

- ii. define the audit criteria and scope for each audit;
 - iii. select auditors and conduct audits to ensure objectivity and the impartiality of the audit process;
 - iv. ensure that the results of the audits are reported to relevant management;
 - v. take appropriate correction and corrective actions without undue delay;
 - vi. Retain documented information as evidence of the implementation of the audit program and the audit results.
- b. Top management shall review the organization's quality management system, at planned intervals, to ensure its continuing suitability, adequacy, effectiveness, and alignment with the strategic direction of the organization. The organization shall analyze and evaluate appropriate data and information arising from monitoring and measurement. Appropriate data can include information on product and service problems reported by external sources (e.g., government/industry alerts, advisories). The results of analysis shall be used to evaluate:
- i. conformity of products and services;
 - ii. the degree of customer satisfaction;
 - iii. the performance and effectiveness of the quality management system;
 - iv. if planning has been implemented effectively;
 - v. the effectiveness of actions taken to address risks and opportunities;
 - vi. the performance of external providers;
 - vii. the need for improvements to the quality management system.

SUBPART G 3 — MAINTENANCE APPROVED ORGANISATION SCHEME (MAOS)

Rationale

Firms engaged in Maintenance, Repair, Overhaul (MRO) and Servicing of Air Systems viz Aircrafts, Helicopter, UAVs (On-aircraft Maintenance and off-aircraft Maintenance) Aero-engines, Air Launched Missiles and other airborne stores like Electrical & Electronics, Mechanical systems etc. shall be required to obtain firm's approval from DGAQA for carrying out such regular activities. Firms Engaged in MRO & Servicing of Air System is named as Air System Maintenance Organisation (ASMO) and those involved in MRO & Servicing of airborne store is Maintenance Organisation (MO). Maintenance comprises of continuing airworthiness activities required for ensuring that the air system complies with the airworthiness requirements at all times in its operational life by way of daily checks and inspections, scheduled maintenance to remain in a condition for safe operation. Thus elimination of damage by replacement of parts or appliances without the necessity for design activity shall be considered as a maintenance task and shall therefore require only approval for procedure and personal carrying out the task. A 'repair' means elimination of damage and/or restoration to an airworthy condition following initial release into service by the manufacturer of any product, subsystem or part. To ensure that, the organizations taking up Maintenance, Repair, Overhaul of Air Systems/Airborne Stores, possesses the requisite technical capability, Infrastructure and Human resources to undertake such activities, a Maintenance Approved Organisation scheme (MAOS) is established.

Approval of all design changes and repairs follows the same principles of certification as for a new product. For all changes and repairs, the certification basis of the change or repair must be established, the means of compliance determined and compliance with the certification basis demonstrated. Alteration of any type design data covered by an existing Military Type Certificate or change approval requires a new design change approval. Certification of all new repair designs requires a repair design approval. Therefore, the General MRO activities may range a wide variety of activities and are often carried out as a subset of the tasks handled by design organisation and production organisation. Hence regulations in Subpart G1 and Subpart G2 are applicable to MRO organisation on a case to case basis depending on the extent to which the firm is planning to take up the activities. Hence in general, the Regulations provided in Subpart G2 to be followed for MRO organization also.

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21.G3.1. Applicability

Regulation

The regulation brought in this subpart is applicable to Firms engaged in Maintenance, Repair, Overhaul and Servicing of Military Air Systems /Airborne Stores viz Aircrafts (including Helicopter, UAVs) Aero-engines, Air Launched Missile and other standalone airborne stores like Electrical & Electronics, Mechanical systems etc which possess a MTC or form a part of the main system which possess a MTC for Indian military applications.

Acceptable means of Compliance

- a. The provisions stipulated in this SUBPART to be complied through an audit programme, on satisfactory culmination of which DGAQA may grant approval of the organisation.
- b. For all changes and repairs, the certification basis of the change or repair must be established, the means of compliance determined and compliance with the certification basis demonstrated.
- c. Alteration of any type design data covered by an existing Military Type Certificate or change approval requires a new design change approval.
- d. Certification of all new repair designs requires a repair design approval.

Guidance Material

NIL

21.G3.2. User Requirements

Regulation

ASMO/MO organizations shall carryout the activities as per the User requirements in terms of time schedules, usability and other ergonomic and environmental requirements.

Acceptable means of Compliance

- a. The ASMO/MO organization shall meet technical requirements as well as the specific logistic and ergonomic User requirements.
- b. Repair/service/maintenance carried out on the Airsystem /airborne store shall ensure the compliance with the applicable airworthiness standards and done in accordance with the usability requirements of the User.
- c. Activities carried out by ASMO/MO organization shall not deteriorate the ease of use for the systems / sub systems.

Guidance Material

- a. Often user requirements deal with how a user will interact with a system and what that user expects.
- b. The time schedules, Logistics management etc are to be worked out in consultation with the user.

21.G3.3. Maintenance Approved Organisation Scheme (MAOS) Approval

Regulation

The Main Contractor and a contractor-run organization who intend to carryout Maintenance on a specific type of Air System (Air System Maintenance Organisation, ASMO) & on a specific airborne store (Maintenance Organisation) should apply for the issue or continuation of an approval to DGAQA for the Maintenance of military registered Air Systems or Air borne stores through the Maintenance Approved Organisation Scheme (MAOS).

Acceptable means of Compliance

- a. Eligibility : The organization seeking approval of DGAQA should provide evidence that either the firm is in possession or likely to receive an order from user services or MoD or any other aviators for service of military Air Systems, airborne stores and associated Ground Handling/Ground Support Equipments
- b. The applicant shall :
 - i. justify that, for a defined scope of work, an approval under this Subpart is appropriate for the purpose of showing conformity with a specific design; and
 - ii. hold or have applied for an approval of that specific services on the type of stores; or
 - iii. have ensured, through an appropriate arrangement with the applicant for, or holder of, an approval of that specific design, satisfactory coordination between maintenance, production and design.
 - iv. Possess design/manufacturing data for parts and appliances obtained through a licence agreement.
 - v. In case MRO organization and production organization are not company of India, then prior to grant of production organization approval, there should be an agreement acceptable to DGAQA.
- c. On-aircraft Maintenance and off-aircraft Maintenance **shall** only be carried out by organizations whose management, technical resources and quality assurance arrangements are adequate to provide products and services of the required quality, economically and on time.
- d. An Organisation shall be entitled to Maintain any aircraft and/or component/airborne store for which it is approved when all the necessary facilities, equipment, tooling, material, technical Information/maintenance data and certifying staff are available.

- e. Maintenance by ASMO & MO can be carried out at:-
 - i. the locations identified in the approval certificate and in the exposition or
 - ii. at another organization that is working under the quality system of the ASMO/MO or
 - iii. at any location subject to the need for such maintenance arising either from the un-serviceability of the aircraft or from the necessity of supporting occasional line maintenance, subject to the conditions specified in the exposition.
- f. In order to obtain DGAQA approval, the contractor-run organization must submit an Maintenance Organization Exposition (MOE) that defines the requested scope of approval and the procedures to which they will adhere to in order to meet the requirements
- g. The content of a typical MOE is placed in Annexure 21.G3.A1. The exposition shall be amended as necessary to remain an up-to-date description of the Air Systems Maintenance Organizations (ASMO)/Maintenance Organisation. The exposition and any subsequent amendment shall be approved by DGAQA.
- h. Work undertaken according to defined Maintenance packages and/or modification programmes at a Military-run Maintenance organization (MMO) where such work is not undertaken under its control would be regarded as “contractor-run” Maintenance and hence an organization undertaking such work will require approval and be considered as a separate ASMO and the approval through MAOS is essential.

Guidance Material

- a. Continuing Airworthiness can be carried out by Military-run Maintenance organizations (MMO) or by the Main Contractor who is involved in licensed production or the contractor-run approved Air System Maintenance organizations (ASMO).
- b. A military-run maintenance organization (MMO) does not require a MAOS approval to maintain military registered Air Systems or Airborne stores, but compliance to the various servicing schedules and maintenance procedure is to be ensured by Service HQ.
- c. In some cases ASMO or MO may require to subcontract certain maintenance tasks to firms having AS/ISO/NADCAP or equivalent approval for , but not limited to, plating, heat treatment, plasma spray, fabrication of specified parts for minor repairs / modifications, etc., with proper evaluation and control of the subcontracted item.
- d. To be appropriately approved to subcontract, the organization should have a procedure for the control of such subcontractors like pre-audit procedure, extend of use, inspection, Quality Assurance and Quality Control and Product Acceptance Procedure. In this case, the certification of maintenance release should always be endorsed under the ASMO's/MO's approval reference.
- e. The availability of qualified personal in the MRO organisation is an important aspect to issue a certificate of Air System Release. At a small organisation there is a requirement

of at least one full time person who meets the requirements for certifying staff and holds the position of Accountable Manager (Maintenance) (AM(M)), Maintenance Manager and is also certifying staff. No other person may issue a certificate of Air System release and therefore, in his absence no Maintenance may be released.

- f. The quality monitoring function may be contracted to an appropriate quality monitoring organisation or to a person with appropriate technical knowledge and extensive experience of quality audits employed on a part time basis, with the agreement of the DGAQA. It is the responsibility of the MRO organisation to comply with the findings of the contracted quality monitoring organization or the person.

21.G3.4. Application for MAOS approval

Regulation

An application for the issue or variation of Maintenance Approved Organisation Scheme (MAOS) approval should be submitted to the DGAQA along with the supporting documents proving the capability of the organisation of the applied task.

Acceptable means of Compliance

- a. On receipt of the application, DGAQA will assess the organization's need for approval and the required level of clearance.
- b. For obtaining the approval from DGAQA, the organization should confirm that it is ready to comply with the following requirements:-
 - i. Allow DGAQA and his authorized representatives to inspect the organization for initial and continued compliance with procedures and standards relating to the Maintenance of military registered Air Systems and to investigate specific problems.
 - ii. Cooperate with the DGAQA and his authorized representatives, in order that he can discharge his responsibilities for the Continuing Airworthiness of relevant military registered Air Systems.
 - iii. Give full access to those areas of the organization involved in the Maintenance of military registered Air Systems, when deemed necessary by the DGAQA.
- c. When satisfied that all conditions have been met through assessing the application and, where necessary, conducting an approval visit to the organization, the MAOS will issue an approval certificate to the Maintenance organization.

Guidance Material

- a. The firm seeking approval should apply to DGAQA Ministry of Defence , New Delhi through Regional office(whenever available) and Subsequently DGAQA detail a Team to assess the firm's capacity with respect to infrastructure, human resources, workshop facilities and existence of Quality Management System. The duty of the assessment team will be to satisfy that the firm has the capacity and resources which will facilitate it to execute the specified class and nature of work satisfactorily as per the requirements.
- b. Any organisation either government or private shall be eligible as an applicant for an approval under this Subpart provided the applicant shall justify that, has the capability and infrastructure to carryout the defined scope of work, an approval under this Subpart is appropriate for the purpose of showing conformity with a specific design and hold or have applied for an approval of that specific design or have ensured, through an appropriate arrangement with the applicant for, or holder of, an approval of that specific design, satisfactory coordination between MRO services, production and design.
- c. An organisation shall be entitled to have a ASMO/MO approval issued by the Authority when it has demonstrated compliance with the applicable requirements of AFQMS issued by DGAQA. If the infrastructure, resources and existence of an existing Quality Management System are satisfactory, a letter and Certificate of approval will be issued to the firm by DGAQA. It should be understood that the grant of 'Approval' only indicates that at the time of granting approval, the Firm's Organization fulfilled all the requirements for such approval. The Supervising Representative(s) from the DGAQA will carry out periodical assessment of the approved firm(s). The continuation of the approval will be subject to the periodical verifications showing that the required standards are being maintained.
- d. DGAQA/ Resident in-charge shall be responsible for executive Q.A. function & effective supervision on continual basis for assuring that the products/services supplied by the main contractor meet the specified requirements. Level of intervention of DGAQA and Re-verification of stages will be mutually decided based on performance of stores, its criticality and effectiveness of the firm's QMS. Conduct of Quality audits, spot checks by DGAQA shall be based on criticality of stores, areas of concern, priorities and customer complaints.
- e. A firm may be a Main Contractor for some contracts and Sub-Contractor for others. All the sub-contract / outsourcing activities will be governed as per the DGAQA Guidelines for QA during outsourcing. But whether a firm is acting as a Main Contractor or Sub Contractor, does not affect its status as an Approved Firm, provided it fulfils the necessary conditions. DGAQA involvement in subcontracts/ outsourcing activities of the Main Contractor is generally limited to critical stores.

- f. Any major non-conformity, observed in a stage prior to its delivery to the customer, shall be notified to DGAQA before taking up any action to correct the Non conformity.
- g. Main contractor top management should take serious note of the non-conformances reported by DGAQA representatives during their check stages inclusive of observations during spot/surveillance checks as these will be indicative of discrepancies in the Quality Management System of the firm.
- h. The terms of approval shall be issued as part of a organization approval. The terms of approval shall identify the scope of work, the products or the categories of Air systems and subsystems or both, for which the holder is allowed to offer MRO services under the terms of approval. Any change to the terms of approval shall be approved by DGAQA.
- i. The approval is issued for a limited duration but not less than two years and further extension is subject to periodic inspection and quality audit of the organisation.
- j. Any amendment of the approval required should be submitted to the DGAQA . In addition, the organization should notify the DGAQA of the following changes in order for the DGAQA to amend, if necessary, the approval certificate:
 - i. The ownership of the organization or its parent company.
 - ii. The name of the organization.
 - iii. The main location of the organization.
 - iv. Additional locations of the organization at which the task covered in the approval will be exercised.
 - v. Change of the Accountable Manager.

21.G3.5. Production of spare parts for repair

Regulation

The spare parts for repair shall be made in accordance with the airworthiness criteria agreed by the airworthiness authorities.

Acceptable Means of Compliance:

- a. Parts and appliances to be used for the repair shall be manufactured in accordance with production data based upon all the necessary design data as provided by the repair design approval holder as in Subpart G2 or produced by an organisation appropriately approved in accordance with Subpart G2 or produced by an appropriately approved OEM or a maintenance organisation.
- b. The embodiment of a repair shall be made by an appropriately approved maintenance organisation, or by a production organisation appropriately approved by DGAQA. The

design organisation shall transmit to the organisation performing the repair all the necessary installation instructions.

- c. A repair design may be approved subject to limitations, in which case the repair design approval shall include all necessary instructions and limitations. These instructions and limitations shall be transmitted by the repair design approval holder to the operator in accordance with a procedure agreed with DGAQA.

Guidance Material

Nil

21.G3.6. Military-run Maintenance Organization (MMO)

Regulation

A military-run maintenance organization (MMO) shall be entitled to maintain any aircraft and/or component for which it has been established to do so by the relevant Front-Line Command of the User Service.

Acceptable Means of Compliance:

- a. A Military-run Maintenance Organization (MMO) is authorised to maintain any Air System and/or airborne store (component) for which it has been established to do so by the relevant Front-Line Command.
- b. Maintenance activity carried out by an MMO should be conducted under the control of the relevant Continuing Airworthiness Management Organization (CAMO)
- c. A military-run maintenance organization (MMO) does not require a MAOS approval to maintain military registered Air Systems or Airborne stores, but compliance to the various servicing schedules and maintenance procedure is to be ensured by Service HQ.

Guidance Material

NIL

21.G3.7. Air System Maintenance Programme

Regulation

Maintenance of the Air System shall be carried out in accordance with the Air System Maintenance Programme devised by the operating services in compliance with the technical advisories/instructions/ documents issued by the designer with the concurrence with the airworthiness authorities.

Acceptable means of Compliance

- a. The operating service shall formulate an Air System Maintenance Programme based on the technical advisories/ instructions/ documents issued by the designer in concurrence

with the airworthiness authorities for maintaining the continued airworthiness of the aircsystem.

- b. Air System Maintenance Programme shall consider the resources needed to achieve such tasks in order to ensure Air System availability and compliance with Procedures.
- c. Air System Maintenance Programme shall Ensure that all Maintenance is carried out in compliance with airworthiness and operational requirements to enhance the safety of flight
- d. With regard to Air System Maintenance, the organization shall establish procedures to minimize the risk of multiple errors and capture errors on critical systems

Guidance Material

Nil

21.G3.8. ASMO/MO Support Requirements

Regulation

The Maintenance organization shall have a system appropriate to the amount and complexity of work to plan the availability of all necessary personnel, tools, equipment, material, Technical Information and facilities in order to ensure the safe completion of the Maintenance work.

Acceptable means of Compliance

- a. Maintenance organization shall have adequate management systems in place, tailored to meet the complexity of the work required in order to ensure its safe completion.
- b. The organization shall have a system appropriate to the amount and complexity of work to plan the availability of all necessary personnel, tools, equipment, material, Technical Information and facilities in order to ensure the safe completion of the Maintenance work.
- c. When it is required to hand over the continuation or completion of Maintenance tasks for reasons of a shift or personnel changeover, relevant information shall be adequately communicated between outgoing and incoming personnel. A formalised process will be developed for the same.
- d. An Accountable Manager (Maintenance) (AM(M)) shall be designated/appointed who has a basic understanding of policies and has organizational authority for:-
 - i. Ensuring that all Maintenance is carried out in compliance with policy.
 - ii. Ensuring that all necessary resources are available to accomplish Maintenance and, where applicable, support the ASMO/MO organization approval.
 - iii. Establishing and promoting the safety and quality policy in ASMO/MO organization.

Guidance Material

- a. In order to successfully complete Air System and airborne store Maintenance, an organization must consider the resources needed to achieve such tasks in order to ensure Air System availability and compliance with Procedures. If a Maintenance organization fails to undertake adequate planning or implement an appropriate system of work, which considers Human Factors, there is an increased risk of Maintenance error and risk to Airworthiness.
- b. Non-engineering staff, including Aircrew, **shall** only be permitted to undertake Air System Maintenance and/or flight servicing when authorized. Aircrew required to undertake Maintenance and/or flight servicing tasks should undertake a competence assessment prior to authorization
- c. An organization applying for approval is required to appoint a number of positions within the organization, with each having specific responsibilities, and detail them in the Exposition. Without the appointment of specific roles within a Maintenance organization, personnel leadership and management of essential functions could be compromised, thus increasing the risk of a Maintenance Occurrence and the organization operating outside its scope of work.
- d. A record of the qualification and competence assessment should be kept. The Maintenance organization should have in place procedures for:
 1. Ensuring that all personnel are competent by virtue of their training and experience for the tasks on which they are employed.
 2. Ensuring staff are trained, assessed and authorized for specific tasks.
 3. Providing initial and continuation training by a suitable organization.
 4. Maintaining a record system detailing the training and qualification of all staff.
 5. Maintaining a record of all personnel authorizations.

21.G3.9. / Quality Assurance

Regulation

ASMO /MO organisation should operate with a defined quality policy and establish a Quality Management System to deliver assurance of approved Maintenance procedures

Acceptable means of Compliance

- a. ASMO /MO organisation should have a Quality Assurance system with properly qualified staff who will hold responsibility for the MRO output of their relevant areas.
- b. The Quality Assurance system of the ASMO /MO organisation should conform to the requirements specified by DGAQA for their approval. All engineering and logistics organizations within the military air environment **shall** develop and implement a Quality Management System which, as a minimum, meets the basic requirements and principles of the ISO 9001/AS9001.

- c. Military Maintenance Organizations (MMOs) shall operate within the Air Safety Management System (ASMS) developed by the relevant Duty Holder and the applicable single-Service quality policy. Approved Air System Maintenance Organizations (ASMOs) shall establish a safety and quality policy for the organization, to be included in the Maintenance Organization Exposition (MOE).
- d. Air System Maintenance Manager(s) and/or Workshop Manager(s) will hold responsibility for the Maintenance output of their relevant areas.
- e. Quality Manager shall have the responsibility for monitoring the quality system, including the associated feedback system to Accountable Manager (Maintenance) AM(M).
- f. The organization shall follow approved procedures, taking into account Human Factors, to ensure good Maintenance practices and compliance with procedures.
 - i. An independent inspection should be carried out on Air Systems or airborne stores on occasions that include, but are not limited to, whenever Maintenance work involves disconnection, replacement, connection, assembly or adjustment. An independent inspection should be conducted by an individual suitably competent and authorized who has had no involvement with the original Maintenance task requiring the independent inspection.
 - ii. Maintenance procedures shall be established to ensure that damage is assessed and Modifications and repairs are carried out using approved Technical Information from OEM or TAA and the limits expressed within the approved Technical Information are not compromised; this will require the development of appropriate procedures, where necessary, by the organization
 - iii. Maintenance Procedures should be reviewed and updated at an appropriate periodicity to ensure that they reflect current best practice. It is the responsibility of all organizations' employees to report any unauthorized deviation from approved procedures via their organization's internal Occurrence reporting mechanisms.
 - iv. In order to prevent omissions, every Maintenance task or group of tasks should be signed-off. To ensure the task or group of tasks is completed, it should only be signed-off after completion
 - a) The organization shall establish a quality system that includes the following:
 - i. Independent audits in order to monitor compliance with required Air System/airborne store standards and adequacy of the procedures to ensure that such procedures invoke good Maintenance practices and airworthy Air System/Air System components.

1. The independence of the audit should be established by always ensuring that audits are carried out by personnel not responsible for the function, procedure or products being checked
 2. Independent audits should include a percentage of random audits carried out on a sample basis when Maintenance is being carried out.
 3. The independent audit should ensure that all aspects, are checked every 12 months, including all Sub-Contracted activities. This may be carried out as a complete single exercise or subdivided over the 12 month period in accordance with a scheduled plan. However, where findings have been identified, the particular procedure should be rechecked against other product lines until the findings have been rectified, after which the independent audit procedure may revert back to 12 monthly for the particular procedure
-
2. A quality feedback reporting system involves person or group of persons who report the quality issues ultimately to the AM(M). The AM(M) ensures proper and timely corrective action is taken in response to reports resulting from the independent audits established.
 - i. A report should be raised each time an audit is carried out, describing what was checked and the resulting findings against applicable requirements, procedures and products.
 - ii. On receiving the independent quality audit report, the relevant department(s) should rectify findings and inform the quality department or nominated quality auditor of such rectification.
 - iii. All records pertaining to the independent quality audit and the quality feedback system should be retained for at least 2 years after the date of clearance of the finding to which they refer.
 - iv. The AM(M) should hold regular meetings with staff to check progress on rectification and review the overall performance and receiving at least a half yearly summary report on findings of non-compliance.

Guidance Material

- a. Maintenance organizations within the Defence Air Environment (DAE) undertake a wide range of complex Maintenance activity on Air Systems and Air System components in the course of their duty or contract. Without a system of assurance that such Maintenance is being undertaken as per standard directed by procedures and Technical Information, the validity of any release statement may be undermined.

- b. Quality audit should monitor compliance with procedures, identifying non-compliance in an effective and timely manner in order that the organization remains in compliance with procedures and policies.

21.G3.10. Certification of Air System Release and airborne store Release

Regulation

ASMO /MO organization should have a process to certify and release of Air Systems and airborne stores post Maintenance.

Acceptable means of Compliance

- a. The Certification of Air System Release shall be endorsed by appropriately authorized certifying staff on behalf of the organization when it has been verified that all Maintenance has been properly carried out by the organization in accordance with approved procedures, taking into account the availability and use of the Technical Information, and that there are no non-compliances which are known to endanger Air Safety.
- b. The document on which the Certification of Air System Release is endorsed should relate to the Maintenance task ordered or the appropriate elements of the Air System Maintenance manual, which itself may cross-refer to other Technical Publications, Special Instructions (Technical) (SI(T)s), etc. or refer to the date such Maintenance was carried out and when the Maintenance took place relative to any life or overhaul limitation in terms of date/flying hours/cycles/landings etc. as appropriate.
- c. When extensive Maintenance has been carried out and the document containing the Certification of Air System Release summarizes this Maintenance, a unique cross-reference to the work package should be included.
- d. A document containing the Certification of airborne store Release shall be issued at the completion of any Maintenance on a component whilst off the Air System or When an airborne store is removed as serviceable from an Air System or assembly (for cannibalisation). However, Cannibalization of parts from Air Systems and uninstalled Air System equipment should be strictly controlled and documented by appropriately authorized personnel. Removal of components as serviceable from an Air System for Cannibalization purposes must only be authorized when all of the following circumstances apply:
 - i. The item is required urgently to restore another Air System to serviceable state.
 - ii. Engineering or supply personnel, as appropriate, have checked all possible sources of uninstalled spares on the Station/Ship/Unit, considered local manufacture, repair or local purchase.

- iii. A logistics demand of the appropriate priority has been placed and the delivery forecast is such that the item will not be available within the required time period.
 - iv. Where possible, if the part must be transferred between lited assemblies, including engines, the residual life on the item fitted is to be at least equal to that of the item being removed.
- e. The Certification of airborne store Release **should** be annotated with a statement confirming that the item has been inspected. In addition, the following **should** be specified:-
- i. When the last Maintenance was carried out and by whom.
 - ii. If the airborne store is unused, when the component was manufactured and by whom with a cross reference to any original documentation, which **should** be included with the certificate.
 - iii. A list of all Airworthiness Directives (ADs)/SI(T)s, repairs and Modifications known to have been incorporated or, if no ADs/SI(T)s, repairs or Modifications are known to be incorporated, then this **should** be so stated. Software implemented on the airborne store should be specified clearly giving the version number and date of installation.
 - iv. Detail of life used for service life limited parts in any combination of fatigue, overhaul or storage life.
 - v. Details, if applicable, of the airborne store's Maintenance history record, as long as the record contains details that would otherwise be required on the Certificate of Component Release. The Maintenance history record and acceptance test report or statement, if applicable, **should** be attached to the Certificate of Component Release.
- f. Items must be endorsed with a Certification of airborne store Release:
- i. Prior to transfer between Maintenance organizations.
 - ii. Prior to movement within the same Maintenance organization from one work location to another, for the purpose of further Maintenance or reinstallation.
 - iii. When the item is the subject of Cannibalization and is transferred between a Station, Ship or Unit.
 - iv. Prior to return to the supply/logistic organization for whatever reason.
- g. Components/airborne stores removed from Air Systems involved in an accident or incident (including, but not limited to heavy landings and lightning strikes) **should** only be endorsed with a specific work order including all additional tests and inspections made necessary by the accident or incident. Such a work order may require input from the CEMILAC or CEMILAC -approved Design Organization, as appropriate. This work order **should** be referenced with the Certification of Component Release.

- h. On occasions when a Maintenance activity cannot comply with relevant Technical Informations (TI), or there is insufficient resource, the Maintenance must remain incomplete. However, an operational requirement may necessitate a Maintenance activity being completed prior to resources becoming available or prior to an approved and promulgated TI amendment being issued by the TAA. In such cases, the Mil CAMO must be consulted for deferment of such Maintenance and/or deviation from the TI. If an appropriately authorized individual agrees to the deferment of Maintenance, then details of the deferment, including, where applicable, reference to such approval for deferment, **should** be entered in the technical log records and sanctioned by an authorized individual.

Guidance Material

Certifying staff shall ensure that there are no non-compliances which are known to endanger Air Safety. 'Endanger Air Safety' means any instances where safe operation could not be assured or which could lead to an unsafe condition. It typically includes, but is not limited to, significant cracking, deformation, corrosion or failure of primary structure, any evidence of burning, electrical arcing, significant hydraulic fluid or fuel leakage and any emergency system or total system failure. It does not include any Faults for which rectification has been deferred by an authorized individual. The Certification of Air System Release shall be endorsed before flight at the completion of any Maintenance on the Air System (MOD Form 700).

21.G3.11. Certifying staff

Regulation

Certifying staff hold the authorization privilege to endorse the 'Certification of Air System Release and/or Component/airborne store Release.

Acceptable means of Compliance

- a. Certifying staff are only those individuals with the specific responsibility of endorsing the 'Certification of Air System Release and/or Component/airborne store Release.
- b. The Certifying staff shall be appropriately experienced and have completed the Technical Type Training or trained by the OEM.
- c. Civil Qualification can be considered if the aircraft certified for civil use is used by the military.
- d. Military staff within an MMO will meet the eligibility criteria by virtue of their trade and rank after necessary training.

- e. For ASMO/MOs the qualification of an individual as certifying staff should be categorized according to the scope of certification privileges available and the trade boundaries within which these privileges may be exercised.
- f. Any organization undertaking component Maintenance **shall** have appropriately qualified certifying staff, to be suitably authorized for component Maintenance activities.

Guidance Material

- a. The organization shall ensure that certifying staff and support staff have an adequate understanding of the relevant Air Systems and/or components to be maintained, together with the associated organization procedures. Authorization shall be limited to those Air Systems and/or components on which they have been qualified.
- b. The organization shall establish the competence and control the authorization of personnel involved in any Maintenance, management and/or quality audits. All personnel who maintain Air Systems, Air System components and associated equipment, including contractor staff, should be trained, assessed as competent and authorized for specific tasks and roles
- c. The organization shall ensure that all certifying staff and support staff with supervisory responsibilities have at least 6 months of actual relevant Air System or component Maintenance experience in any consecutive 2 year period following initial authorization
- d. The organization shall ensure that all certifying staff and support staff receive sufficient continuation training in each 2 year period to ensure that such staff have up-to-date knowledge of relevant technology, organization procedures and Human Factor issues. The organization shall establish a programme for this purpose.
- e. The organization shall assess all prospective and current certifying staff for their competence, qualification and capability to carry out their intended certifying duties prior to the issue or re-issue of a certification.
- f. Person responsible for the quality system shall also remain responsible on behalf of the organization for issuing certification authorizations to certifying staff.

21.G3.12. Configuration Control

Regulation

The Configuration Management (CM) process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design and operational information shall be followed during the MRO activities.

Acceptable means of Compliance

- a. Technical and administrative direction and surveillance to be applied on the configuration(s) and changes to the configuration(s) of Aeronautical Products throughout their lifecycles.
- b. The CM program may be tailored to satisfy the management of design change, product conformance and product support requirements.
- c. The in-service CM process shall be an integral part of the design change process employed by the organization and satisfies the airworthiness design change certification process.

Guidance Material

Nil

21.G3.13. Maintenance Equipment and Tools

Regulation

The ASMO/MO organization shall have available and use the necessary equipment, tools and materials to perform its intended scope of work.

Acceptable means of Compliance

- a. Where the Air System Document Set (ADS) specifies a particular tool or equipment, the organization shall use that tool or equipment, unless the use of alternative tooling or equipment is agreed by the DGAQA (TAA), via approved procedures.
- b. For ASMO/MOs, such procedures shall be detailed in the Maintenance Organization Exposition (MOE).
- c. The Organisation shall ensure that it can account for any equipment, tool or material used on an Air System or component and that the Air System or component is clear of all equipment, tools and materials on completion of any Continuing Airworthiness activity.
- d. The organization should define and document a process to readily identify on which Air System or component (airborne store) any equipment, tools or materials are in-use and by whom. The whereabouts of all equipment, tools and materials should be identified
- e. The organization shall ensure that all tools, equipment and particularly test equipment, as appropriate, are controlled and calibrated according to an officially recognized standard, at a frequency to ensure serviceability and accuracy. Records of such calibrations and traceability to the standard used shall be kept by the organization.

- f. Clear system of labelling all tooling, equipment and test equipment should be employed and provide information on when the next inspection, service or calibration is due and if the item is unserviceable specify the reason of unserviceability.
- g. Any tools and equipment that the organization authorizes for use should be clearly identified and listed in a control register.

Guidance Material

NIL

21.G3.14. Military Airworthiness Review

Regulation

The ASMO/MO organization shall have Periodic Military Airworthiness Review in its intended scope of work.

Acceptable means of Compliance

- a. Military Airworthiness Review is necessary to establish conformance to the standard practices that are applicable to an Air System's Maintenance history and configuration.
- b. The Military Continuing Airworthiness Management Organization (Mil CAMO) shall ensure that a Military Airworthiness Review (MAR) is conducted for each individual military registered Air System for which they are responsible before it is flown. The adequacy of test done on system/subsystem to be verified.
- c. The MAR should consider all areas as stipulated by the Military Airworthiness Review Process; the level and depth to which the review activity in each area is conducted should be justified and recorded. For new-production Air Systems, the Statement of Acceptance (SofA) should be issued on the basis of the recognized Certificate of Conformity or civilian equivalent accompanying the airframe.
- d. For previously-used Air Systems brought on to the Military Aircraft Register, a MAR should be conducted, though any previous Certificate of Airworthiness and valid civil Airworthiness Review Certificate (ARC) or suitable Export Certificate of Airworthiness provided with the Air System may be utilized as evidence.
- e. A contractor-run Maintenance organization shall meet the specified requirements to qualify for the issue or continuation of an approval to maintain military registered Air Systems and/or components.

Guidance Material

- a. The terms 'Line' and 'Base' Maintenance are used to define specific types of Maintenance activity. These terms overlap, but are not aligned to, the military framework of 'Forward' (1st line (Squadron level), 2nd line (Wing or Lab level)) and 'Depth' (4th line (Depot or Yard level)), since Line and Base Maintenance can be carried

out in both the Forward and Depth domains. It is possible for an organization to be approved to conduct any or all types of Maintenance activities.

- b. 1st Line Maintenance is defined as any Maintenance that is carried out in the Squadron before flight to ensure that the Air System is fit for the intended flight. It may include, but is not limited to:-
 - i. Trouble shooting/fault diagnosis.
 - ii. Fault rectification.
 - iii. Component replacement with use of external test equipment if required.
 - iv. Scheduled Maintenance and/or checks including visual inspections that will detect obvious unsatisfactory conditions/discrepancies but do not require extensive in-depth inspection.
 - v. Minor repairs and Modifications, which do not require extensive disassembly and can be accomplished by simple means.
- c. Maintenance tasks which involve prolong grounding of the Air System or Airborne Component and is out of the flying for longer duration falls under the 2nd line Maintenance. Here the task is done at the same base. It may include, but not limited to:-
 - i. Schedule Maintenance of Air Systems which requires extensive dismantling.
 - ii. Major repairs and Modifications.
 - iii. Special checks
 - iv. Schedule Servicing on Air borne Components like Ejection Seat etc.
 - v. Calibration and Repair of Airborne Components.
- d. All other Maintenance Activities to the order of Overhaul or major structural Repair or Major Upgrade will fall under 4th line Maintenance. This is likely to be at a different location which can be geographical apart.

21.G3.15. Special Checks for Ageing Aircraft

Regulation

The risk to airworthiness due to the ageing of aircraft in service to be mitigated by Integrity Management through additional rigorous periodic audit of trend data, procedures and the aircraft's physical condition.

Acceptable means of Compliance

- a. The Airworthiness Authority (TAA) should initiate an independent Ageing Aircraft Audit (AAA) for each ageing aircraft fleet under their control 15 years after a type's declared In Service Date (ISD), or at the mid-point between the declared ISD and the initial planned Out of Service Date (OSD) whichever is soonest. Repeat audits should be conducted at 10-year intervals thereafter.

- b. The Ageing Aircraft Audit should cover the airworthiness and Integrity Management of the aircraft, giving particular consideration to ageing. TAAs should identify the areas to be covered by Structures, System and Propulsion Audits based on the safety consequences of potential failure and analysis of information from all available resources. During the life of an aircraft, cumulative exposure to the threats to Integrity (such as overload, fatigue, environmental/accidental damage, absence of configuration control, or maintenance/supply errors), and the risk of them interacting, increase with time and usage. Additionally, calendar-based ageing mechanisms (such as the effects of environmental ageing and degradation) can compromise Integrity
- c. Any audit activity should be completed and a report, to include recommendations, issued, within a 2-year period.
- d. It may become increasingly difficult to support ageing aircraft, as the Original Equipment Manufacturers (OEMs) may not be able to support or supply an exact replacement for an item. Effective obsolescence management becomes increasingly important for ageing aircraft.
- e. The TAA may appoint an Ageing Aircraft Audit Coordinator who is responsible for controlling the interfaces between the Audits and for coordinating the Ageing Aircraft Audit results. A list of all Audits and the demarcation between them will be included in an Ageing Aircraft Audit Coordination Document.
- f. A final Ageing Aircraft Audit Report, covering all Audits, will be produced and accepted before the Ageing Aircraft Audit can be considered complete; the Report will include recommendations. Advisers, DOs and OEMs, where contracted, may assist the TAA to interpret the Ageing Aircraft Audit report and findings. Additionally, generic aircraft airworthiness and cross-platform risks identified by the Ageing Aircraft Audit are to be reported by the TAA to the appropriate Airworthiness Management Group.
- g. The TAA will provide the recommendations in the Ageing Aircraft Audit Report and initiate appropriate follow-up action, ensuring that all identified hazards are at least tolerable and As Low As Reasonably Practicable (ALARP). The risks are to be managed via the TAA's Safety Management System. Progress against the recommendations and hazards is to be monitored by the Project Safety Working Group (PSWG) or Integrity Working Groups. The TAA may consider the benefits of producing a report on 'Lessons Identified' from the Ageing Aircraft Audit activity.

21.G3.16. Air System Maintenance Documentation, Forms and Certificates

Regulation

A complete technical history of the use of an individual Air System including significant events in the life of airframe, engines and/or modules and related products, parts and appliances to be maintained for supporting both Type and Continuing Airworthiness coverage.

Acceptable means of Compliance

- a. The DGAQA **shall** ensure that a documentation system is used to record and maintain the configuration management and technical history of an individual Air System and related products, parts and appliances.
- b. The documentation system **should** be capable of identifying the maintenance condition, usage and repair status of the individual Air System and related products, parts and appliances. The reference to Air System maintenance documents, forms and certificates includes Air System Maintenance Forms, Engineering Record Cards or any TAA approved equivalents to be identified properly.**ion**
- c. On delivery or transfer of any Air System, the Contractor shall despatch the original copies of all relevant maintenance documentation, forms and certificates (including MOD Form 700 series documents or equivalent agreed with the TAA) to the receiving unit, under following conditions:-
 - i. Original documents should not be carried in the Air System to which they refer.
 - ii. Any document bearing an original signature required to be carried on an Air System, including forms for completion by the Pilot on arrival at the destination, should be duplicated and a copy held at the despatching unit.
 - iii. All Air System engineering documentation forms transferred should be listed on a transfer document completed by the Contractor's authorized signatory. Every effort should be made to ensure that documentation for Air Systems on delivery or transfer reaches the receiving unit without delay. Documents sent by post should be registered or sent by other traceable means of despatch.
 - iv. When Air Systems and airborne stores are received by the Contractor for modification, repair, major maintenance, etc, the associated forms should also be returned. In the event of non-receipt of the forms the Contractor should advise the despatching unit who will investigate and provide the necessary information.
 - v. Closed forms for Service Air Systems and related products, parts and appliances are to be returned to the Service with the Air System on transfer (but not in any circumstances on the Air System to which they refer) for disposal in accordance with Service instructions.

Guidance Material

A complete technical history of the use of an individual Air System is required for supporting Airworthiness activities. Incorrect management of this technical history could have significant consequences. It is appropriate that a system is used to record maintenance documentation in order to maintain the configuration management and technical history.

21.G3.17. Military Continuing Airworthiness Management Organization (Mil CAMO)

Regulation

Military Continuing Airworthiness Management Organization (Mil CAMO) to use Air System Maintenance Programme (AMP) to ensure all necessary Air System corrective and preventive Maintenance is carried out before flight.

Acceptable Means of Compliance:

- a. A dedicated group within the User Services may be formed as Military Continuing Airworthiness Management Organization (Mil CAMO) for a particular Air System and this group shall function as per the Procedures laid down by the respective Services. This type of Mil CAMO does not require any approval from TAA.
- b. An Organisation outside the User Services may also be designated as Military Continuing Airworthiness Management Organization (Mil CAMO) for a particular Air System by the User Services. This Organisation shall obtain an approval from TAA subject to demonstrating adequate capability and procedures for ensuring the Continuing Airworthiness Management of its Air Systems.
- c. The Mil CAMO should ensure that prior to an Air System being released for flight, all corrective and preventive Maintenance due before the end of the planned period of operation has been completed and documented in the Air System technical log.
- d. Preventive Maintenance shall comprise flight servicing, scheduled maintenance and condition-based maintenance.
- e. Corrective maintenance includes all those maintenance activities required to return an aircraft or equipment to a serviceable state following an unscheduled arising.
- f. The minimum activity that a Mil CAMO must accomplish in order to ensure the Airworthiness of Air Systems in their Area of Responsibility. For all Air Systems within its control, the approved Mil CAMO shall:-
 - i. Develop and control an Air System Maintenance Programme, support any applicable reliability programme and propose amendments and additions to the Maintenance schedule to the Technical Airworthiness Authority (TAA).
 - ii. Manage the embodiment of Modifications and repairs.
 - iii. Ensure that all Maintenance is carried out to the required quality and in accordance with the Aircraft Maintenance Programme, and certificate of released is correct. For

this Mil CAMO should be in agreement with the work packages used by Maintenance Organisations.

- iv. The Mil CAMO should be responsible for the management and oversight of any issues arising from Maintenance including the delivery and acceptance processes. Quality Assurance system is to be set up through internal QA process or by contract cover or by formal visits to the organisation.
- v. Ensure that all applicable Service Instructions are applied.
- vi. Ensure that Military Maintenance Organizations (MMOs) or Approved Maintenance Organizations (AMOs) correctly manage Faults, reported or discovered during scheduled Maintenance.
- vii. The Mil CAMO should review Limitations/Acceptable Deferred Faults in order to assess cumulative risk and seek advice from TAA on Airworthiness risk for out-of-limits fault and damages.
- viii. Maintenance organizations are required to notify the Mil CAMO at the earliest opportunity that they have deviated from Technical Information. When a notification has been received, the Mil CAMO must, consider the implications and provide comments on the deviation with a view to advising appropriate remedial action
- ix. The Mil CAMO should report to the TAA and Military operator about any identified condition of an Air System, component or Maintenance procedure that endangers Air Safety as identified by the Mil CAMO.
- x. Co-ordinate scheduled Maintenance, the application of SI(T) and the replacement of service life limited parts. Where a service life limited part's life cannot be ascertained, the Mil CAMO must ensure that it is not used until such life can be determined, recovered or the part disposed of.
- xi. Manage and archive all Continuing Airworthiness records and the operator's technical log.
- xii. Assure that the weight and moment statement reflects the current status of the Air System. Although managed by the Mil CAMO, the Mil CAMO itself is not responsible for carrying out the weighing activity.
- xiii. The Mil CAMO should maintain oversight of Occurrence reports raised (this includes, but is not limited to: flight Safety Occurrence Reports, narrative Fault reports, Serious Fault Reports, etc) and subsequent action. It should Initiate and coordinate any necessary actions and follow-up activity highlighted by an Occurrence report.

Guidance Material

- a.* The Aircraft Commander **shall** declare an aircraft, if on continuous charge, to be unserviceable if he considers that a fault is unacceptable for further flight. The Aircraft Commander of an aircraft **shall** ensure that all faults (including pre-flight accepted faults) that become apparent while he is responsible for the aircraft are reported to the responsible maintenance organization as part of the post-flight declaration and entered in the relevant form (MOD Form 700). He **shall** also report when an aircraft under his charge has been subject to an exceedance or an incident that may be considered hazardous.
- b.* Corrective maintenance shall use the principles of 'Inspect and Repair As Necessary' (IRAN). The extent of IRAN will be based on the stores/component OEM guidelines. Further, Type Airworthiness Authorities (TAAs) shall define and promulgate the extent of corrective maintenance that is within the capabilities of Forward maintenance organizations and the arrangements for that corrective maintenance which is beyond their capabilities.

21.G3.18. Continuing Airworthiness Management Records

Regulation

Military Continuing Airworthiness Management Organization (Mil CAMO) to manage records of Continuing Airworthiness activity carried out on Air Systems and Air System components are essential for Airworthiness decision making, provides a legal record, and enables quality assurance, data exploitation and investigations.

Acceptable Means of Compliance:

- a. The Mil CAMO should ensure that all Continuing Airworthiness activity is recorded and includes, as a minimum:
 - i. Details of the Air System type, the registration mark and the date, together with:
 1. Total flight time.
 2. Total flight cycles.
 3. Total number of landings.
 4. Any other Airworthiness data specified by the Type Airworthiness Authority (TAA).
 - ii. The current Air System status, including:
 1. Status of Special Instructions (Technical)
 2. Status of Modifications and repairs
 3. Status of compliance with the Aircraft Maintenance Programme (AMP).
 4. Status of service life limited components, including life remaining.
 5. Weight and balance report.
 6. Status of deferred Maintenance and operational limitations.
 7. Symmetry check report (if required by the Air System Document Set).
 8. Status of the Military Airworthiness Review Certificate (MARC) and supporting information.
 - iii. A technical log for each Air System, including:
 1. Information about each flight, necessary to ensure continued Flight Safety.
 2. The document containing the Certification of Air System Release.
 3. The current Maintenance statement. If the Air System is declared serviceable this should include a declaration that no Maintenance is outstanding and state when the next scheduled Maintenance is due.
 4. A copy of the current MARC.
 5. List of deferred Maintenance and operational limitations.
 6. Any necessary guidance instructions on Maintenance support arrangements.
- b. The Mil CAMO should ensure that
 - i. records are maintained of all competence assessments and authorizations issued.

- ii. Maintenance records and any associated Technical Information are retained by the Maintenance organization
 - iii. Records are maintained of any Continuing Airworthiness activities and decisions taken in line with its responsibilities
 - iv. Continuing Airworthiness records are present, Can be accessed by those entitled, Can be understood, Can be trusted as being authentic and Can be disposed of when no longer required.
 - v. Documents indicate, where appropriate, the source of the record, higher authority and associated references and/or Technical Information.
 - vi. Records are presented to the Airworthiness authorities upon request.
- c. The organization shall record all details of Maintenance work carried out. As a minimum, the organization shall retain records necessary to prove that all requirements have been met for endorsing the Certification of Air System/ Component Release, including subcontractor's certificates/release documents, where applicable.
- d. Certification of Air System or airborne store Maintenance is required to provide a fully auditable record of the work carried out. When more than one person is detailed to work on a Maintenance task, each person must be identified and sign for the work they complete within that task.
- e. Following Procedures are to be in place for the management and retention of Continuing Airworthiness records.
- i. Configuration Control. Continuing Airworthiness records should be configuration controlled. Responsibility and accountability for maintaining configuration control of Continuing Airworthiness records should be specified.
 - ii. Retention of records. The Mil CAMO should ensure the retention of Continuing Airworthiness records and meets the following conditions:
 - 1. Airworthiness Information Management (AIM) records should be categorized into one of the categories detailed by the TAA in the AIM instructions and retained for at least the minimum retention periods specified for each documentation category.
 - 2. Other Continuing Airworthiness records that are classified as “significant Air Safety documentation” should be retained for a minimum of 5 years beyond the out of service date.
 - 3. Records should be stored in a manner that ensures protection from damage, alteration and theft.
 - 4. The records should remain readable and accessible for the duration of the retention period.
 - 5. Physical separation of live and backup records should be maintained.

6. Maintenance records, together with all supporting documents, should be classified as significant Air Safety documentation.
 7. Maintenance records should be retained until the work it records has been invalidated by documented work carried out subsequently (for example, Scheduled Maintenance, Depth Maintenance, Base Maintenance or equivalent Maintenance).
1. Records audit: All Continuing Airworthiness records that have been mandated for retention should be available for audit purposes.
 2. Quarantine of records: Whenever the requirement arises, the Mil CAMO should quarantine the Continuing Airworthiness records:
 - The records should be made available to Accident investigators on request.
 - Access to quarantined records, including copies and the live information system, should be controlled through a means specified by the Mil CAMO, so as not to prejudice any investigation.
 - Release of the records for full read/write access post quarantine should be strictly controlled and meet the needs of Accident investigators.
 3. Lost, corrupted or inaccurate records: The Mil CAMO should manage the actions to be taken in the event that Continuing Airworthiness records are lost, corrupted or inaccurate, to mitigate the impact on Air Safety.
 4. Records transfer: The Mil CAMO should ensure that, where a Maintenance organization terminates its operation, all retained Maintenance records are transferred to the relevant Mil CAMO, which should retain the records for the prescribed retention period. Details of the transfer should be recorded to show who effected the transfer and who receives the records.
 5. Organization closure: Where a Mil CAMO terminates its operation, all retained records should be transferred to the operating organization, unless determined otherwise by the TAA.
 6. Air System transfer: Aircraft and Equipment transfers shall be notified by means of an official allotment order. Where Continuing Airworthiness management of an Air System is transferred to another Mil CAMO, all retained records should be transferred to the new Mil CAMO. Details of the transfer should be recorded.
 7. Records disposal: The Mil CAMO should ensure that a Continuing Airworthiness records are disposed off as per existing disposal procedures. Completed hard copy records may be scanned and stored electronically, but must be subject to certification that the electronic copy is a true, legible and complete facsimile of the original.
 8. Record Reconstruction: Reconstruction of lost or destroyed records can be done by reference to other records which reflect the time in service, research of records maintained by repair facilities and reference to records maintained by individual

mechanics, etc. When these things have been done and the record is still incomplete, the Mil CAMO may make a statement in the new record describing the loss and establishing the time in service based on the research and the best estimate of time in service.

Guidance Material

NIL

21.G3.19. Instructions for Sustaining Type Airworthiness

Regulation

Instructions for continuing airworthiness post MRO servicing shall be issued with the approval of DGAQA.

Acceptable Means of Compliance:

- a. The organization shall hold and use applicable, approved and current Technical Information for performing Maintenance, including Modifications and repairs. In the case of Technical Information provided by the Military Continuing Airworthiness Management Organization (Mil CAMO), the organization shall hold such data when the work is in progress.
- b. The organization shall use a recognized procedure to timely report any errors in Technical Information used by Maintenance personnel. A record of such communications to the authorized sponsor of the Technical Information should be retained by the Maintenance organization until such time as the authorized sponsor has clarified the issue.
- c. The holder of the repair design approval shall furnish at least one complete set of those changes to the instructions for continuing airworthiness which result from the design of the repair, comprising descriptive data and accomplishment instructions prepared in accordance with the applicable requirements, to each operator of aircraft incorporating the repair.
- d. The repaired product, part or appliance may be released back into service before the changes to those instructions have been completed, but this shall be for a limited service period, and in agreement with the Authority. Those changes to the instructions shall be made available on request to any other operator required to comply with any of the terms of those changes to the instructions. The availability of some manual or portion of the changes to the instructions for continuing airworthiness, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product

has entered into service, but shall be available before any of the products reaches the relevant age or flight - hours/cycles.

- e. If updates to those changes to the instructions for continuing airworthiness are issued by the holder of the repair design approval after the repair has been first approved, these updates shall be furnished to each operator and shall be made available on request to any other operator required to comply with any of the terms of those changes to the instructions. A programme showing how updates to the changes to the instructions for continuing airworthiness are distributed shall be submitted to DGAQA.
- f. The organization shall ensure that all applicable Technical Information is readily available for use when required by Maintenance personnel. Where Technical Information is held electronically, or on microfilm/microfiche, the number of terminals to access the data should be sufficient in relation to the size of the work programme to enable easy access for supervisors, mechanics and certifying staff.

Guidance Material

- a. The Maintenance of Air Systems can be a complex and involve activity that requires the use of accurate, detailed Technical Information in order to ensure Maintenance personnel are working to current processes and procedures. Failure to use and adhere to the Technical Information published in the Air System Document Set (ADS) will adversely affect the Continuing Airworthiness of an Air System or component, increasing the likelihood of an Occurrence. This section requires a Maintenance organization to use current and approved Technical Information and to employ systems that enable the reporting of unsatisfactory features and amendments.
- b. Applicable Technical Information shall also include, but not be limited to, any of the following:
 - i. Any applicable requirement, procedure, operational directive or information issued by the authority.
 - ii. Any applicable Special Instructions (Technical) (SI(T)) or Airworthiness Directives (AD) issued by the authority
 - iii. Continuing Airworthiness instructions issued by Design Organization, or the Mil CAMO.
 - iv. Any applicable standard, such as, but not limited to, Maintenance standard practices recognized by the TAA as a good standard for Maintenance.
- c. An organization undertaking Air System and/or uninstalled engine/Auxiliary Power Unit (APU) Maintenance should hold and use the following additional Technical Information, where published:

- i. The appropriate sections of the Air System Document, including all relevant Technical Publications, or engine/APU Technical Publications, depending on the organization's planned scope of work whether a Military Maintenance Organization (MMO) or a contracted Maintenance organization seeking approval.
 - ii. Service Bulletins, Service Letters and Service instructions(SI,STI,UON,AN){Refer to Subpart L –Continued &Continuing Airworthiness}
 - iii. Modification leaflets.
 - iv. Non-Destructive Testing/Non-Destructive Inspection manual.
- d. An organization undertaking component/airborne store Maintenance, other than complete engines/APUs, should hold and use the following additional Technical Information, where published:
- i. The appropriate sections of the vendor Maintenance and repair manual relevant to the scope of Maintenance undertaken at the maintenance facility.
 - ii. MOD SI(T)s, Service Bulletins and Service Letters.
- e. An organization undertaking only specialized services (eg Non-Destructive Testing) should hold and use all applicable specialized service(s) process specifications.
- f. Maintaining the Amendment State of Technical Information: Once produced, Technical Information (TI) **shall** be maintained throughout its complete life-cycle. The organization shall establish a procedure to ensure that Technical Information is kept up to date. In the case of an ASMO using MOD-sponsored Technical Information, the ASMO shall be able to show that either it has written confirmation from the MOD that all such Technical Information is up to date, or it has work orders specifying the amendment status of the Technical Information to be used, or it can show that it is on the MOD-sponsored Technical Information amendment list.
- g. The organization (MMO/ASMO/MO) **shall** provide a common work card or work sheet system to be used throughout relevant parts of the organization, (base Maintenance, Line Maintenance, Workshops/Labs). The worksheets are to be used as follows:
- i. The organization shall either transcribe accurately the Technical Information onto such work cards or work sheets, or make precise reference to the particular Maintenance task or tasks contained in such Technical Information.
 - ii. Work cards and work sheets that are computer generated and held on an electronic database shall be subject to both adequate safeguards against unauthorized alteration and a back-up electronic database, which shall be updated within 24 hours of any entry made to the main electronic database.
 - iii. Complex Maintenance tasks shall be transcribed onto the work cards or work sheets and subdivided into clear stages to ensure a record of the accomplishment of the complete Maintenance task.

- iv. The organization shall establish processes to ensure that all work cards and/or work sheets are completed in a correct and consistent manner.
- v. In the case of a lengthy Maintenance task involving a succession of personnel completing the task, it may be necessary to use supplementary forms, work cards or work sheets to indicate what was accomplished by each individual person.

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**vi. Annexure 21.G3.A1- MAINTENANCE ORGANIZATION EXPOSITION (MOE)
CONTENT**

Part 1 – Management

- 1.1 Corporate commitment by the Accountable Manager (Maintenance).
- 1.2 Safety and Quality Policy.
- 1.3 Management personnel.
- 1.4 Duties and responsibilities of the management personnel.
- 1.5 Management organization chart.
- 1.6 List of certifying staff and support staff.
- 1.7 Manpower resources.
- 1.8 General description of the facilities at each address intended to be approved.
- 1.9 Organization's intended scope of work.
- 1.10 Notification procedure to the TAA regarding changes to the organization's activities/approval/location/personnel.
- 1.11 Exposition amendment procedures including, if applicable, delegated procedures.

Part 2 – Maintenance Procedures

- 2.1 Supplier evaluation and subcontract control procedure.
- 2.2 Acceptance/inspection of aircraft components and material from outside contractors.
- 2.3 Storage, tagging and release of aircraft components and material to aircraft maintenance.
- 2.4 Acceptance of tools and equipment.
- 2.5 Calibration of tools and equipment.
- 2.6 Use of tooling and equipment by staff (including alternate tools).
- 2.7 Cleanliness standards of maintenance facilities.
- 2.8 Maintenance instructions and relationship to aircraft/aircraft component manufacturers' instructions, including updating and availability to staff.
- 2.9 Repair procedure.
- 2.10 Aircraft maintenance programme compliance.
- 2.11 Procedure for complying with Special Instructions (Technical) and Airworthiness Directives, as applicable.
- 2.12 Optional modification procedure.
- 2.13 Maintenance documentation in use and completion of same.
- 2.14 Technical record control.
- 2.15 Rectification of faults arising during maintenance.

- 2.16 The procedure for endorsing the Certification of Aircraft/Component Release or issuing a Certificate of Maintenance.
- 2.17 Records for the MOD.
- 2.18 Reporting of faults to the Technical Airworthiness Authority(TAA)/Continuing Airworthiness Management Organization (CAMO).
- 2.19 Return of faulty aircraft components to store.
- 2.20 Faulty components to outside contractors.
- 2.21 Control of computer maintenance record systems.
- 2.22 Control of man-hour planning versus scheduled maintenance work.
- 2.23 Control of critical tasks.
- 2.24 Reference to specific maintenance procedures such as:
 - 2.24.1 Engine running procedures.
 - 2.24.2 Aircraft pressure run procedures.
 - 2.24.3 Aircraft towing procedures.
 - 2.24.4 Aircraft taxiing procedures.
- 2.25 Procedures to detect and rectify maintenance errors.
- 2.26 Shift/task handover procedures.
- 2.27 Procedures for notification of technical information/maintenance data inaccuracies and ambiguities, to the TAA/CAMO.
- 2.28 Maintenance planning procedures.

Part L2 – Additional Line Maintenance Procedures

- L2.1 Line maintenance control of aircraft components, tools, equipment etc.
- L2.2 Line maintenance procedures related to servicing/fuelling/de-icing etc.
- L2.3 Line maintenance control of faults and repetitive faults.
- L2.4 Line procedure for completion of technical log.
- L2.5 Line procedure for pooled parts and loan parts.
- L2.6 Line procedure for return of faulty parts removed from aircraft.
- L2.7 Line procedure control of critical tasks.

Part 3 – Quality System Procedures

- 3.1 Quality audit of organization procedures.
- 3.2 Quality audit of aircraft and/or components.
- 3.3 Quality audit remedial action procedure.
- 3.4 Certifying staff and support staff qualification and training procedures.
- 3.5 Certifying staff and support staff records.
- 3.6 Quality audit personnel.
- 3.7 Qualifying inspectors.
- 3.8 Qualifying mechanics.

- 3.9 Aircraft or aircraft component maintenance tasks exemption process control.
- 3.10 Concession control for deviation from organization's procedures.
- 3.11 Qualification procedure for specialized activities such as NDT, welding, etc.
- 3.12 Control of manufacturers' and other maintenance working teams.
- 3.13 Human Factors training procedure.
- 3.14 Competence assessment of personnel.
- 3.15 Compliance matrix.

Part 4 – Outsourced Operations

- 4.1 Contracted operators.
- 4.2 Operator procedures and paperwork.
- 4.3 Operator record completion.

Part 5 Miscellaneous Items

- 5.1 Sample of documents.
- 5.2 List of sub-contractors.
- 5.3 List of line maintenance locations.
- 5.4 List of contracted organizations.

SUBPART H –CERTIFICATES OF AIRWORTHINESS (CoA) FOR AIR SYSTEMS AND AIRBORNE STORE

Rationale:

Prior to delivery to the user services for operational use or for carrying out development flight trials, DGAQA is responsible to establish the compliance of the Air Systems and Airborne Stores to the baseline configuration approved by CEMILAC and ensure the state of Airworthiness. This baseline is the fundamental starting point for all subsequent Military Airworthiness Reviews. Configuration variations will occur throughout the development and operational life cycle of an Air System and failure to understand its configuration will make Continuing and continued Airworthiness difficult. This Regulation brings out the format in which the Airworthiness assurance agencies certifies that each of the Air Systems and Airborne Stores during design and development or after production or maintenance are compliant to Approved Baseline Configuration and performance requirements.

Contents:

- 21.H.1 Applicability**
- 21.H.2 Certificate of Airworthiness (CoA)**
- 21.H.3 Eligibility**
- 21.H.4 Application for CoA**
- 21.H.5 CoA for development Flight Trials of Air System and Airborne Stores**
- 21.H.6 CoA for Production of Air System and Airborne Stores**
- 21.H.7 Duration and continued validity**

21.H.1 Applicability

Regulation

Every Air System / Airborne store released to user services or to a flight test agency shall hold a Certificate of Airworthiness (CoA) issued by DGAQA or the designated Quality Assurance agencies of the User Services.

Acceptable Means of Compliance

- a. This Sub Part is on the issue of Certificate of Airworthiness is applicable in the following categories:
 - i. Release of Air Systems / Airborne stores for any development flight trial activities
 - ii. Release of the Air Systems/ Airborne Stores to the services during the limited series or bulk production phase.
- b. Release of the Air Systems/ Airborne Stores to the services after the completion of any modification or upgradation or maintenance activities.

Guidance Material

Nil

21.H.2 Certificate of Airworthiness (CoA)

Regulation

Certificate of Airworthiness (CoA) is an endorsement by appropriately authorized certifying staff on behalf of the organization or by DGAQA, when it has been verified that each of the Air System/Airborne Store released under 21.H.1 conforms to the finalised / certified baseline configuration and is in an acceptable state of Airworthiness.

Acceptable Means of Compliance

- a. During Design and Development phase:
 - i. The CoA for a Proto type Air System is issued in the form of the Certificate for Safety of Flight – F-1090 by DGAQA after ensuring that the configuration is in accordance with approved baseline documents and that there are no non-compliances which are known to endanger Flight Safety for every developmental flight trials under taken by the Main Contractor.
 - ii. The CoA for a Proto type Airborne Store is issued in the form of an Inspection Note before integration on an Airsystem by DGAQA or head of the Quality department of the main contractor authorised by DGAQA for an airborne store after ensuring all developmental activities are properly carried out by the organization in accordance with approved procedures and airborne store is in an acceptable state for safe flight.
- b. During production phase:
 - i. A Certificate for Safety of Flight – F-1090 for an Air System is issued by DGAQA after ensuring all production activities are properly carried out by the organization in accordance with approved procedures, for every flights including ferry flights under taken by the Pilots of Main contractor and also by the User Pilots
 - ii. A Form 423 is issued by the Main Contractor with the details of their advice and inspection Note on which Serviceability of equipment mentioned there in is Certified by DGAQA.
 - iii. A release Note will be issued by DGAQA or head of the Quality department of the main contractor authorised by DGAQA for an airborne store after ensuring all production activities are carried out by the organization in accordance with approved baseline configuration & procedures and the Airsystem/Airborne store is in an acceptable state of Airworthiness.
- c. During Service Operation: During the Operational phase of an Air System in Indian Defence Services, CoA is managed by the respective Services in their own Forms & Procedures (eg: MOD Form 700 used in Indian Air Force)

Guidance Material

- a. Refer Subpart P on flight testing for the details Form 1090, Certificate of Flight safety issued during development and Production.
- b. DGAQA directive on Certificate of Safety for Flight dated 05-01-2016 and Technical Standing Order (TSO) issued by DGAQA.

21.H.3 Eligibility

Regulation

Organisations which has demonstrated its capability for design, development and Production of an Air system/airborne store with the TAA shall be eligible to apply for a CoA.

Acceptable Means of Compliance

- a. Any organisation which is involved in the design and development of Military Air Systems or Airborne Stores shall hold a relevant Organisation Approval (DOA) under provisions mentioned at Subpart G1 for such kind of Air Systems or Airborne Stores.
- b. Any organisation who intends to produce Military Air Systems or Airborne Stores shall hold a relevant Production Organisation Approval (POA) under provisions mentioned at Subpart G2 for the production of such kind of Air Systems or Airborne Stores.
- c. An organisation who holds a valid Military Type Certificate (MTC)/Restricted MTC/Type Approval/ LoA/ IMTSoA or an organisation which holds a license for the production of such Air Systems or Airborne Stores obtained through a License Agreement (through Transfer of Technology) can apply for a Certificate of Airworthiness from DGAQA.

Guidance Material

Nil

21.H.4 Application for CoA

Regulation

Pursuant to IMTAR 21.H.3, an application for an airworthiness certificate shall be made in a form and manner established by DGAQA.

Acceptable means of Compliance

- a. Each application for a certificate of airworthiness shall include:
 - i. For Newly designed and developed Aircraft following documents shall be submitted:
 1. A copy of MTC/RMTC&License agreements for production if any and Organisation approval Certificates from TAA
 2. A Statement of conformity to applicable Type Certification Data Sheet (TCDS).
 3. A workdone report on the activities carried out duly coordinated by the respective QA Agencies.

4. A weight and balance report with a loading schedule
 5. The flight manual and any other manuals required by the Authority of the State of registry
- ii. For a modified /upgraded Aircraft in addition to the above documents following documents shall be submitted:
1. Historical records to establish the production, modification, and maintenance standard of the aircraft, including all limitations associated with a restricted certificate of airworthiness.
 2. Records showing the total life consumed by each installed life-limited aircraft, engine and propeller component
 3. details of any major structural and life-limited component changes made to items such as wings and tail plane, and a summary of the individual histories of such components, unless new when fitted.
 4. details of any accidents or incidents in which the aircraft has been involved
 5. details of any major repairs or modifications performed on the aircraft, engines and propellers and verification that they have been properly approved and incorporated
- iii. For a newly manufactured air borne stores following documents shall be submitted.
1. A copy of TA/LoA/TSOA, License agreements for Production if any and Organisation approval Certificates from TAA
 2. Statement of conformity to approved baseline configuration.
 3. Acceptance Test Procedure and Reports duly coordinated by DGAQA along with work done reports on all the activities carried out by the respective authorised Quality Assurance Personnel.

Guidance Material

- a. Refer Subpart P on flight testing for the details Form 1090, Certificate of Flight safety issued during development and Production.
- b. DGAQA directive on Certificate of Safety for Flight dated 05-01-2016 and Technical Standing Order (TSO) issued by DGAQA.

21.H.5 CoA during the Design and Development of Air System and Airborne Stores

Regulation

All Military Air Systems and Airborne stores released for developmental / Experimental Flights shall hold a Certificate of Airworthiness indicating Flight Safety.

Acceptable Means of Compliance

- a. A Certificate for Safety of Flight -Form 1090 shall be issued by DGAQA for every developmental flight trial of a prototype Air System carried out by the Main Contractor.
- b. CEMILAC approved Flight Clearance Note (FCN) of an Air System and Flight Plan Coordination Memo (FPCM) for a Sortie shall be the basis for the approval of Form 1090.
- c. A detailed workdone report(D-form) on the activities, tests and inspections carried out, limitations if any, shall be prepared by the authorised QA personnel and shall be duly coordinated by DGAQA. The D-form shall be a pre-requisite for approval of Flight Plan Coordination Memo (FPCM) by CEMILAC.
- d. A serial number wise Inspection Note has to be issued by DGAQA for an airborne store undergoing developmental flight based on Flight Clearance issued by the CEMILAC.

Guidance Material

Refer Subpart 'P' Flight Testing of Air Systems &airborne stores.

21.H.6 CoA during the Production&Maintenance of Air System and Airborne Stores

Regulation

Military Air Systems or Airborne Stores released after Production or Maintenance from Main Contractor/Organisation to user services shall hold a valid CoA issued by DGAQA

Acceptable Means of Compliance

- a. Certificate for Safety of Flight – F-1090 for an Air System is issued by DGAQA after ensuring all production activities are properly carried out by the organization in accordance with approved procedures, for every flights including ferry flights undertaken by the Pilots of Main contractor and also by the User Pilots.
- b. Form 423 is issued by the Main Contractorfor an Air System Manufactured or Maintained with the details of their advice and inspection Note on which Serviceability of equipment mentioned there in is Certified by DGAQA.
- c. A release Note will be issued by DGAQA or head of the Quality department of the main contractor authorised by DGAQA for an airborne store after ensuring all production or

Maintenance activities are properly carried out by the organization in accordance with approved procedures and airborne store is in an acceptable state of Airworthiness

Guidance Material

Refer Subpart 'F' Production of Air Systems &airborne stores.

21.H.7 Duration and continued validity

Regulation

A Certificate of Airworthiness (CoA) may be issued for an unlimited duration except for F-1090

Acceptable Means of Compliance:

- a. CoA remain valid subject to:
 - i. Compliance with the applicable type-design, airworthiness directives and instructions for continuing airworthiness; and
 - ii. The aircraft remaining on the same register;
 - iii. The type-certificate or restricted type-certificate under which it is issued not being previously invalidated under IMTAR Subpart B.
 - iv. The certificate not being surrendered or revoked by the Authority of the State of registry.
- b. Validity of F-1090 is for a particular flight conducted in a day or in exceptional cases if no flight carried out on that day, validity may be extended for next day based on satisfactory DI conducted by authorised QA personnel of the Main Contractor in consultation with DGAQA.

SUBPART I: RESEARCH AIRSYSTEMS AND AIRBORNE STORES

Rationale

It may be required to prove and demonstrate innovative/novel technologies of an airsystem/airborne stores, without any requirement for the type design to be produced and inducted into the user services for regular operations. A Qualitative Staff Requirement does not exist, however, a systematic certification approach is still essential to ensure the airworthiness of the airsystem/airborne store for its demonstration trials.

Content:

- 21.1.1. Declaration by Main Contactor**
- 21.1.2. No Objection by the User Services**
- 21.1.3. Application by the Main Contractor**
- 21.1.4. Identification of authorization of Personnel/Group**
- 21.1.5. Airsystem /Airborne store Development Life Cycle process**
- 21.1.6. Documentation**
- 21.1.7. Audit**
- 21.1.8. Failure Reporting**

21.1.1. Declaration by Main Contractor

The main contractor to declare that the Airsystem/Airborne Store is for research purposes or demonstration of technology and shall not be delivered for regular operation by the User Services.

Acceptable Means of Compliance

A Letter of declaration from Main Contractor to TAA.

Guidance Material

A Qualitative Staff Requirement does not exist.

21.1.2. No Objection from User Services

If personnel from the User services are to be involved at any point in the development, then a No Objection from user services to be obtained regarding the Non-Involvement of TAA.

Acceptable Means of Compliance

No Objection letter from user services

Guidance Material

NIL

21.1.3. Application by the Main Contractor

Main contractor shall apply / inform to TAA for involvement of TAA or self certification by the Main contractor.

Acceptable Means of Compliance

- a) Details of the project
- b) No Objection from user services as compliance to 21.1.2

Guidance Material

NIL

21.1.4. Identification of Authorization of Personnel / Group

The main contractor shall identify designated personnel / group as authorizing members to perform the role of TAA i.e the roles of CEMILAC & DGAQA.

Acceptable Means of Compliance

- a) List of authorized personnel and their roles & responsibilities to be provided to TAA by the Head of Main Contractor.
- b) The List shall also contain the signatures of the authorized personnel.

Guidance Material

The Airworthiness Certification Plan may be used to define the roles and responsibilities of the individuals in the development.

21.1.5. Airsystem/Airborne Store development Life cycle

The Design and Development of the airdesign/airborne store shall follow the regularization of Subpart B (B1,B2,B3,B4) for airdesigns and Subpart C for airborne stores, as applicable.

Acceptable Means of Compliance

- a) Compliance to Subpart B
- b) Compliance to Subpart C

Guidance Material

The roles of TAA may be replaced by the members as identified at 21.1.4.

21.1.6. Documentation

The Main contractor shall prepare & maintain the documentation of the development, duly signed by authorized signatories.

Acceptable Means of Compliance

NIL

Guidance Material

A structured cataloguing and archiving system may be followed, that facilitates in retrieving the relevant information to be presented to TAA upon request.

21.1.7. Audit

The process may be audited by TAA if required during the development. The Main contractor to facilitate the auditing process.

Acceptable Means of Compliance

- a) List of documents prepared may be provided to TAA.
- b) Identified documentation may be provided to TAA upon request.
- c) Participation of TAA in reviews, if required, as observers.

Guidance Material

- NIL-

21.1.8. Failure Reporting

The Main Contractor shall have Failure Reporting, Analysis and Corrective Action System to report and resolve the defects/failures during development.

Acceptable Means of Compliance

- d) A Defect Investigation Team need to be established at the main contractor premises in consultation with TAA.
- e) Defects/Failures to be properly documented and traced.
- f) All configuration control measures should be followed for any amendments.

Guidance Material

Nil

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SUBPART K - INDIGENOUS SUBSTITUTIONS OF AIRBORNE STORES

Rationale

Occasions may arise when the Airborne Stores such as Airborne Equipment, Materials or Standard Parts, which were hitherto bought out from a foreign source and used on an aircsystem or within the other airborne stores may have to be designed and developed within the country for the sake of self-reliance, to obviate obsolescence etc. Indigenous substitution of such airborne equipment, materials and Aircraft Standard parts are discussed in this regulation. This regulation provides the detailed procedures for development, prototyping, testing, evaluation, approval and production of such items being used as indigenous substitutions. The indigenous substitution can be undertaken by any agency i.e. Public Sector, Private Sector, Government Agencies, or organisations within user services such as Base Repair Depots (BRDs), Naval Aircraft Yards (NAYs) etc.

Contents

- 21.K.1. Applicability**
- 21.K.2. Indigenization Agency**
- 21.K.3. Responsibilities of Indigenization Agency**
- 21.K.4. Local Type Certification Committee (LTCC)**
- 21.K.5. Criticality Classification of Airborne Stores by LTCC**
- 21.K.6. Airworthiness Certification Approach**
- 21.K.7. Airworthiness Certification of Non-Critical Airborne Stores by LTCC**
- 21.K.8. Airworthiness Certification Plan (ACP)**
- 21.K.9. Quality Assurance Plan (QAP)**
- 21.K.10. Development and Prototyping Phase**
- 21.K.11. Test and Evaluation Phase**
- 21.K.12. Deviations**
- 21.K.13. Airworthiness Clearance**
- 21.K.14. Production of Non-Critical Airborne Stores for Indigenous Substitution**
- 21.K.15. Withdrawal of Airworthiness Clearance**

Regulatory Articles (RAs):

21.K.1. Applicability

Regulations

- a. Substitution of Airborne Stores such as Airborne Equipment, Materials or Standard Parts bought out from a foreign source with indigenously developed airborne stores shall only be covered in this subpart.
- b. Substitution of an indigenously developed airborne stores with another indigenous airborne store shall be not covered in this subpart and shall be handled using the policy provisions given in Chapter-1, Part-II of DDPMAS_Policy document and associated regulations given in Sub Part – C on Ab-initio developed airborne stores.
- c. Indigenous substitution for ground based systems such as TTGEs / Test Rigs etc. shall be outside the purview of this regulation and shall be separately handled by TAA on case to case basis.

Acceptable Means of Compliance

- a. All types of airborne stores such as airborne equipment, materials, standard parts etc. can be taken up for indigenous substitution.
- b. For the purpose of indigenous substitution, SRUs such as modules, assembled components (like PCB assembly, Power Supply modules etc) also shall be treated as an airborne store and shall be handled using these policy provisions.
- c. On obtaining necessary approvals from TAA/LTCC, Indigenized airborne store shall be listed as an alternate item in the approved build standard of the Air System on which the indigenized store has to be used.

Guidance Material

Indigenous substitution process should ensure that functionality, safety, and reliability of the indigenized airborne store is adequately verified and validated according to the airworthiness standards applicable.

21.K.2. Indigenisation Agency

Regulations

- a. Indigenous substitution can be taken up by any agency i.e, Public Sector, Private Sector, Government Agencies or the Organizations within the User Services responsible for indigenization activities such as BRDs, NAYs etc., hereinafter referred as the Indigenization Agency (IA).
- b. The IA shall follow the Design Approved Organization Scheme given in the DDPMAS_Policy and the associated regulations given in **Sub Part G1**.

Acceptable Means of Compliance

Approval for the IA as per the DAOS.

Guidance Material

NIL

21.K.3. Responsibilities of Indigenisation Agency

Regulations

- a. The IA shall be responsible for design, development and production of the indigenized airborne stores. In case, some of these activities are achieved by way of sub-contracting to suitable vendors, the IA shall ensure that the vendors comply with the airworthiness certification requirements.
- b. The IA shall ensure that there is no violation of Intellectual Property Rights (IPR) & related issues.
- c. The Indigenization agency shall ensure that, requisite Specifications / Qualitative Requirements/Service Requirements for the airborne store to be indigenized based on the specific requirements from the users, are available.
- d. IA shall ensure the availability of necessary test facilities at all the applicable levels at which testing is envisaged.
- e. IA shall identify the Authorized Holder of Sealed Particulars (AHSP) for the airborne store.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.4. Local Type Certification Committee (LTCC)

Regulations

- a. LTCC shall be constituted at RCMA / CEMILAC with relevant stakeholders and it shall assess & classify the airborne stores to be indigenously substituted based on their criticality.
- b. Upon consideration, LTCC shall refer the critical airborne stores to RCMA/CEMILAC for clearance. Non-critical airborne stores shall be cleared by LTCC itself.
- c. The composition of LTCC shall be as follows:

Chairman:	CRE/RD of the RCMA, CEMILAC
Members:	Head of Indigenization, IA Representative of the Design Department of IA Head of Quality Department of IA Domain Expert to be nominated by RCMA/CEMILAC DGAQA Representative User Representative
Member:	Rep RCMA/CEMILAC
Secretary	

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.5. Criticality Classification of Airborne Stores by LTCC

Regulation

LTCC is empowered to classify airborne stores as Critical and Non-Critical. The approach to airworthiness certification including the extent of testing would depend on the criticality of the airborne store.

Critical: Airborne store, whose malfunctioning may affect safety, reliability, maintenance, interchangeability and operational effectiveness is called as a critical airborne store.

Non-Critical: Airborne store, which is not classified as critical, is treated as non-critical.

Acceptable Means of Compliance

Criticality classification report by the LTCC.

Guidance Material

NIL

21.K.6. Airworthiness Certification Approach

Regulations

- a. The airborne stores, identified to be critical by the LTCC, shall be referred to RCMA/CEMILAC for progressing the airworthiness certification activities leading to

clearance as per Chapter-1, Part-II of the DDPMAS_Policy document applicable to ab-initio development of airborne stores and associated regulations as given in Sub Part-C.

- b. The airborne stores, identified to be non-critical by the LTCC, shall be provided with the airworthiness certification coverage leading to its clearance by the LTCC itself.

Acceptable Means of Compliance

- a. Airborne Store Clearance by CEMILAC for critical airborne stores.
- b. Airborne Store Clearance by LTCC for non-critical airborne stores.

Guidance Material

NIL

21.K.7. Airworthiness Certification of Non-Critical Airborne Stores by LTCC

Regulation

The broad approach to be followed by the LTCC for airworthiness certification of non-critical airborne stores shall be as outlined here from Section 21.K.8 to 21.K.15 which is on similar lines as that followed by CEMILAC for ab-initio development of airborne stores.

Acceptable Means of Compliance

Airborne Store Clearance by LTCC for non-critical airborne stores.

Guidance Material

NIL

21.K.8. Airworthiness Certification Plan (ACP)

Regulations

- a. IA shall prepare an Airworthiness Certification Plan (ACP) bringing out the design & development details of the airborne store along with the involvement of TAA and other stakeholders at various stages. This plan shall be approved by CEMILAC.
- b. ACP shall cover the details of the proposed Means of Compliance such as safety assessment, design reviews, analysis, simulation, inspection and testing like functional & qualification testing, rig Integration checks, ground & flight test as applicable on the prototype airborne store.

Acceptable Means of Compliance

ACP duly approved by CEMILAC.

Guidance Material

NIL

21.K.9. Quality Assurance Plan (QAP)

Regulation

IA shall prepare a Quality Assurance Plan (QAP) bringing out the stages of development, QA roles, delegation related to the Air borne stores along with the involvement of TAA and other stakeholders at various stages. This plan shall be approved by DGAQA.

Acceptable Means of Compliance

QAP duly approved by DGAQA.

Guidance Material

NIL

21.K.10. Development and Prototyping Phase

Regulations

- a. Technical specifications for the airborne store shall be prepared by the IA and provided to CEMILAC for approval. The items for which technical specification from the OEM is available, the same can be used as the basis. However, adequacy of OEM specification shall be ensured by the IA in consultation with CEMILAC and addendum (if any) shall be incorporated accordingly. For the cases for which no technical details are available, the technical specifications shall be prepared by the IA on its own.
- b. Development of airborne store shall be carried out as per identified System Engineering Process leading to finalization of Standard of Preparation (SOP) and fabrication of prototypes.
- c. Technical reviews at appropriate stages of development shall be conducted with the participation of relevant stake holders.
- d. IA shall establish appropriate processes for Configuration Control and Defect Investigation during all the phases.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.11. Test and Evaluation Phase

Regulations

- a. Functional and Performance Testing: Adequate functional and performance testing for the airborne stores shall be carried out at appropriate levels using testers / simulators and rigs, as applicable.
- b. Qualification Testing: Qualification test plan shall be proposed by the designer of the airborne store in accordance with the technical specification of the airborne store. If the qualification testing details of the airborne store to be indigenously substituted are available from its OEM, the same can be used as the basis.
- c. The qualification test plan shall be approved by CEMILAC.
- d. Qualification tests shall be carried out at NABL/ Govt approved test houses / Laboratories as far as possible.

Qualification tests shall be witnessed by the internal quality assurance group of the IA. IA shall ensure witnessing of tests by DGAQA, if considered necessary by them. Qualification test results from these test houses/ laboratories shall be coordinated by DGAQA for their acceptance for issuance of clearance.

- e. Flight Testing: In regard to airborne stores where flight tests are required for their evaluation, views of the end users shall be taken into consideration before finalizing the flight test plan. Flight Test Plan shall be prepared by the IA and approved by CEMILAC. Clearance for undertaking development flight testing shall be issued by CEMILAC as per the regulations given in **SUBPART P**.

Acceptable Means of Compliance

- a. QTP approved by CEMILAC
- b. QT Results coordinated by DGAQA and Compliance to QTP
- c. Flight Test Plan approved by CEMILAC

Guidance Material

NIL

21.K.12. Deviations

Regulation

The deviations / defects observed if any, during the course of indigenous substitution shall be discussed in the LTCC and the agreed corrective action shall be implemented by the IA.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.13. Airworthiness Clearance

Regulation

Airworthiness clearance for the non-critical airborne stores shall be issued by the LTCC. The clearance for critical airborne stores shall be issued by CEMILAC.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.14. Production of Non-Critical Airborne Stores for Indigenous Substitution

Regulations

- a. IA shall produce the airborne store as per the Standard of Preparation released as a part of clearance process.
- b. Quality Assurance aspects during production shall be ensured by DGAQA.
- c. Production Quality Test / Acceptance Tests: IA shall conduct the necessary tests (PQT & AT) on the airborne store produced as per the schedule finalized mutually between IA and DGAQA.
- d. Production Deviations: Deviations in the production shall be addressed through a Non-Conformance Review Process (NCRP).
- e. Modifications: Modifications to the approved SOP shall be handled through a Configuration Control Process (CCP) with relevant stakeholders by the IA. Procedure for modifications during production and in-service phase shall be as given in **Subpart L**.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.K.15. Withdrawal of Airworthiness Clearance

Regulation

If the conditions of clearance of the indigenously substituted airborne stores are not satisfied or the field performance as per the feedback provided by users is not satisfactory, the clearance issued earlier may be withdrawn by LTCC after due investigation with the involvement of CEMILAC, DGAQA and IA.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

DRAFT

SUBPART L - CONTINUED & CONTINUING AIRWORTHINESS

Rationale:

Continued Airworthiness incorporates all the tasks to be carried-out to verify that the conditions under which a type certificate has been granted continue to be fulfilled at any time during its period of validity. Once an airsystem enters the in-service phase, the focus is to ensure that airworthiness of the design is sustained throughout the operational life. This subpart address the continued airworthiness activities like defect investigation, issue of service instructions, incident and accident investigation, lifing & life extension, modification and upgrades. That apart, the requirements for Operational/Continuing Airworthiness is also listed.

Contents:

21.L.1 Applicability

21.L.2 Operational Failure Reporting, Analysis and Corrective Action System

21.L.3 Service Instructions

21.L.4 Incident and accident investigation

21.L.5 Lifing and Life Extension

21.L.6 Modifications and Upgrades

21.L.7 Continuing Airworthiness

21.L.1 Applicability

Regulation

This sub-part applies to all the aircsystems and airborne stores that have entered service.

Acceptable Means of Compliance

- a. The sub-part shall include the aircsystem, airborne stores, the TTGE (used during maintenance, servicing and operation).
- b. This sub-part shall be applied to the aircsystems and airborne stores are produced under initial airworthiness clearances, license manufactured and bought out air systems and airborne stores.

Guidance Material:

The main-contractor and the services may establish mechanisms for ensuring that the aircsystems and the airborne stores that are operated, continue to be airworthy.

21.L.2 Operational Failure Reporting, Analysis and Corrective Action System

Regulation

The main contractor shall form a mechanism involving all the stake-holders for analysis of user reported failures and evolving corrective and preventive actions.

Acceptable Means of Compliance

- a. The user services shall forward the defective items to the main contractor as per the established mechanisms by the services.
- b. The main contractor shall collect, analyze and plan corrective and preventive actions for failures. The failure data and the analysis reports shall be reported to the Service HQ and TAA periodically not exceeding 6 months.

Guidance Material

- a. The services may send the defective items through PWR, DI or other mechanisms established between the Service HQ and main contractor.
- b. Defect investigations are carried out to ensure that the causes of the defects are properly identified to introduce remedial measures. The Chief of Quality Assurance Department may constitute Defect Investigation Committee (DIC) to review the defect data. The committee shall meet at least once in a month for analysing all defect investigations and review of the necessary remedial measures.

c. A database of all defects and incidents reported by Service Headquarters may be maintained by the contractor firm. The main contractor to carry out, periodically, a trend analysis of all the defects/failures that have been investigated by the contractor firm. Copies of such trend analysis shall be circulated to Service Headquarters and TAA. The process may identify High Failure Rate Aggregates (HFRA) and take high priority actions to address them.

21.L.3 Service Instructions

Regulation

The main contractor, during the course of production and in-service phase, shall issue applicable instructions required for continued airworthiness of an air system or airborne store. Such instructions shall be approved by TAA.

Acceptable Means of Compliance

- a. The main contractor shall issue continued airworthiness instructions through one of the following types:
- i. Urgent Operating Notice (UON) / Alert Notice
 - ii. Servicing Instructions (SI)
 - iii. Special Technical Instructions (STI)
 - iv. Service Bulletins (SB)

Guidance Material

- a. UONs are normally issued by the contractor firm duly co-ordinated by RCMA and flight test department of the contractor firm. These are to be promulgated immediately by Service Hqrs.
- b. The SBs are issued either by the licensor in the case of bought out equipment used on the aircraft or the contractor firm.
- c. STIs and SIs, prepared by the main contractor are coordinated by CEMILAC and forwarded to Service Headquarters. STIs and SIs are issued by the Service Headquarters to the respective Squadrons, Bases and Maintenance Organisation of the Services.

21.L.4 Incident and Accident investigation

Regulation

The user services shall provide necessary incident/accident information to the TAAs for air systems where Indian TAA have provided Certification and QA coverage.

Acceptable Means of Compliance

- a. The user services to forward the relevant data to Main Contractor, CEMILAC and DGAQA that are required for studying and mitigating the technical and quality related issues leading to the incident / accident.

Guidance Material

The user services may involve the TAA during the incident/accident information. This gives the TAA the first hand information on the incident/accident. If, for any reasons, the TAA could not be present for the incident/accident investigation, the User services may share the relevant details required for CEMILAC and DGAQA to study the reasons for failures and incorporate remedial actions.

21.L.5 Lifing and Life Extension

The main contractor shall carry out periodic assessment of the initial assigned life with the involvement of all stake holders, Service Hq and TAA

Acceptable Means of Compliance

- a. The main contractor shall formulate a lifing plan document as a part of TCDS/Type Record. The plan document shall identify the items for lifing and the lifing policy to be followed. The lifing aspects of the aircraft and the airborne stores shall be finalized with the approval of the TAA.
- b. The main contractor shall constitute a Lifing Committee with CEMILAC as chairman with members from User representatives, DGAQA and other stake-holders to review and approve the update to the initial life in a progressive manner.

Guidance Material

- a. The lifing plan shall include all the lifing aspects like, but not restricted to, Total Technical Life (TTL), Time between Overhaul (TBO), Total Calendar Life (TCL), Storage Life. The applicability and implementation of IRAN (Inspect and Repair as Necessary) may also be planned for identified item.
- b. Refer Subpart N, Regulation 21.N.9.

21.L.6 Modifications and Upgrades

Regulation

The user services implement the continued airworthiness activities for the aircsystem fleet/airborne store maintained by them as per the documentation provided by the OEM of the system. In cases where the user services decide to modify or upgrade the aircsystem/airborne store, the service may involve Indian TAA for aspects which may affect the safety of the Aircsystem.

Acceptable Means of Compliance

- a. The user services may involve TAA for aspects that may affect the safety of the aircsystem. For such involvement, the services and TAA shall jointly plan the technical and procedural aspects. The user services shall provide the relevant technical data for the TAA to provide coverage.
- b. Subpart D & E are applicable.
- c. Indigenous substitution of components can be undertaken by the Services. The regulations of Subpart K are applicable.

Guidance Material

- a. Indian user services are operating and maintaining many bought-out aircsystems and airborne stores where Indian MRO may not be involved. Such continued airworthiness of such systems is under the responsibility of foreign OEM and user services. The user services, for strategic, operational, sustainability or economic considerations may decide to modify the aircsystem build-standard/maintenance methodology. Under such conditions, the User may seek the involvement of Indian TAAs to provide certification and QA coverage. For such involvement, the services need to share the relevant aircraft details. The involvement of TAA may include, but not restricted to indigenous substitution, life extension, alternate repair scheme formulation, changes to maintenance and servicing schedules.
- b. Subpart D & E

21.L.7 Continuing Airworthiness

Regulation

The User Services shall carry out all necessary tasks on the aircsystem throughout its in-service life cycle to ensure the Continuing Airworthiness of the aircsystem.

Acceptable Means of Compliance

- a. The scheduled maintenance activities as per the publications of the OEM/ Instructions of the respective Maintenance Organisation shall be duly followed and completed.
- b. The User Services/Maintenance Organisation of the User Services, shall have procedures to track, monitor and address the necessary maintenance, serviceability, overhaul and other related maintenance activities periodically.
- c. The respective Quality Assurance Agency of the user services shall perform all the necessary Quality assurance related activities.

Guidance Material

- a. Publications of OEM
- b. Instructions of Maintenance Organisation of the respective User Services
- b. Process and Procedure documentation of the respective User Services.

SUBPART M- REPAIR

Rationale

There could be deviations during the manufacturing process or some damages during the operational service of the aircraft or airborne store. The component that suffers deviation from the original conditions cannot be discarded as it would have cost and time implications on the operational capabilities of the air system/Airborne store. There may exist a possibility to recover the component/store with the rework/maintenance procedure which would save Time, Energy and Cost. The procedures described here are applicable only to a specific Air System/airborne stores (identified by a Tail No/Serial No). The cases of repairs applicable to a batch of Air Systems/airborne store shall be treated as changes to Type Design and shall follow the procedures described under Subpart D&E.

Contents

- 21.M.1 Eligibility and Demonstration of Capability for taking up Repair of an Airsystem or an airborne store**
- 21.M.2 Classification of Repairs of an Air System**
- 21.M.3 Repair Design Procedure for an Air System**
- 21.M.4 Issue of a Repair Design Approval for an Airsystem**
- 21.M.5 Repair of an Airborne store**
- 21.M.6 Production of Repair airborne stores and embodiment of Repair**
- 21.M.7 Unrepaired Damage**
- 21.M.8 Record Keeping**
- 21.M.9 Instructions for Sustaining Type Airworthiness**

21.M.1 Eligibility and Demonstration of Capability for taking up Repair of an Airsystem or an airborne store

Regulation

- a. MTC/AMTC/MSTC holders are eligible as an applicant for Repair of an Air System and TA/LoA/IMTSOA holders are eligible as an applicant for repair of an airborne store.
- b. Any organization/s that has demonstrated, or is in the process of demonstrating, its capability under Subpart G shall be eligible as an applicant for Repair of an airsystem/airborne stores under the conditions laid down in this Subpart.

Acceptable Means of Compliance

- a. An organization approved under DAOS (Subpart G1) will be eligible carrying out the repair design of an Air System/airborne store
- b. An Organisation approved under PAOS (Sub part G2) will be eligible for Production of a Repair Part of an Airsystem/airborne store
- c. An Organisation approved under PAOS (Sub part G2) or MAOS (Subpart G3) will be eligible for the embodiment of Repair on an Airsystem/airborne store
- d. Repair of specific kind, to be applied for the entire fleet, and better classified as a modification and dealt as per Subpart D.

Guidance Material

Nil

21.M.2 Classification of Repairs of an Airsystem

Regulation

Repair shall be classified as major or minor either by an appropriately approved DO under a privilege invoked under subpart G1 or by CEMILAC

Acceptable Means of Compliance

- a. Minor Repairs : Minor changes to type design or minor repairs requiring no further demonstration of compliance.
- b. Major Repairs: Minor changes to type design or minor repairs where additional work is necessary to demonstrate compliance with the airworthiness and environmental protection requirements

Guidance Material

Clarification of the terms major/minor

Minor Repairs:

- a. Repairs carried following the guidelines of Repair Manuals of the type Aircraft are considered as minor. It shall not induce any changes to the Form, Fit , Function, Life and Strength.
- b. Repairs whose effects are considered minor and require minimal or no assessment of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements, are to be considered minor.
- c. When not all the certification substantiation data will be available to those Persons/organizations classifying repairs, a qualitative judgement of the effects of the repair will therefore be acceptable for the initial classification. The subsequent review of the design of the repair may lead to it being re-classified, owing to early judgement being no longer valid. In such cases, the decision of CEMILAC shall be final.

Major Repairs:

- a. A new repair is classified as major if the result on the approved Type Design has an appreciable effect on structural performance, weight, balance, systems, operational characteristics or other characteristics affecting the Airworthiness of the product, part or appliance.
- b. Repairs that require a re-assessment and re-evaluation of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements are to be considered as major repairs.

Note:

Temporary repairs for which specific inspections are required prior to installation of a permanent repair do not necessarily need to be classified as major.

21.M.3 Repair Design Procedure for an Air System

Regulation

The Organization **shall** demonstrate that the Repair is in compliance with the Military Type certificate/MSTC of the Air System, restoring the full Airworthiness status of the Air System.

Acceptable Means of Compliance

Repair Procedure for minor Repair:

- a. A repair to an Air System shall be in accordance with the Repair Manual/scheme approved by the MTC holder.
- b. DO/ASDO shall provide evidence to CEMILAC that aircraft complies with all the relevant requirements and require no further demonstration of compliance.
- c. DO/ASDO shall ensure that the work carried are recorded in the relevant aircraft documents(F700)/log book.
- d. Consideration should be given to whether the approved repair scheme has a sufficiently wide application to be included in the Aircraft Maintenance Manual (AMM) or equivalent.

Repair Procedure for major Repair:

- e. The applicant for approval of a repair design should submit all necessary substantiation data (eg analysis, calculations or tests) to CEMILAC, ensuring restoration of the Air system to the original design levels, complying/conforming to the full Airworthiness status.
- f. CEMILAC shall consider the implications of a repair scheme embodied that does not restore static strength, stiffness, fatigue life, functionality and Airworthiness to the original design levels, in order that consideration can be given to the need for an amendment to the Air System Release to Service (RTS) and Special Flying Instruction(SFI).
- g. The DO should respect any extant design limits and comply with the following requirements:
 - i. The DO should notify RCMA where additional limitation may be necessary to RSD following the incorporation of a Service approved repair scheme.
 - ii. Designs should not transgress Flight Critical limitations without the written technical agreement of the Air System DO for the Air System concerned or the Local Technical Committee (LTC), where access to ASDO/Design Data is not available.
 - iii. Arrangements should exist for all ASDO repair schemes, where technical advice is required or as defined above, to be passed to the DO. The DO should provide

advice as to whether or not the proposed repair transgresses the prescribed design limitations.

- iv. A complete list of all repair schemes, and consequently changes to the Air System build standard, should be forwarded to ASDO/MTC holder for the Air System affected, for configuration management purposes and maintenance of any DO design records.
- h. DO to ensure that the changes made to the Air System, its effect on Maintenance and Operations be included intimated to the user services and update of relevant documents or equivalent (SB/SI/STI).

Guidance Material

a. Repair Design

- i. A repair means the elimination of damage and/or restoration to an airworthy condition following initial release into service by the manufacturer of any product, part or appliance. The elimination of damage by replacement of parts or appliances without the necessity for design activity is to be considered as a maintenance task and requires no approval.
- ii. The term 'repair scheme' will be taken to include 'repair instructions'.
- iii. Manuals and other Instructions for Sustaining Type Airworthiness (ISTA) (such as the Manufacturers Structural Repair Manual, Maintenance Manuals and Engine Manuals provided by the holder of the Type Certificate, design approval or (E)TSO authorization as applicable) for operators, contain useful information for the development and approval of repairs.
- iv. When manuals and other instructions for Type Airworthiness are as approved, they may be used by operators without further approval to cope with anticipated In-Service problems arising from normal usage provided that they are used strictly for the purpose for which they have been developed.

b. DO repair schemes

- i. DO repair schemes which restore the original structural designer's intent inherently meet the full load spectrum of the aircraft's design. A repair scheme is not a modification and therefore a full Safety Assessment is not required in order to substantiate the repair's Structural Integrity and Airworthiness.
- ii. Any change in Mass or CofG due to the installation of a repair scheme is to be recorded in the Air System Document Set (ADS).
- iii. The DOs for Air system Repair are not authorized to undertake repairs to Systems or Software for which approval was not granted.
- iv. Unless the CEMILAC explicitly details otherwise, compliance with prescribed design limitations is taken to mean:

1. That the repair provides effective restoration of Structural Integrity (ie static ultimate load), without under or over stiffening, and therefore the Air System RTS is unaffected.
 2. That the repair is durable for the remaining life of the airframe, or for an explicitly specified duration where operationally necessary.
 3. That the DO holds sufficient design information to create an airworthy repair scheme.
- v. The precedence of any repair is valid if an identical repair can be applied, without divergence, to identical structure.

c. Repairs to articles

When an approved maintenance organization is designing a new repair (based on data not published in the ADS or Original Equipment Manufacturer documentation), under their terms of approval, on an article installed on an aircraft, such a repair can be considered as a repair to the aircraft in which the article is installed, not to the article taken in isolation. In which case, this will be identified as "repair to aircraft x affecting article y", but not "repair to article y".

d. Repair design substantiation data

- i. Relevant substantiation data associated with the design of a new major repair and record keeping should include:
1. Damage identification and reporting source.
 2. Major repair design approval sheet identifying applicable specifications and references of justifications.
 3. Repair drawing and/or instructions and scheme identifier.
 4. Correspondence with the RCMA, DO or (E)TSO approval holder, if its advice on the design has been sought.
 5. Structural justification (static strength, fatigue, damage tolerance, flutter etc) or references to this data.
 6. Effect on the aircraft, engines and/or systems (performance, flight handling, etc as appropriate).
 7. Effect on maintenance programme.
 8. Effect on Airworthiness limitations, the Flight Manual and the Operating Manual.
 9. Weight and moment change.
 10. Special test requirements.
- ii. Relevant minor repair documentation should include paragraphs (a) and (c), above. Other points of above paragraph should be included where necessary. If the repair is outside the approved data, justification for classification should be provided.
- iii. Special consideration should be given to repairs that impose subsequent limitations on the part, product or appliance

- iv. Special consideration should also be given to Life Limited parts and Critical Parts, notably with the involvement of the RCMA, when deemed necessary
- v. Repairs to engine critical parts should normally only be accepted with the involvement of the RCMA.

21.M.4 Issue of a Repair Design Approval of an Airsystem

Regulation

CEMILAC **shall** ensure that the repair design complies with the applicable TCB prior to approval and DO shall ensure that the relevant documents are updated.

Acceptable Means of Compliance

- a. The approval should be issued only:
 - i. By the RCMA.
 - ii. For minor repairs only, by an appropriately approved DO under privilege.
- b. In order for the RCMA to approve major repair design the following should be applicable:
 - i. The TCB for the product, part or appliance to be repaired has been identified together with all other relevant requirements.
 - ii. All records and substantiation data including documents showing compliance with all relevant Airworthiness requirements are held for review by the CEMILAC.
- c. A summary list of all repair approvals should be provided to the RCMA on a regular basis as agreed.

Products Type Certified by the CEMILAC

- d. The RCMA should seek CEMILAC approval in cases of major repairs proposed by DO approval holders, if the major repair is:
 - i. Related to new interpretation of the Airworthiness requirement as used for Type Certification.
 - ii. Related to different means of compliance from that used for Type Certification.
 - iii. Related to the application of Airworthiness requirements different from that used for Type Certification.

Guidance Material

- a. **Approval by DO.** Approval of repairs through the use of privileges invoked by the RCMA, means an approval issued by the DO without requiring RCMA involvement. CEMILAC will monitor application of this procedure within the surveillance plan for the relevant organization. When the organization exercises this privilege, the repair release documentation is to clearly state that the privilege has been identified under their DAOS approval.

- b. **Previously approved data for other applications.** When it is intended to use previously approved data for other applications, it is expected that applicability and effectiveness would be checked with an appropriately approved DO. After damage identification, if a repair solution exists in the available approved data, and if the application of this solution to the identified damage remains justified by the previously approved repair design, (structural justifications still valid, possible Airworthiness limitations unchanged), the solution can be considered approved and can be used again.
- c. **Temporary repairs.** These are repairs that are life limited, to be removed and replaced by a permanent repair after a limited service period. These repairs are to be classified as minor and the service period defined at the approval of the repair, and recorded in the MOD F700 or equivalent.
- d. **Fatigue and damage tolerance.** When the repaired product is released into service before the fatigue and damage tolerance evaluation has been completed, the release is to be for a limited period, defined at the issue of the repair.

21.M.5 Repair of an Airborne store:

Regulation

Unscheduled maintenance of an airborne store i.e. repairs/ refurbishing, in the event of occurrence of a snag/defect/failure/ damage to the store shall be carried out in accordance with the Repair Manual prepared by the Main Contractor and duly approved by RCMA/CEMILAC.

Acceptable Means of Compliance:

- a. Repair Manual shall be prepared by the Main Contractor and duly approved by RCMA
- b. Work-done report in compliance to the approved Repair Manual shall be coordinated by ORDAQA/DGAQA

Guidance Material:

- a. Repair is an unscheduled maintenance activity carried out due to unforeseen circumstances like occurrence of snag/defect/failure/ damage to the accessory in order to restore the accessory to a serviceable condition.
- b. Repair Manual of an airborne store shall be evolved by the Main Contractor and submitted to DGAQA and RCMA/CEMILAC for their comments. The repair manual shall be finalized after considering the comments of all stakeholders and shall be approved by RCMA/ CEMILAC. A Repair manual should contain the following but not limited to:--
 - i. Description and specification

- ii. Repair procedures – Individual work card for each repair
- iii. Tools, equipment, consumables required to carry out a particular repair
- iv. Tests required to be carried out after completion of repair

21.M.6 Production of Repair airborne stores and embodiment of Repair

Regulation

- a. Airborne stores to be used for the repair **shall** be manufactured in accordance with(iaw) production data based upon all the necessary design data as provided by the DO:
 - i. By a Production Organization (PO) appropriately recognized iaw Supart G2
 - ii. By an Approved Maintenance Organization (AMO) iaw Subpart G3
- b. The embodiment of a repair **shall** be made:
 - i. By a PO that satisfies the requirements of Subpart G2
 - ii. By a Maintenance Organization, appropriately approved under Subpart G3

Acceptable Means of Compliance

Airborne store used for the repair **should** be appropriately marked as given in Subpart Q.

Guidance Material

Nil

21.M.7 Unrepaired Damage

Regulation

When a damaged product, part or appliance is left unrepaired and is not covered by previously approved data, CEMILAC or an appropriately approved DO under privilege **shall** approve its continued use based on the assessment.

Acceptable Means of Compliance

- a. The evaluation of the unrepaired damage for its Airworthiness consequences **should** be made by the ASDO/DO under privilege and should inform the TAA.
- b. When the organization evaluating the unrepaired damage is neither the ASDO nor the DO, this organization **should** justify that the information on which the evaluation is based is adequate either from its own resources or through an arrangement with the original DO.
- c. The DO **should** evaluate the unrepaired damage for Airworthiness consequences and if in any doubt, **should** consult the ASDO/TAA.

Guidance Material

- a. This regulation is not intended to supersede the normal maintenance practices defined by the DO, (eg blending out corrosion and re-protection, stop drilling cracks, etc), but addresses specific cases not covered in the ADS/Repair Manual.

21.M.8 Record Keeping

Regulation

For each repair, all relevant design information, drawings, test reports, instructions and limitations possibly issued in accordance with Subpart M justification for classification and evidence of the repair design approval, **shall**:

- a. Be held by the repair design approval holder and shall be made available to the TAA.
- b. Be retained by the repair design approval holder in order to provide the information necessary to ensure the Type Airworthiness of the repaired products, parts or appliances.

21.M.9 Instructions for Sustaining Type Airworthiness

Regulation

The holder of the repair design approval **shall** provide the complete set of Instructions for Sustaining Type Airworthiness (ISTA) which result from the design of the repair, to the TAA.

Acceptable Means of Compliance

- a. The repaired product, part or appliance may be released back into service before the changes to those instructions have been completed, but this should be for a limited period, and in agreement with the User services and TAA.
- b. If updates to those changes to the ISTA are issued by the holder of the repair design approval after the repair has been first approved, these updates should be submitted to the TAA.
- c. A programme showing how updates to the changes to the ISTA are distributed should be submitted to the TAA.
- d. The availability of some manual or portion of the changes to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into service, but should be available before any of the products reaches the relevant age or flight hours/cycles.

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SUBPART N - BOUGHT OUT AIR SYSTEMS AND AIR BORNE STORES

Rationale

Sometimes to fulfil the urgent/essential need of the defence of the country, procurement of Air systems from outside the country is inevitable. Also, in order to increase the potential of the Air system and/or to cater for obsolescence, modifications /up-gradation to the bought out Air Systems, leading to change in Type Design are inevitable. This Subpart establishes the procedure for the approval of changes to type designs and type-certificates, and establishes the rights and obligations of the applicants for, and holders of, those approvals.

Contents

- 21.N.1. Applicability**
- 21.N.2. Association of TAA in Bought-out air systems/ airborne stores**
- 21.N.3. Revalidation of approvals by TAA**
- 21.N.4. Revalidation of Civil Approvals by TAA**
- 21.N.5. Modifications on Bought-out air systems/ airborne stores**
- 21.N.6. Indigenous substitution of bought out airborne stores**
- 21.N.7. Major upgrades on aircsystems/airborne stores**
- 21.N.8. Repair of Bought-out air systems/ airborne stores**
- 21.N.9. Life Extension Programme for Bought-out air systems/ airborne stores**

21.N.1. Applicability

Regulation

The regulations contained in this subpart are applicable to bought out air system and airborne stores for Indian military applications.

Acceptable Means of Compliance

Nil

Guidance Material

Nil

21.N.2. Association of TAA in Bought-out air systems/ airborne stores

Regulation

TAA and Approved Design agency shall be associated in the negotiations during purchase of any Air system/airborne stores from outside the country to ensure that the certification basis/airworthiness certification plan requirements are met

Acceptable Means of Compliance

Nil

Guidance Material

Nil

21.N.3. Revalidation of approvals by TAA

Regulation

- a. MTC or RMTC or AMTC or type approval or LoA or IMTSOA shall not be required for the bought out air systems/airborne stores if they are used as it is and got an approval from the foreign airworthiness approval agencies recognized by India.
- b. MTC or RMTC or AMTC or type approval or LoA or IMTSOA shall be required for the bought out air systems/airborne stores for which no approval from the foreign airworthiness approval agencies is available or modification and upgrades are expected in the bought out air systems/airborne stores.

Acceptable Means of Compliance

The regulation Subpart B and C should be used to give appropriate clearance for the bought out air systems/airborne stores

Guidance Material

Follow Subpart B and C

21.N.4. Revalidation of Civil Approvals by TAA

Regulation

The bought out airtsystem/airborne stores which has civil approvals shall be validated by Indian TAA for the use in Indian military applications

Acceptable Means of Compliance

Follow Subpart R

Guidance Material

Follow Subpart R

21.N.5. Modifications on Bought-out air systems/ airborne stores

Regulation

The bought out air systems/air borne stores shall be modified if need arises. Any modification shall be approved by TAA

Acceptable Means of Compliance

Follow applicable procedure of "Subpart D" for Modifications of an Airtsystem and "Subpart E" for Modification of an airborne store.

Guidance Material

Follow Subpart D & Subpart E

21.N.6. Indigenous substitution of bought out airborne stores

Regulation

The indigenous substitution shall be allowed to replace bought out air systems/air borne stores if need arises. Any indigenous substitution shall be approved by TAA

Acceptable Means of Compliance

Follow Subpart K

Guidance Material

Follow Subpart K

21.N.7. Major upgrades on aircsystems/airborne stores

Regulation

Major upgrades to the bought out air systems/air borne stores shall be allowed if need arises. Any major upgrades shall be approved by TAA.

Acceptable Means of Compliance

Follow Subpart D & E

Guidance Material

Follow Subpart D & E

21.N.8. Repair of Bought-out aircsystems/ airborne stores

Regulation

The bought out air systems/air borne stores shall be repaired in the event of any mal function observed. Any repair shall be approved by TAA.

Acceptable Means of Compliance

Follow Subpart M

Guidance Material

Follow Subpart M

21.N.9. Life Extension Programme for Bought-out aircsystems/ airborne stores

Regulation

The bought out air systems/air borne stores shall be life extended based on the approved design agency or User services need. Life extension shall be accorded by CEMILAC.

Acceptable Means of Compliance

a. A Life extension program should be undertaken when it is identified that an air system and stores needs to be extended beyond its current certified life measured in any applicable lifing parameter (such as calendar time, flying hours, Fatigue Index (FI), landings or pressure cycles).

b. The constitution of Lifing Committee and its responsibility as per Subpart L should be followed in the life extension program

Guidance Material

- a. Life Extension Program includes the following:
 - i. The life of air system and stores are restricted in terms of both calendar life and flying hours for TTL and TBO.
 - ii. While TTL flying hours limitation is from total fatigue or endurance life, the TBO flying hours life restriction appears from the consideration of safe life concept.
 - iii. 'Wear' is function of component usage or operational 'cycles'. For equipment having movable parts, wear takes place with the usage. This wears increases the clearance thereby giving rise to vibrations, noise, thus further aggravating the damage. Severity of application and the design stress to the material strength ratio plays a vital role in determining the life in terms of flying hours.
 - iv. 'Material Ageing' is a function of exposure to various environments and of elapsed time. While both metallic and non-metallic materials are susceptible to wear, ageing is predominantly with non-metallic materials.

b. Methodology Followed For Life Extension

For the purpose of lifing studies, the aircraft can be divided into following sub groups:

- i. Airframe structure
- ii. Aircraft system & Equipments
- iii. Mechanical Equipment
- iv. Electrical & Avionics Equipment
- v. Rubber seals & Hoses

As Complete design data of the bought aircraft was not supplied. Therefore, besides considering the operators feedback and field failure data, the following methodology may be adopted:

i. Airframe structure

An airframe is made up of a large number of parts some of which are critical for safety of flight in the sense that their failure may cause catastrophe. These may be called primary load bearing parts. All primary load bearing and stress critical components should be subjected to analytical fatigue life assessment and monitored during fatigue testing.

In airframe metallic materials and their treatment, corrosion of metallic material and ageing deterioration of surface treatment/paintings plays an important role to decide calendar TBO life of the ac. A typical coastal bases like Andaman, Jamnagar and Bhuj, where corrosion is major factor, it should be considered while life extension.

In some aircraft parts non-metallic material like sealing compound used in the integral fuel tanks, resins and glue used in honeycomb structure and fiber reinforced plastics (Laminates, Radomes) play a significant role in calendar life as it is not possible to replace these parts during overhaul. Thus the Total Calendar Life (TCL) of these perishable is a deciding factor for the TCL of the aircraft system and store.

For airframe following points need to be considered

1. Experiences on structural inspection, micrometry measurement and crack detection during overhaul.
2. Calculation of Design Reserve Factors of the critical/primary load bearing structural members.
3. Analytical evaluation of fatigue life using MIL 8866 loading for important structural members.
4. Consideration of structural modification related to Airframe fatigue.
5. Fatigue/Endurance testing of airframe and structural components.

ii. Aircraft System & Equipments

1. Experiences on dismantling, stripping, micrometric measurement and crack detection during overhaul of equipment.
2. Field failure data and defect investigation of high-density failure components.
3. Artificial ageing by Intensified Simulated Alternating Test (ISAT) for avionics components.
4. Artificial ageing to simulate calendar life for mechanical equipment.
5. Endurance testing of artificial aged components for simulated service life.
6. Looms and Cable Connectors: Types of cables, connectors and technology of soldering, fabrication and laying of looms on aircraft are important aspects deciding the TBO calendar life of ac. While movable loom is replaced during each overhaul, stationary looms and connectors are for full ac life.
7. Field experiences on flight incidences and accident at times indicate requirement of reduction of life. The life of aircsystem and stores are therefore periodically reviewed by lifting committee headed by CEMILAC with design agency, Government Inspection agency and User as members.

iii. Rubber Seals And Hoses

1. The life of rubber based components is fixed after carrying out artificial ageing and measuring the ageing co-efficient for the various samples. In this respect CEMILAC directive CEMILAC/5390/AW,C,T/4/DIRECTIVES dated 18th June 2015 is available.
 2. Where on condition components are deemed to be safety critical, safety related or safety relevant (a range of terminologies are generally in use), the 'on condition' approach needs to be re-qualified and recertified for the life extension period. Also, the addition of evidence from service experience is an essential element of the analysis. It is not uncommon for in-service experience to indicate significant shortfalls in the validity of the original qualification and certification. For example, the 'on-condition' approach may have been based upon design MTBF rates which have proven in service to be extremely optimistic.
- iv. Many of the assumptions included in the life extension of aircraft components relate to the usage of the component in service. The components may be subject to an 'on-condition' maintenance policy and signs of degradation may also be unlikely to be detected during a zonal inspection. Therefore, changes in usage, including the environment in which the aircraft is operated can have significant implications for life extension.
 - v. Concessions and waivers, which are used to record acceptable deviations from design, production or repair, have significant implications for LEP and have, without exception, proved to be problematic. When considering categorization, the existence of concessions or waivers can affect the component category. Concessions or waivers could preclude life extension without further investigation or analysis, or the presence of widespread concessions or waivers may render life extension impractical. Moreover, the concessions or waivers may have been acceptable for the original life requirement but may not be acceptable, or there may be insufficient evidence to assess their acceptability for the life extension requirement.
 - vi. For each component within the LEP one of the first tasks is to understand the evidence basis for the clearance of that component and how this may be affected by life extension. At the simplest level, the evidence required to support a component LEP can be considered to be divided into four source areas: understanding the material properties (e.g. fatigue strength, corrosion resistance or thermal conductivity), understanding the effect of geometry (e.g. cut-outs, joint configuration, wire bend radii, insulation thickness), understanding the loads (e.g. gust, pressure, vibration, thermal, impact) and understanding the failure criteria (e.g. residual strength, system leak, loss of function, buckling)

- vii. The qualification and certification of aircraft for LEP relies on a combination of test evidence, analytical evidence and service experience. Test evidence alone, without analysis to confirm that the test is representative, backed up by in-service experience, is inadequate. Equally, analytical solutions, without test validation and in service evidence, are also lacking.
- viii. The interfaces between disciplines, systems and components need to be considered carefully within a LEP and ownership clearly identified. The issue of interfaces is often further complicated by components being managed by TAA and being supplied by different OEM. Therefore, this is a clear risk area within the LEP that may require careful management.
- ix. In bought out item where original qualification and certification data are no longer available, the Design Standards applied at the time and evidence that the aircraft met the design requirements can be a valuable source of information for assessing the life extension potential.

SUBPART P- FLIGHT TESTING OF AIRSYSTEMS AND AIRBORNE STORES

Rationale

Every Airsystem under development has to undergo extensive flight testing to validate the design, to obtain the actual performance of the Airsystem and to ensure its airworthiness and safety. Flight testing may also be conducted during production acceptance, post-scheduled maintenance or to confirm the airworthiness of an Airsystem after certain fault rectification or replacement of components when checks for proper operation cannot be carried out on the ground. Flight testing would also be necessary during the development of aero engines, Airborne Stores, systems and during weapon integration for indigenously developed, licence built or bought out Airsystems.

Contents

- 21.P.1. Applicability**
- 21.P.2. Agencies for Flight Testing of Indian Military Airsystems**
- 21.P.3. Clearance for Flight Trials**
- 21.P.4. Certificate of Safety of Flight (F-1090)**
- 21.P.5. Flight testing during Design & Development of Airsystem**
- 21.P.6. Flight testing during Production of Airsystem**
- 21.P.7. Flight testing of Modification / upgradation of In-Service Airsystem**
- 21.P.8. Flight testing of Airsystem with flight test instrumentation**

21.P.1. Applicability

Regulation

This Subpart is applicable for the Flight Testing of Airsystems for its performance evaluation other than during its operational use.

Acceptable Means of Compliance

- a. The regulations are applicable for:
 - i. Flight testing of Ab-initio design and developed Aircraft and UAS
 - ii. Flight Testing of upgraded Aircraft and UAS
 - iii. Flight Testing of ALMs and Engines
 - iv. Flight Testing of Airborne Stores
 - v. Flight testing of new production aircraft& UAS which is indigenously developed, licence built or bought out.
 - vi. Flight Testing of Aircrafts& UAS for customer acceptance
 - vii. Flight Testing of Service Aircrafts& UAS after modifications
 - viii. Flight Testing after Maintenance / overhaul activities
 - ix. Flying the aircraft to a location where maintenance or any kind of airworthiness review are to be performed.
- b. Subpart is also applicable for flying the Aircraft / UAS to an exhibition / show and participation during exhibition / show, before the issue of design approval or before showing conformity with the approved design.
- c. This subpart is also applicable for the flight testing of Airsystems where new operating techniques are introduced.

Guidance Material

- a. The subpart details procedures and guidelines for flight testing of an indigenously designed and developed aircraft.
- b. The regulation brought in this subpart is also applicable for undertaking flight tests for weapon/armament or other stores integration on indigenously, licence built or bought out aircraft etc.
- c. The subpart is also applicable for ab-initio development of Light and Heavy Fixed wing and Rotary wing UAS categorised & certification mandated as per 21.B2.1, by an Indian Agency for military applications.
- d. This subpart is also applicable flight testing of equipment on indigenously developed aircraft, licence built or bought out aircraft.
- e. Ferry flights in cases where maintenance is not performed in accordance with approved programmes, where an Airworthiness Directive (AD) (such as SI, STI, UON or SB) has not been complied with where certain equipment outside the Master Minimum

Equipment List (MMEL) is unserviceable or when the aircraft has sustained damage beyond the applicable limits.

21.P.2. Agencies for Flight Testing of Airsystems

Regulation

- a. Flight Testing of Military Airsystems shall be conducted only by authorised testing agencies at a pre-defined Air space, which is preferably a military flying zone.
- b. All test Aircraft/Airsystems shall be identified with a Tail Number / Registration Number assigned by user services or by such agencies authorised to do so by Govt. of India.

Acceptable Means of Compliance

- a. Any other agencies nominated/authorised by Indian Military Services should only be conducting the flight trials at designated airspaces.
- b. The flight test department of the main contractor (indigenously developed or manufactured under licence), ASTE, APT and NFTC are the authorised agencies for undertaking flight testing.
- c. Test flights should be flown by a test pilot, authorised by the Chief Test Pilot of the Flight Test Agency or Main Contractor, who in turn holds such authority from MoD or Military Services.
- d. Only test pilot /test engineers, who have successfully undergone a course in experimental flight testing are authorised to undertake flight testing of experimental, prototype or technology demonstrator aircraft under development as a flight crew member.
- e. Persons who have successfully undergone the production test pilots course are authorised to flight-test production aircraft.
- f. The main contractor is responsible for the flight test of the aircraft, equipment and installation designed and developed by them.
- g. Task Directive for Flight Testing for Military Airsystems shall be issued by respective Service HQ.
- h. Only persons authorised by CTP shall be flown as crew members during the development flight testing of Military Aircraft, if situation demands so.

Guidance Material

- a. NFTC is responsible for those aircraft for which they are the designated flight test agency. The Aircraft and Systems Testing Establishment is responsible for all flight tests requirements originated by IAF and DRDO and APT for requirements originated by the Army.
- b. CSDO, NASDO, APT, MAG (Avn), Indian Navy or NFTC will be associated during such trials as and when necessary.

21.P.3. Clearance for Flight Trials

Regulation

Flight trials of a new type of aircraft or aircraft in which design changes have been incorporated or where existing flight limitations are to be extended, are authorised after the appropriate Certificate of Flight Trials has been endorsed by CEMILAC

Acceptable Means of Compliance

- a. The QA of the Main Contractor shall ensure that all the Airborne Stores and associated equipment installed in the Airsystems holds necessary clearances/approvals/CoA from authorised agencies as per Subpart H.
- b. A Flight Clearance Note (FCN), issued by CEMILAC constitute the Certificate for Flight Trials.
- c. FPCM for the configuration and envelope of Airsystems
- d. A Certificate of Airworthiness (CoA) in the form of Certificate for Safety of Flight (Form 1090) issued by DGAQA is the authorisation for conducting the flight trials.
- e. Production Acceptance Test (PAT) completion for production Aircraft

Guidance Material

- a. Necessary Integration checks on Aircraft shall be carried out to check the performance at ground as per Ground Integration Test Plan / Procedure document, approved by CEMILAC. Certificate of Design (CoD) should be available for all the identified systems.
- b. FCN shall define the baseline configuration for Flight Testing. FCN and its updates may be issued in the following cases:
 - i. First flight of ab-initio developed Aircraft or UAS
 - ii. Major performance enhancement or configuration update of ab-initio developed Aircraft or UAS.
 - iii. First Flight and subsequent major configuration update of an upgraded Aircraft or UAS.
- c. A Flight Plan Co-ordination Memo (FPCM) defining the current configuration and flight limits shall be issued by CEMILAC for undertaking day-to-day trial flights subsequent to issue of FCN. FPCM shall also cover minor configuration updates in the baseline configuration defined in FCN.
- d. FPCM shall be issued based on the inspection and ground test report along with a work done report on any configuration update / repair carried out on the Airsystem. These reports shall be coordinated by DGAQA.

e. In case of service Aircrafts, where Form 1090 is not issued by DGAQA, and IAF Form 700 constitutes the Certificate of Airworthiness, Development Flight Clearance (DFC) issued by CEMILAC for Airborne Stores may be considered as Certificate of Flight Trials.

21.P.4. Certificate of Safety of Flight (F-1090)

Regulation

A certificate of Safety for Flight (Form 1090) shall be issued prior to any type of flight of a new, repaired, reconditioned or modified aircraft by DGAQA.

Acceptable Means of Compliance

- a. DGAQA/Internal QA authorised by DGAQA is responsible for the issue of a Certificate of Safety of Flight (Form 1090) for undertaking any test flights including production acceptance flight tests by the contractor for purposes of trials /production flight/acceptance and ferry to the user units in respect of aircraft under development/ overhaul/repair.
- b. The Certificate is issued after the inspection to ensure that the aircraft has been manufactured/ overhauled/ repaired and ground tested in accordance with the applicable drawings or approved schedules.
- c. In respect of prototype or modified Aircraft/UAS (trial Mod etc), which are not according to a production configuration, F-1090 can be issued only after the approval of FPCM by CEMILAC, defining the special configuration and envelope.

Guidance Material

- a. All flights by Customer's Pilots at the Contractor's workplace for the purpose of acceptance and delivery of aircraft will be covered under F-1090 issued by DGAQA.
- b. Certificate of safety of flight is valid for one day for one flight. A fresh F-1090 is required to be issued for each flight and each day.
- c. A fresh F-1090 will be issued for purposes of ferrying the aircraft to the Operating Unit.
- d. A fresh F-1090 or a revalidation of the F-1090 will be required under conditions stipulated earlier under the heading 'Flight trials by Contractor's Pilots'.

21.P.5. Flight testing during Design & Development of Airsystem

Regulation

Flight trials need to be carried out for a new type of Airsystem or for Airsystem for which design changes have been incorporated or where existing flight envelopes are to be extended, by the authorized flight test agency.

Acceptable Means of Compliance (AMC):

- a. The flight testing is authorised after the appropriate Flight Clearance Note(FCN), Flight Plan Coordination Memo (FPCM)endorsed by CEMILAC and certificate of safety of flight (Form 1090) issued by DGAQA.
- b. The flight clearance Note for the flight test of an Airsystem will be issued based on the clearance of the Certificate of Design (CoD) of all the relevant system.
- c. The Certificate of Flight Trials shall be completed and signed by the Chief of Design of the Contractor and CEMILAC.
- d. The consolidated flight test requirements in the form of a Flight test Specification to be evolved before the design evaluation flight trials.
- e. Based on the duly coordinated work done report of RDAQA stating the hardware and standards of the Airsystems, FPCM will be coordinated by Flight test agency and CEMILAC.
- f. Bulk clearance for a series of flight tests can also be authorised by CEMILAC provided, there is no change in the Standard of Preparation of the aircraft being flight tested and the flight tests are undertaken to the same flight envelope cleared.
- g. As a result of an accident or any untoward incident, the CEMILAC would be prudent to restrict further trials pending further investigation.
- h. The consolidated flight test report shall be submitted to CEMILAC by the contractor in coordination with the flight test agency.

Guidance material

- a. The flight testing of Airborne store shall take place after successful completion of Safety of Flight test and necessary ground integration trials clearances accorded by CEMILAC/RCMA.

21.P.6. Flight testing during Production of Airsystem

Regulation

After the complete flight evaluation of a new Design & Developed Airsystem, it shall be cleared for the production based on the finalized Build standard and the operational clearance issued by CEMILAC. The flight evaluation to be carried out by the authorized flight test agency of the contractor for the acceptance of production standard aircraft.

Acceptable Means of Compliance (AMC):

- a. Each production aircraft of a type shall undergo identical standards of ground and flight tests before acceptance. The tests shall be detailed in a schedule of tests, prepared by the Main Contractor, in coordination with CEMILAC and DGAQA, considering the inputs from the User services.
- b. Each flight of the contractor flight test agency shall be authorised after the certificate of safety of flight (F1090) issued by DGAQA.
- c. As a part of the User Evaluation Trials (UET), the authorised flight test agency of User Services shall under take the flight tests and the test shall be authorised after the appropriate Certificate of Flight Trials and certificate of safety of flight issued by RDAQA.

Guidance material:

NIL

21.P.7. Flight testing of Modification / Upgradation of In-Service Airsystem**Regulation**

The in-service Aircraft / UAS which are modified/upgraded for increasing their operational effectiveness are to be flight tested to evaluate the performance. The flight evaluation shall be carried out by the authorized flight test agency.

Acceptable Means of Compliance (AMC):

- a. The technical evaluation study / analysis and ground test results, drawing and necessary documents shall be submitted to CEMILAC.
- b. The flight clearance certificate for the flight testing of the Aircraft/UAS, shall be authenticated by the main contractor / User services and CEMILAC.
- c. The detailed flight test plan shall be evolved together by main contractor, user and CEMILAC.
- d. The consolidated flight test report shall be submitted to CEMILAC by the contractor in coordination with the flight test agency.
- e. As a part of the User Evaluation Trials (UET), the authorised flight test agency of User Services shall under take the flight tests and the test shall be authorised after the appropriate Certificate of Flight Trials and certificate of safety of flight issued by RDAQA.

Guidance material:

NIL

21.P.8. Flight testing of Airsystem with flight test instrumentation

Regulation

Necessary approvals from TAAs shall be obtained for the instrumentation scheme followed during the flight testing.

Acceptable Means of Compliance (AMC)

- a. The instrumentation and FDR requirements, including the parameters to be measured, **should** be formally recorded.
- b. Provision for automatic monitoring and recording, including Telemetry to be included.
- c. Provision of a crashworthy FDR which meets the requirements for crashworthiness and parameters / sampling rates.r:
- d. The parameters to be recorded, including sampling rates, when considering the subparagraphs above.
- e. All installations should conform to the airworthiness and strength requirements applicable to the aircraft concerned and to the requirements of the applicable airworthiness code.
- f. The Contractor should submit all relevant information on the instrumentation and FDR to the TAA
- g. The instrumentation drawings should be included in the Configuration Status Record or equivalent drawing list for the aircraft.
- h. The Contractor should demonstrate to the satisfaction of the TAA, with appropriate trials and safety arguments, that the installation, when completed, is safe and effective.

Guidance material

- a. Instrumentation is often required for the flight trials of new types of aircraft, and of aircraft incorporating major modifications, to facilitate the gathering of trial data. Importantly, the recording of flight trial data can also be used for post-event analysis in case of an unexpected incident or accident. The installation of a crashworthy Flight Data Recorder (FDR) may therefore be required.
- b. The MOD may assist the Contractor by obtaining and/or modifying instrumentation and equipment when by so doing there are advantages to the flight trials programme.
- c. The term 'instrumentation' in this RA refers to all items which are fitted temporarily to an aircraft specifically for carrying out flight trials and which will be subsequently removed.

SUBPART Q - IDENTIFICATION OF AIR SYSTEMS AND AIRBORNE STORES

Rationale:

To comply with configuration control requirements, each Air System and Airborne Stores fitted on an Air System must be individually identified. There is important safety, operational and economic benefits if the possibility of recurrent failure of a product/store can be confined to identifiable material batches, components, equipment or air system. To achieve this, traceability and interchangeability are required for selected Air Systems and airborne stores.

Contents:

21.Q.1 Identification of Air Systems

21.Q.2 Handling of Identification Data

21.Q.3 Identification of Airborne Stores

21.Q.4 Identification of Critical Parts

21.Q.5 Traceability of Identifiable Parts

21.Q.6 Identification of IMTSOA Article

21.Q.1 Identification of Air Systems

Regulation

The identification shall be unique and shall include the specific information of Manufacturer's name, Product designation, Type/Part No and the Manufacturer's Serial Number and/or Tail No. and any other information found appropriate.

Acceptable Means of Compliance:

- a. Any organization that manufactures an Air System should identify that Air System by means of a fireproof plate that has the information specified marked on it by etching, stamping, engraving, or other approved method of fireproof marking.
- b. The identification plate shall have necessary provisions to identify the current configuration such as Mod No. / Modification Status.
- c. The identification plate should be placed on a non-critical surface and secured in such a manner that it is accessible, legible and not likely to be defaced or removed during normal service (including maintenance), or lost or destroyed in an accident.

Guidance Material:

Aircraft/UAS –Type/Part No. & Tail No.

Engine/ALM Part No & Sl. No.

Tail No. Shall be issued by authorised agency

21.Q.2 Handling of Identification Data

Only approved Design, Production or Maintenance Organizations, or Military Services shall place, remove or change identification information on any Air System.

Acceptable Means of Compliance:

- a. Any organization performing maintenance work should remove, change, or place identification information only in accordance with established methods, techniques and practices.
- b. Any removed identification plate should be re-installed only on the assembly from which it was removed.

Guidance Material:

Nil

21.Q.3 Identification of Airborne Stores

Each Airborne Store shall be uniquely identified and permanently & legibly marked in accordance with the applicable identification data.

Acceptable Means of Compliance:

- a. Any organization that manufactures an Airborne Store should identify that Airborne Store by means of a fireproof plate that has the information specified marked on it by etching, stamping, engraving, or other approved method of fireproof marking.
- b. The identification shall be unique and shall include the specific information of Manufacturer's name, Product designation, Part No., Software version and the Manufacturer's Serial Number and any other information found appropriate
- c. The identification plate shall have necessary provisions to identify the current configuration such as Mod No. / Modification Status unless specified otherwise.
- d. The identification plate should be placed on a non-critical surface and secured in such a manner that it is accessible, legible and not likely to be defaced or removed during normal service (including maintenance), or lost or destroyed in an accident.
- e. If a Store is too small or that it is otherwise impractical to mark a part or appliance with any of the information specified, the authorized release document accompanying the part or appliance or its container should include the information that could not be marked on the part.
- f. The Line Replaceable Units (LRUs) shall be accompanied with a log card where the details of the sub-assemblies are filled with. The log card shall be approved by DGAQA prior to release. An appropriate format shall be finalised by the DO/PO in consultation with DGAQA.
- g. Any change in configuration which affects the form-fit-function replacement in the field shall be identifiable.
- h. Any private markings used by the manufacturer to facilitate the assembly of parts should not be located in a position where they will confuse other identification marks.

Guidance Material:

- a. The Airborne stores, for the purpose of this regulation, may include Line Replaceable Units (LRUs), Shop Replaceable Units (SRUs), Modules, Finished Parts, Sub-assemblies and/or any identifiable item used during the manufacture of Airsystems or Airborne Stores.

21.Q.4 Identification of Critical Parts

Each manufacturer of a part which has been identified as a critical shall permanently and legibly mark that part with a part number and a serial number.

Acceptable Means of Compliance:

Nil

Guidance Material:

Nil

21.Q.5 Traceability of Identifiable Parts

The Design Organization shall prepare, for inclusion in the Design Records, a list of all Identifiable Parts. The list shall be agreed with TAA and kept under review in the light of service experience and changes in design.

Acceptable Means of Compliance:

- a. The list of Identifiable Parts should include Critical Parts and also those parts which are likely, in the case of a fault, to affect airworthiness or operational effectiveness.
- b. Drawings of parts on the list of Identifiable Parts should contain the following:
 - i. The statement 'Identifiable Part' or be otherwise identified.
 - ii. The information to be recorded to ensure traceability.
 - iii. Show where such information is to be recorded.
- c. The format of log book also shall be finalised and shall be traceable.

Guidance Material:

Nil

21.Q.6 Identification of IMTSOA Article

Each IMTSOA article shall have unique identification.

Acceptable Means of Compliance:

- a. Each holder of an IMTSO authorisation under **Subpart C** shall permanently and legibly mark each article with the following information:
 - i. The name and address of the manufacturer;
 - ii. The name, type, part number or model designation of the article;
 - iii. The serial number or the date of manufacture of the article or both; and

- iv. The applicable IMTSO number.
- b. If the Authority agrees that a part is too small or that it is otherwise impractical to mark a part with any of the information required by paragraph a, the authorised release document accompanying the part or its container shall include the information that could not be marked on the part.

Guidance Material:

Nil

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SUBPART R - CIVIL CERTIFIED MILITARY AIRCRAFT

Rationale

New Indian Military Airsystems that are intended to be operated on the Indian Military Aircraft Register in the Service Environment **shall** be certificated prior to their Release to Service. This regulation shall be followed if the Airsystem is a derivative of Civil Certified version. It shall be ensured that the certified version of Airsystem or its modified version shall comply with the user requirements and Indian Airworthiness regulations.

Contents:

21.R.1 User Requirements

21.R.2 Certification Basis

21.R.3 Certification Program

21.R.4 Compliance to Certification Basis

21.R.5 Continuing Airworthiness

21.R.6 Modifications

DRAFT

21.R.1 User Requirements

Regulation

Users shall finalise the Qualitative Requirements for the Airsystem to be acquired in the form of Request for Proposal (RFP). TAA shall vet the RFP from the continued Airworthiness and up-gradation point of view.

Acceptable Means of Compliance

- a. Depending on the operational requirements, the mode of procurement shall be categorised into one of the following:
 - i. Procurement of a Civil Certified Airsystem without any modifications
 - ii. Procurement of Civil Certified Airsystem with Modifications/ up-gradations by OEM
 - iii. Procurement of Civil Certified Airsystem with / without modifications by OEM and subsequent modifications /up-gradations in India
 - iv. Procurement Civil Certified Airsystem with licence production / TOT for subsequent manufacturing in India.

Guidance Material

- a. The user shall finalise the operational requirements as per provisions laid out in Procurement Policy Documents. However, the certification requirements shall be explicitly brought in the requirements and CEMILAC & DGAQA shall vet the same.
- b. Any details required for future modifications / upgrade shall be included as per Subpart N, Bought Out Airsystems. The modifications / up-gradations in India shall be certified in accordance with Subpart D, Modifications.
- c. The procurement may be classified into one of the following categories:
 - i. Procurement of a Civil Certified Airsystem without any modifications

If the Airsystem to be procured is a Civil Certified version from the country of origin and is intended to be procured without any modifications to the certified configuration, the Airsystem shall be accepted by the user without any further Certification process, provided the following conditions are met with.

 1. The Civil Certification Agency of the country of origin is recognized by the Indian counterpart.
 2. The Airsystem Type shall hold a Type Certificate (TC) or Amended TC or Supplementary TC or equivalent
 3. The individual Airsystems by Serial Number are delivered with a Certificate of Airworthiness from the Country of Origin

4. There are no changes in the operational limits from the certified configuration
 5. No Modifications in the Certified Configurations
- ii. Procurement of Civil Certified Airsystem with Modifications/ up-gradations by OEM
- If the Airsystem to be procured is a modified or up-graded version of a Civil Certified version from the country of origin, the Airsystem shall be accepted by the user through any of the following routes:
1. The modifications / up-gradations shall be certified by the Civil / Military Certification Agency of the country of origin. An Amended/Supplementary TC or equivalent shall be issued with.
 2. The Civil / Military Certification Agency of the country of origin is recognized by the Indian counterpart.
 3. In case the Civil / Military Certification Agency of the country of origin is not certifying the modifications / up-gradations, Indian TAA shall be approached for certification.
- iii. Procurement of Civil Certified Airsystem with / without modifications and subsequent modifications /up-gradations in India
1. The conditions mentioned in para a and (or) b above shall be met with.
 2. The Indian design agency involved in modifications /up-gradations in India shall be identified with.
 3. Subsequent modifications carried out in India shall be certified by the Indian TAA (CEMILAC & DGAQA)
 4. An STC shall be issued to the Indian design agency involved in modifications /up-gradations in India subsequent to completion of such jobs.
- iv. In case of procurement Civil Certified Airsystem with licence production / TOT for subsequent manufacturing in India, provisions mentioned in Subpart F for production under license agreement, should be followed.

21.R.2 Certification Basis

Regulation

The TAA shall ensure the use of applicable airworthiness codes as a standard means to show compliance of products, parts and appliances with the essential requirements in RFP. Such codes shall be sufficiently detailed and shall be specific to indicate the conditions under which the Airsystems will be accepted.

Acceptable Means of Compliance

- a. Procurement of a Civil Certified Airsystem without any modifications
 - i. The Civil Certification agency of the country of origin shall be recognized by the Indian counterpart (DGCA) or by FAA/EASA.
 - ii. The Airsystem shall hold a valid Type Certificate (TC), Amended TC or Supplementary TC (STC) from Certification agency of the country of origin or from a Certification agency recognized by DGCA / FAA/ EASA
- b. Procurement of Civil Certified Airsystem with Modifications/ up-gradations by OEM
 - i. The Civil Certification agency of the country of origin shall be recognized by the DGCA / FAA/EASA.
 - ii. The Airsystem shall hold a valid Type Certificate (TC), Amended TC or Supplementary TC (STC) from Certification agency of the country of origin or from a Certification agency recognized by DGCA / FAA/ EASA
 - iii. Certification basis for any Military modifications shall be based on the agreement with Indian TAAs. FAR 21 or equivalent, MIL STD, RTCA DO 160, DEF STAN etc can be acceptable certification codes.
- c. Procurement of Civil Certified Airsystem with / without modifications by OEM and subsequent modifications /up-gradations in India
 - i. The Civil Certification agency of the country of origin shall be recognized by the DGCA / FAA/EASA.
 - ii. The Airsystem shall hold a valid Type Certificate (TC), Amended TC or Supplementary TC (STC) from Certification agency of the country of origin or from a Certification agency recognized by DGCA / FAA/ EASA
 - iii. Certification basis for any Military modifications shall be based on the agreement with Indian TAAs.

Guidance Material

- a. FAR 21 / CAR21 or its equivalent regulations prevailing in the country of origin shall be the default Basis for Certification.
- b. FAR 21 or equivalent, MIL STD, RTCA DO 160, DEF STAN etc can be acceptable certification codes.
- c. Any proposed alternative Airworthiness codes are to be sufficiently detailed and specific, such that the detail for their use in the case put forward is clear.

21.R.3 Certification Program

Regulation

A Certification Program shall be finalised to show the compliance to applicable Airworthiness Codes

Acceptable Means of Compliance

A Certification Program shall describe the certification process in each of the 3 categories mentioned at Para xxx above.

- a. Procurement of a Civil Certified Airsystem without any modifications
 - i. If the Airsystem to be procured is a Civil Certified version from the country of origin and is intended to be procured without any modifications to the certified configuration, the Airsystem shall be accepted by the user without any further Certification process. No Specific Certification Program is required.
- b. Procurement of Civil Certified Airsystem with Modifications/ up-gradations by OEM
 - i. If the Airsystem to be procured is a modified or up-graded version of a Civil Certified version from the country of origin, the certification program shall address the following aspects:
 1. In case the Civil / Military Certification Agency of the country of origin is the certifying agency, a certification plan in consultation with the agency shall be finalised.
 2. In case the Indian TAA is providing certification coverage, a certification program shall be finalized with Indian TAA. This program shall be in accordance with Subpart D/E, Modifications, depending on the scope of activities.
- c. Procurement of Civil Certified Airsystem with / without modifications and subsequent modifications /up-gradations in India
 - i. For any modifications carried out in the country of origin, para b above shall apply.
 - ii. For the modifications/upgradations carried out in India, a certification program shall be finalized with Indian TAA. This program shall be in accordance with Subpart B, C, D & E, Design & Development and Modifications, depending on the scope of activities.
 - ii. The Indian agency, which is carrying out the modifications and upgradations shall have necessary organization approvals as mandated in Subpart B, C, D & E

Guidance Material

- a. FAR 21 / CAR21 or its equivalent regulations prevailing in the country of origin shall be the default Basis for Certification.
- b. FAR 21 or equivalent, MIL STD, RTCA DO 160, DEF STAN etc can be acceptable certification codes.

- c. Airworthiness codes detailed in Subpart B and C also shall be used in applicable cases.
- d. Any proposed alternative Airworthiness codes are to be sufficiently detailed and specific, such that the detail for their use in the case put forward is clear.

21.R.4 Compliance to Airworthiness Codes

Regulation

The TAA shall ensure that the Aircraft is certified to approved Airworthiness codes

Acceptable Means of Compliance

- a. User services in consultation with the OEM of the Airsystems and CEMILAC & DGAQA shall finalise an acceptance program where the compliance to applicable airworthiness codes as finalized in the certification program shall be checked for.
- b. Any additional testing required to ensure such compliance also shall be included.
- c. In case the Indian TAA is providing the certification coverage, on satisfactory completion of these activities, an application to Supplementary Type Certificate (STC) shall be generated by the OEM in accordance with Subpart D and submitted to CEMILAC.

Guidance Material

- a. FAR 21 or its equivalent regulations prevailing in the country of origin shall be the default Airworthiness code.
- b. Any proposed alternative Airworthiness codes are to be sufficiently detailed and specific, such that the detail for their use in the case put forward is clear.

21.R.5 Continuing Airworthiness

Regulation

Continuing Airworthiness of the Airsystems shall be the responsibility of the user services

Acceptable Means of Compliance

- a. The Airsystems on receipt to India shall be registered with user services and shall be issued with a service registration number.
- b. An IAF Form 700 document or equivalent shall be created in accordance with the operating instructions of user services.
- c. User services in consultation with the OEM of the Airsystems shall carryout all routine maintenance activities as per approved manuals and instructions.
- d. Any service bulletins/instructions released by OEM shall be implemented by user services.

Guidance Material

- a. Aircraft manuals approved by OEM and respective certification agencies
- b. Operating instructions released by OEM as well as user services

21.R.6 Modifications

Regulation

Modifications carried out on the Airsystems shall be certified by a competent Airworthiness Certification Agency

Acceptable Means of Compliance

- a. The modifications carried out as per the Service Bulletins/Instructions by the OEM, to incorporate changes in the basic Airsystem configurations shall be carried out by the trained personnel with user services and shall be endorsed in form 700 or applicable documents.
- b. All the modifications that are carried out in India, to incorporate the Military functionalities shall be certified by the Indian TAA
- c. All the Modifications shall be certified in accordance with Subpart D and E whichever is relevant.
- d. An STC shall be issued by Indian TAA for all major upgradations carried out in India in accordance with Subpart D
- e. If any upgradation is carried out by OEM on the basic certified configuration of the Airsystem, that shall be certified by either the Certification Agency of the country of origin or Indian TAA depending on the scope of activities and as agreed upon by the relevant stakeholders.

Guidance Material

- a. Forms for Advance Modification Intimations (AMI) and Mod leaflets.
- b. Service Bulletins and Instructions by the OEM.

SUBPART S: CUSTOMER FURNISHED EQUIPMENT AND CUSTOMER SPECIFIED EQUIPMENT

Rationale:

It is quite possible that the customer viz., the user services insist on using an equipment or specified by them. Certain equipment may already be held in their inventory or may be procured by them directly and furnished for installation on Airsystems. Such type of equipment are identified as **Customer Furnished Equipment (CFE)**.

In some cases, Services may specify certain equipment to Airsystem integrator to be installed on Airsystems to meet their specific operational requirements or to have commonality with other platforms in their inventory. Such equipment is identified as **Customer Specified Equipment (CSE)**

There may be instance when, additional equipment has to be procured by the Integrator, so as to ensure performance of the system specified by the Services. The details of additional equipment may not be specified at contract stage. If this additional equipment is solely related with the safety and functionalities of the CSE, they shall also be categorised as CFE/CSE by the User & Main Contractor.

The Technical Airworthiness Agencies (TAA) are responsible to ensure that the safety and performance parameters of the Airsystem is not compromised with the installation of such equipment.

Contents

- 21.S.1 Customer Furnished Equipment (CFE)
- 21.S.2 Customer Specified Equipment (CSE)
- 21.S.3 Transfer of technology (ToT) for Manufacturing
- 21.S.4 Continued Airworthiness

21.S.1 Customer Furnished Equipment (CFE)

Regulation

The user services are responsible for ensuring the safety, performance, reliability and life of such equipment. Responsibility of the integration, performance evaluation and airworthiness assurance of CFE Equipment lies with User Services, Airsystem Integrator & TAA.

Acceptable Means of Compliance

- a. For CFEs, already held in services inventory as a part of their earlier Airsystem installation, TAA shall ensure that the operational envelope requirements of the

intended Airsystem are adequately met. In case of some mismatch in operational envelope requirements of earlier Airsystem installation and intended Airsystem requirements, TAA will specify for additional Qualification testing. Service is responsible for ensuring qualification independently or through Integrator/OEM according to Platform requirements as stipulated by TAA.

- b. User Services is responsible for obtaining design details related to Airsystem necessary for ensuring integrity and safety after integration onto the Airsystem.
- c. The Airsystem integrator in consultation with TAA shall carryout necessary analysis and tests to demonstrate that the installation of CFEs doesn't affect the safety and performance of the Airsystem.
- d. If any design changes are implemented to make the equipment suitable for Airsystem integration, necessary tests and analysis to evaluate such changes should be carried out in consultation with TAA. In these cases, involvement of Equipment OEM is essential.
- e. The Airsystem integrator should evaluate the equipment and bring out the short falls if any, in terms of functional, performance, environment parameters and the life of the equipment and their effect on the Airsystems where such equipment are used.
- f. The Airsystem integrator should inform the TAAs as well as concerned service HQ of any short falls and the implications of using such equipment. A disposition on these aspects from the services shall be mandatory requirement prior to the release of such items for operational use.
- g. Role of TAA for CFEs will be restricted to Platform Clearance only.
- h. The through life service and configuration control requirement of such equipment shall be the responsibility of the user services.
- i. If the equipment are supplied by the OEM of Bought out Airsystems, so as to address obsolescence or to increase operation capability, Airsystem OEM may integrate new equipment/ replaces an equipment from by itself/ or through some Authorised Airsystem Integrator (authorised by Airsystem OEM). Certification of Equipment & its integration will be the responsibility of Aircraft OEM and involvement of TAA is not envisaged. TAA may get involved at specific request of User. However, in this case, availability of certification documents regarding Equipment/Airsystem e.g. type records, all test details like fatigue test, fatigue life, EMI/EMC map, vibration and environmental map, reliability data etc., is essential to be provided to TAA. In such cases, Role of TAA will be limited to bring out certification and performance limitations.

Guidance Material

- a. The importer /user /contractor shall make adequate provision in the contract to provide all necessary artefacts /documents necessary to meet airworthiness certification requirements as specified by TAA.

21.S.2 Customer Specified Equipment (CSE)

Regulation

The Airsystem Integrator, User & TAA shall ensure the safety, performance, reliability and life of those equipment which are specified by the user services for fitment on Airsystem.

Acceptable Means of Compliance

- a. The Main Contractor should ensure that all the relevant details to ensure the safety and performance parameters are obtained from the supplier of the equipment. If the CSE item suppliers are of Indian Origin, the CSEs should have undergone Airworthiness Certification with Indian TAA. Airworthiness certification considerations of CSE items of foreign origins shall be considered on par with Subpart N, Bought Out Airborne Stores.
- b. User Services is responsible for obtaining design details related to Airsystem necessary for ensuring integrity and safety after integration onto the Airsystem.
- c. The User Services, Airsystem Integrator & TAA should verify that safety and performance parameters of the Airsystem are not affected by the installation of such equipment.
- d. If any design changes are implemented to make the equipment suitable for Airsystem integration, necessary tests and analysis to evaluate such changes should be carried out in consultation with TAA. Involvement of Equipment OEM is essential in these cases.
- e. There may be instances, when Equipment OEM is situated abroad and is not willing to share the design configuration details. In such cases, the details as per Annexure enclosed should be obtained from the Equipment OEM. In these cases, role of TAA will be restricted to Platform Integration only. However, TAA shall ensure that the operational envelope requirements of the intended Airsystem are adequately met. In case of any deficiency, TAA will specify for additional Qualification testing. User Services is responsible for ensuring qualification independently or through Integrator/OEM according to Platform requirements as stipulated by TAA.
- f. The Airsystem integrator in consultation with TAA should carryout necessary analysis and tests to demonstrate that the installation of CSE doesn't affect the safety and performance of the Airsystem.
- g. The Airsystem integrator should however evaluate the equipment and bring out the short falls if any, in terms of functional, performance, environment parameters and the life of the equipment and their effect on the Airsystems or systems where such equipment are used.
- h. The Airsystem integrator should inform the TAAs as well as concerned service HQ of any short falls and the implications of using such equipment. A disposition on theses aspects from the services shall be mandatory requirement prior to the release of such items for operational use.

Guidance Material

- a. The term Buyer Nominated Equipment (BNE) is also used in some cases to identify CSE.
- a. The importer /user /contractor shall make adequate provision in the contract to provide all necessary artefacts /documents necessary to meet airworthiness certification requirements as specified by TAA.

21.S.3 Transfer of technology (ToT) for Manufacturing

Regulation

Necessary Transfer of Technology shall be obtained by the Production Organisation in case CSE & BNE items are manufactured under license in India

Acceptable Means of Compliance

- a. Production under license agreement shall be carried out as per Subpart F

Guidance Material

- a. Nil

21.S.4 Continued Airworthiness

Regulation

- a. User Services shall be responsible for the Continued Airworthiness of the CFE items. For CSE items, User, Airsystem Integrator & TAA (Where design configuration shared by Equipment OEM) shall be responsible for CSE items

Acceptable Means of Compliance

- a. Failure Reporting, Modification, Upgradation, Maintenance, Lifting, Storage etc shall be addressed by the user services in consultation with OEM and Aircraft Integrator.
- b. For CSE items, Continued Airworthiness activities shall be carried out in accordance with Subpart L.

Guidance Material

Nil

**CHECK LIST FOR CLEARANCE OF CUSTOMER SPECIFIED EQUIMENTS PURCHASED FROM
ABROAD**

Sl.No.	Particulars
1.	Nomenclature of the Equipment with Part No/Drawing No
2.	Name of the Supplier
3.	Brief Description of the Equipment/LRU
4.	Intended usage
5.	Flight/ Provisional clearance issued by Certification Agency, if any
6.	Technical Specification/Standards etc., (details enclosed)
7.	Whether clearance required for development/series production
8.	a) Whether approved /Type certified by civil / Military authorities of the country of origin
	b) If yes, reference specification to which approved / certified (copy enclosed)
9.	Conditions / Limitations if any
	Detailed results of type Tests carried out
	Installation Features
10.	If already installed / in service with other Aircraft / Helicopter / Engines details thereof
11.	Performance feedback
12.	Estimated MTBF / Reliability Prediction
13.	Design Life of the equipment (with details of test validating it)
14.	Interface Details (ICD)
14.	Declaration of Design & Performance (DDP) (Enclosed as Appendix-A)
15	(a) If not type approved by Government Organisation in the country of origin, Is it planned to obtain certification from CEMILAC? (b) If yes, proposed plan of action for obtaining certification (c) If proposed for licence manufacture in India, the name/address of the licence (d) In case of yes in 15 (c) details of test/ clearance details for manufacture at new source

16.	Supporting Documents, if applicable
	a) Thermal Analysis report
	b) FMECA
17.	Storage & Operational Conditions if any (viz., Temp charging/ Conditioning shelf life etc.,)
18.	Period Maintenance, if applicable.
19.	Any other Information

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DECLARATION OF DESIGN & PERFORMANCE

1.	NAME & ADDRESS OF MANUFACTURER	2.	DDP NO.
		3.	ISSUE NO
		4.	DATE
		5.	TYPE OF DECLARATION
6	DECLARATION OF DESIGN & PERFORMANCE OF		
(a)	DENOMINATION OF THE EQUIPMENT		
(b)	MANUFACTURER NAME & P/N		
(c)	MODIFICATION REFERENCE		
7	DESCRIPTION		
	DESIGN		
8.	WEIGHT		
9.	DIMENSIONS		
10.	SPECIFICATION REFERENCE		
	(a) DESIGN SPECIFICATION REFERENCE		
	(b) APPROVED MASTER DRAWING LIST		
	(c) APPROVAL(E.G. TSO/ESTSO/ANY OTHER CERTIFICATION)		
11.	(a) INSTALLATION DRAWING		
	(b) WIRING DIAGRAM NO.		
	PERFORMANCE		
12.	PERFORMANCE STANDARD REFERENCE		
13.	QUALIFICATION TEST PROCEDURE & QUALIFICATION TEST REPORTS REFERENCE (HARDWARE,SOFTWARE, FLIGHT)		
14.	QUALITY CONTROL PROCEDURE		
(a)	QUALITY PLAN		

(b)	SOFTWARE QUALITY PLAN			
(c)	ACCEPTANCE TEST PROCEDURE			
15.	SERVICE & INSTRUCTION MANUAL			
16.	RELIABILITY & MAINTENANCE POLICY			
16.	STATEMENT OF LEVEL OF COMPLIANCE (QUALIFICATION SUMMARY)			
	NAME OF THE TEST	STANDARD REFERENCE (MIL ETC.)	TEST METHOD	COMPLIANCE OR NON-COMPLIANCE DECLARATION
17.	SOFTWARE CRITICALITY LEVEL			
18.	LIST OF DOCUMENTATION I.E CONFIGURATION & QUALIFICATION, HARDWARE, SOFTWARE, INTER CONNECTION DIAGRAM (ICD), INSTALLATION, TRAINING ETC.			
19.	DECLARATION REGARDING DESIGN & PERFORMANCE			
20.	SIGNATURE			

SUBPART T - TEST RIGS AND TOOLS, TESTERS & GROUND EQUIPMENT (TTGE)

Introduction

For the purpose of the regulations of this subpart, two categories of Ground Systems, viz, Test Rigs and Tools, Testers & Ground Equipment (TTGE) are considered.

Test Rigs

Test Rigs are the equipment / test facilities which are used for the functional & performance evaluation of Airsystems and Airborne Stores during the design, development and production phase. These test rigs are normally not delivered to user services except in some special cases.

The regulations pertaining to Test Rigs are given in **SUBPART 21.T1**.

Tools, Testers & Ground Equipment (TTGE)

Tools, Testers & Ground Equipment (TTGE) are the equipment which are used by the ground and air crew of user services for preparation, service, upkeep and maintenance of Airsystem and Airborne stores during their operational use. Some of the TTGEs may be required during development and production phases also particularly during development and production acceptance flight testing of airsystems.

The regulations pertaining to TTGE are given in **SUBPART 21.T2**.

SUBPART 21.T1 - Test Rigs

Rationale

For the airsystem development programs, Test rigs are required so that the system level functional & performance evaluation can be carried out to demonstrate that the system satisfactorily meets the design & safety requirements. The test rigs are also required for the full functional & performance evaluation of airborne stores.

The approval of Test Rigs is essential so as to ensure that these are safe to use and are capable of providing the required functionality.

Contents

- 21.T1.1 Applicability**
- 21.T1.2 Categorisation of Test Rigs**
- 21.T1.3 Inclusion of Test Rig Requirements at RFP Stage**
- 21.T1.4 Approval of Test Rigs**
- 21.T1.5 Approval Basis**
- 21.T1.6 Technical Specifications**
- 21.T1.7 Design and Development**
- 21.T1.8 Test Rig Software**
- 21.T1.9 Fabrication of Test Rigs**
- 21.T1.10 Identification of Test Rigs**
- 21.T1.11 Qualification Testing**
- 21.T1.12 Documentation Requirements**
- 21.T1.13 Acceptance of Test Rigs for Approval**
- 21.T1.14 Standalone Test Rigs**
- 21.T1.15 Production of Test Rigs**
- 21.T1.16 Transfer of Technology (ToT)**
- 21.T1.17 Modifications / Up-gradations of Test Rigs**

Regulatory Articles (RA):

21.T1.1 Applicability

Regulations

This subpart shall be applicable for the following types of test rigs:

- a. Test rigs, which addresses a broad category of equipment which shall include mock-ups, rigs, jigs, fixtures, simulators, simulation software, software tools, standard test equipment, automated test equipment (ATE), integration rigs, avionics part task trainer (APTT), hardware-in-loop simulator (HILS) etc. used during the design and development phase of Airsystems and Airborne Stores.
- b. Test rigs, as described above, which are used during production phase of Airsystems and Airborne Stores.
- c. Test Rigs used during development / production phase and further delivered to user services.
- d. Telemetry systems used during the development flight testing of Airsystems shall be treated as Test Rigs.
- e. Airsystems such as Flying Test Bed (FTB) used for the development flight testing of Airborne Stores **shall not be** considered as Test Rigs.

Acceptable Means of Compliance

- a. The test rigs made during the design & development phase shall be made available in serviceable condition till the issue of MTC for airsystem under development and TA or equivalent for Airborne Store development, as applicable.
- b. If there is a need to use these test rigs (in as it is condition or with some modifications / up-gradations) during in-service phase of the airsystem / airborne store, the detailed requirements regarding servicing and maintenance aspects shall be finalized in consultation with servicing development organizations of user services such as MAG(Avn) / CSDO / NASDO etc.

Guidance Material

NIL

21.T1.2 Categorisation of Test Rigs

Regulation

Test Rigs shall be categorised depending on their role, functionality and scope of usage.

Acceptable Means of Compliance

Test Rigs shall be categorised as follows:

- Type 1:** Test Rigs used only during development phase
- Type 2:** Test Rigs used during development as well as production phase
- Type 3:** Test Rigs used only during production phase
- Type 4:** Test Rigs delivered to user services including the test rigs used during development / production phase and then delivered to user services

Guidance Material

The Development Telemetry Systems used during the development flight testing of Airsystems are covered under Type 1 Test Rigs.

21.T1.3 Inclusion of Test Rig Requirements at RFP Stage

Regulation

The requirements for test rigs for airsystem and airborne stores development programs shall be identified at the project proposal finalization stage itself and all the RFPs for procurement activities during design & development and productions phases shall necessarily include these requirements.

Acceptable Means of Compliance

- a. The Main Contractor shall identify the test rigs required during design, development and production of Airsystems / Airborne Stores and take these into considerations at project proposal finalisation stage.
- b. These identified test rig requirements shall be included in all the RFPs for procurement activities of airborne stores as well as subsystems of airsystems, as applicable.
- c. User services shall project the requirements of test rigs required for service use phase including their certification aspects at the project proposal stage itself.
- d. The Main Contractor shall identify the test rigs to be supplied, if any for the operational exploitation of Airsystems / Airborne Stores.

Guidance Material

- a. Involvement of Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO would be beneficial for finalisation of requirements for test rigs deliverable to user services so as to address the servicing and maintenance aspects.

21.T1.4 Approval of Test Rigs

Regulation

Test rigs required for usage associated with military airborne applications shall be subjected to an approval process so as to ensure that these are safe to use and are capable of providing the required functionality.

Acceptable Means of Compliance

- a. Test Rigs which are standard in nature and procured from off-the-shelf sources need not be subjected to any approval provided the specifications of such test rigs meet the end use requirements. Such test rigs shall be accepted after verifying their functional performance, calibration status and the approval status, if any.
- b. For the ab-initio designed & developed test rigs, the responsibility of the approval of test rigs shall be based upon the category of the test rigs, as identified in RA 21.T1.2 and shall be as given below:

Type 1: Type 1 test rigs shall be fully approved by CEMILAC

Type 2: Type 2 test rigs shall be approved by DGAQA based on the Technical Specifications approved by CEMILAC

Type 3: Type 3 test rigs shall be fully approved by DGAQA

Type 4: Type 4 test rigs shall be approved by DGAQA based on the Technical Specifications approved by CEMILAC. Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO shall be involved for such test rigs so as to address the servicing and maintenance aspects during their service use.

Guidance Material

NIL

21.T1.5 Approval Basis

Regulation

The test rig development agency shall identify Approval Basis (AB) acceptable to the TAA responsible for the approval of test rig. Compliance to AB shall form one of the basis for the approval of the test rig.

Acceptable Means of Compliance

- a. Test Rigs which are not to be delivered to user services shall be approved based on their functional and performance evaluation.

- b. User deliverable Test Rigs shall be further classified based on their role and operational environment. Approval basis shall be finalised based on this classification.
- c. JSS 55555 or its equivalent document shall be the basis for qualification testing of test rigs deliverable to user services.
- d. The classification given below shall help in arriving at the qualification test requirements for the test rigs based upon their location / deployment environment. The applicable qualification tests based on the class of test rigs shall be finalised from JSS 55555 or its equivalent document. These documents, however, shall be used only as guideline and shall be tailored further in consultation with all the stakeholders.
 - a. **Class 1:** Test Rig permanently installed or stored in an air system for use in flight.
 - b. **Class 2:** Test Rig used in the vicinity of an airtsystem, in tracked and wheeled vehicles
 - c. **Class 3:** Partially protected Test Rig
 - d. **Class 4:** Test Rig used in light buildings, structures and vehicles where it is protected from direct rain, sun etc.
 - e. **Class 5:** Test Rig used in permanent buildings
 - f. **Class 6:** Test Rigs considered to be state of the art in design and construction for which special operational requirements are necessary and which are not compatible with environmental requirement of Class 1 to 5. Environmental requirements for these test rigs shall be defined in the detailed technical specifications after discussion with all the stakeholders based on application and end use.
- e. A Quality Assurance Plan (QAP) for the Test Rigs shall be prepared by the development agency and approved by DGAQA / internal QA group of Main Contractor, as applicable.

Guidance Material: NIL

21.T1.6 Technical Specifications

Regulation

The test rig development agency shall bring out the detailed Technical Specifications document based on the end user requirement.

Acceptable Means of Compliance

- a. The Technical Specifications document for all types of test rigs shall be prepared by the test rig development agency in consultation with the Main Contractor of the airtsystem and airborne stores utilising the test rig.

- b. The document shall address the end use requirements and shall take into account the user requirements, if available.
- c. The responsibility for the approval of Technical Specifications for the test rigs shall be based upon the category of the test rigs, as identified in **RA 21.T1.2** and shall be as given below:

Type 1: Technical Specifications for Type 1 test rigs shall be approved by CEMILAC

Type 2: Technical Specifications for Type 2 test rigs shall be approved by CEMILAC

Type 3: Technical Specifications for Type 3 test rigs shall be approved by DGAQA

Type 4: Technical Specifications for Type 4 test rigs shall be approved by CEMILAC in consultation with Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO.

Guidance Material

Guidance material on contents of major documents for test rigs and TTGEs given at **Annexure-1 to Subpart T**.

The format for Technical Specifications for Test Rigs prescribed by TAA and available as part of Manuals to be used.

21.T1.7 Design and Development

Regulation

The test rig development agency shall follow a design & development process that results in test rig meeting the end use requirements and the approval Basis.

Acceptable Means of Compliance

- a. The design and development activities shall follow a System Engineering Life Cycle Process.
- b. The QA Process to be followed during test rig development and production shall be approved by DGAQA. DGAQA may delegate certain inspection and testing responsibilities to the internal QA of the development agency.
- c. Post placement of order with the identified development agency, the design review for Test Rigs shall be conducted. The design review shall be carried out by the committee constituted with the members from all the stakeholders involved in development, production, approval and end use of the test rigs.
- d. Safety and maintainability features shall be included in the design of the test rigs.

- e. Adequate internal diagnosis features, BITE/POST features etc. shall be included in the design.
- f. Hardware Design details and installation drawings shall be provided by the development agency to certification authorities as part of review processes.
- g. The design standard of preparation (SOP) of the Test Rig shall be finalised by the development agency and approved by TAA responsible for test rig certification. The design SOP shall include Bill of Materials (BOM) and Drawings.
- h. The design shall be considered to be adequate for prototype realisation / fabrication based on the approval and baselining of the design standard of preparation.
- i. Acceptance Test Procedure of the test rig shall be prepared by the development agency and approved by TAA responsible for test rig certification.
- j. A configuration control mechanism shall be implemented during the design and development phase by the development agency.
- k. All deviations /non-conformances arising during design & development phase or from acceptance testing phase of the test rigs shall be documented and disposed of as per the process put in place by the development agency in consultation with the Main Contractor of aircsystem / airborne stores. This process shall ensure that any deviation from the requirements listed in the approval basis is disposed of with the approval of appropriate Waiver Board, if available and TAA responsible for the approval of the test rig.

Guidance Material

NIL

21.T1.8 Test Rig Software

Regulation

The test rig development agency shall follow a proper process for development, evaluation and approval of the software of test rig, if any.

Acceptable Means of Compliance

- a. The test rig software shall be developed and tested in accordance with an established Software Development Life Cycle Process.
- b. The criticality level of the software of the test rig used for a subsystem of an aircsystem or an airborne store shall be arrived at based on the criticality level of such subsystem / airborne store.
- c. The software requirement specifications (SRS) for Type 1, Type 2 and Type 4 test rigs shall be approved by CEMILAC and for Type 3 by DGAQA.

- d. The test rig software shall be evaluated as per the applicable regulations given in Subpart C6.
- e. The test rig software approval as per approved SRS shall be carried out by CEMILAC for Type 1, Type 2 and Type 4 test rigs and by DGAQA for Type 3 test rigs.
- f. The development agency of the test rig containing software shall identify the means of compliance for the software aspects and demonstrate compliance for obtaining approvals.

Guidance Material

- a. Refer **SUBPART C6** for further details on software certification process
- b. Refer AMC under **RA 21.T1.12** for the minimum set of software documents required for test rigs

21.T1.9 Fabrication of Test Rigs

Regulation

Fabrication of Test Rigs shall be carried out by the development agency as per approved and baselined standard of preparation.

Acceptable Means of Compliance

- a. The development agency shall fabricate the Test Rig as per the approved and baselined configuration.
- b. DGAQA / Internal QA of the development agency shall carryout necessary inspection of the units as per approved QAP.

Guidance Material

NIL

21.T1.10 Identification of Test Rigs

Regulation

The test rig development agency shall have a mechanism in consultation with the Main Contractor for unique identification of the test rigs.

Acceptable Means of Compliance

- a. Test Rigs shall have proper configuration identification mechanism.
- b. Subpart Q shall be followed for identifying the applicable regulations for identification.

Guidance Material

Refer SUBPART Q for further details

21.T1.11 Qualification Testing

Regulation

The Test Rigs which are required to be delivered to user services shall be subjected to applicable qualification tests.

Acceptable Means of Compliance

- a. The test rigs required during the development phase as well as production phase (i.e. Type 1, Type 2 and Type 3 Test Rigs) shall not be subjected to qualification testing.
- b. The test rigs which are required to be delivered to user services for service use (i.e. Type 4 Test Rigs), the qualification testing shall be carried out as per the qualification test plan (QTP) approved by DGAQA in consultation with Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO.
- c. The extent of qualification testing shall be arrived at based on the identified class of the Type 4 Test Rigs as per RA 21.T1.5.
- d. A qualification test report (QTR) prepared by the test rig development agency and approved by DGAQA or internal QA group of the development agency duly authorised by DGAQA shall form one of the basis for the acceptance and approval of Type 4 test rigs.

Guidance Material

Refer JSS 55555

21.T1.12 Documentation Requirements

Regulation

The test rig development agency shall have a proper mechanism for preparation, identification and configuration control of all the necessary documents required for the development, approval and end use of the test rigs.

Acceptable Means of Compliance

The following is the broad list of documents which shall be prepared by the test rig development agency and these shall be indicated as part of deliverables in the technical specifications. This list of documents shall be used as a guideline only and shall be tailored further based on type and class of test rig in consultation with all the stakeholders.

- a. Technical Specifications
- b. Design Document

- c. Quality Assurance Plan (QAP)
- d. All applicable drawings (Part drawings, Mechanical and Electrical assembly drawings, schematics drawings, etc) including Master Drawing Index (MDI)
- e. Bill of Material (BOM).
- f. Qualification Test Procedure (QTP) – as applicable
- g. Qualification Test Report (QTR) – as applicable
- h. Acceptance Test Plan (ATP)
- i. Acceptance Test Report (ATR)
- j. Manuals – Test Rig User Manual / Installation Manual / Operating Manual & Maintenance Manual including calibration requirement, product support, list of spare parts etc.
- k. Software Documents (Minimum Set):
 - i. Software Requirement Specification (SRS)
 - ii. Software Quality Assurance Plan (SQAP)
 - iii. Software Development Plan (SDP)
 - iv. Software Configuration Management Plan (SCMP)
 - v. Independent Verification & Validation (IV & V) Plan & Report

Guidance Material

A broad list of the attributes which shall be included in various documents are brought out in Annexure-1 to Subpart T which can be used with proper tailoring.

21.T1.13 Acceptance of Test Rigs for Approval

Regulation

The test rig shall be subjected to the acceptance testing prior to its approval for intended usage.

Acceptable Means of Compliance

- a. The test rig development agency shall prepare a test rig acceptance test plan (ATP) document which shall be approved by the TAA responsible for the approval of the test rig.
- b. Standard test equipment shall be used to verify the correctness of the parameters of the test rigs. Airborne LRUs/subsystems shall be used for verification only when other methods are not available.
- c. The acceptance testing shall be carried out by the test rig development agency and shall be witnessed by the TAA responsible for the approval of the test rig.

- d. An acceptance test report (ATR) prepared by the test rig development agency and approved by the TAA responsible for the approval of the test rig shall form one of the basis for the acceptance of all types of test rigs.
- e. The test rig development agency shall prepare a compliance report against the approval requirements listed in the approval basis as per **RA 21.T1.5** and also the Technical Specifications as per **RA 21.T1.6**.
- f. Along with the compliance report and all the other applicable documents, the test rig development agency shall approach the TAA responsible for the approval of test rig for issuing certificate of approval for the test rig.
- g. On satisfactory completion of all the approval activities and having satisfied itself with the correctness and completeness of the compliance report and other applicable documents, the TAA responsible for the approval of test rigs shall provide necessary certificate to the test rig development agency towards approval of the test rig.

Guidance Material

NIL

21.T1.14 Standalone Test Rigs

Regulation

Standalone test rigs as well as test rigs having applications for aircystems / airborne stores not deliverable to user services shall also be provided with the approval coverage by the TAA.

Acceptable Means of Compliance

CEMILAC and DGAQA, either on their own or through proper delegation, shall provide approval coverage for standalone development of test rigs or test rigs for aircystems not deliverable to user services such as research aircystems / airborne stores etc.

Guidance Material

The approval coverage by TAA will help in encouraging new development agencies to take up design & development projects in military aviation field by starting with low risk test rig design activities. This will also aid the research aircystem / airborne stores projects.

21.T1.15 Production of Test Rigs

Regulation

Production of Test Rigs shall be carried out as per approved SOP and by following a robust QA process.

Acceptable Means of Compliance

- a. Issue of necessary certificate of approval, by the TAA responsible for approval, towards acceptance of the test rig shall enable the test rig development agency to start regular production activities as per the approved SOP.
- b. The development agency for the test rigs undertaking regular production shall have necessary Quality Management System in place with appropriate approval from DGAQA.
- c. During the regular production of test rigs as per approved SOP, DGAQA / internal QA of the Main Contractor duly authorised by DGAQA shall provide the inspection coverage.
- d. ATP during production phase shall be conducted as per TAA approved ATP. Approval shall be obtained for any change in the ATP or SOP.
- e. If Test rigs are produced by an agency other than the development agency, proper ToT as per **RA 21.T1.16** shall be carried out.

Guidance Material

NIL

21.T1.16 Transfer of Technology (ToT)

Regulation

If the production of test rigs is required to be carried out by an agency other than the development agency, a proper Transfer of Technology (TOT) to Production agency by the test rig development agency shall be carried out.

Acceptable Means of Compliance

- a. The transfer of technology (ToT) guidelines issued by CEMILAC shall be followed in consultation with all the other stakeholders.
- b. The Production agency shall have requisite approval from DGAQA for taking up such activities.

Guidance Material

NIL

21.T1.17 Modifications / Up-gradations of Test Rigs

Regulation

Modifications / up-gradations of the already approved test rigs shall be carried out by ensuring compliance to the applicable regulations from this Subpart 21.T1, which shall be

arrived at in consultation with the TAA responsible for the approval of the test rig type and by taking into account the extent of modification / up-gradation required.

Acceptable Means of Compliance

- a. The modifications / up-gradations arising out of alteration of existing functionalities / addition of new functionalities to the already approved test rigs shall be handled using this regulation.
- b. The changes to approved test rigs due to obsolescence management requirements shall be handled using this regulation.
- c. The adaptation of the test rigs developed for one type of airtsystem / airborne store for another shall be handled using this regulation.
- d. The applicability of the regulations from the full set of regulations of Subpart 21.T1 shall be finalised by carefully reviewing the extent of modification / up-gradation / changes required in the already approved test rigs and also the extent of technical documentation available for the test rig to be modified / up-graded.
- e. The proposal for identifying the applicable regulations towards modification / up-gradation shall be prepared by the test rig development agency or any other agency identified for modification / up-gradation and final acceptance of the same shall be by the TAA responsible for the approval of test rig type. This proposal shall also identify the extent of documentation required for the approval of modification / up-gradation of the test rig.

Guidance Material

Modification / up-gradation can arise due to hardware / software changes required or also due to the change in the installation environment.

SUBPART 21.T2 - Tools, Testers & Ground Equipment (TTGE)

Rationale

As part of any air system development program, Tools, Testers & Ground Equipment (TTGE) are also required to be developed which play a major role in aiding the ground and air crew during the preparation of air system for service, upkeep and maintenance in an efficient way.

Generally, those items are categorized as TTGEs which are required to be delivered to the user services for operational use. However, some of the TTGEs may also be required for use during the development and production phases of an air system / airborne store particularly during development and production acceptance flight testing of aircsystems.

The approval of TTGEs is essential so as to ensure that these are safe to use and are capable of providing the required functionality.

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- 21.T2.2 Applicability**
- 21.T2.3 Categorisation of TTGEs**
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- 21.T2.15 Production of TTGEs**
- 21.T2.16 Transfer of Technology (ToT)**

21.T2.17 Modifications / Up-gradations of TTGEs

Regulatory Articles (RA):

21.T2.1 Definitions

Regulations

TTGEs shall include Tools, Testers and Ground Equipment:

Tools: All mechanical/special tools required to maintain the air system / airborne store

Testers: All testers and test equipment which are used to test/verify functions/ parameters of the air system / airborne store

Ground Equipment: Ground handling and Ground support equipment required to operate / maintain the air system / airborne store.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.T2.2 Applicability

Regulations

This subpart shall be applicable for the following types of TTGEs:

- a. TTGEs which are required to be delivered to the user services. However, some of the TTGEs, which may have been used during the development and production phase of an air system / airborne store are also included.
- b. Mission planning systems, post mission analysis systems, data milking devices, maintenance management software tools etc. shall be considered under TTGEs.
- c. Automated Test Equipment (ATE) delivered to user services to maintain and keep the Air Systems / Airborne Stores operational in service environment shall also be considered as part of TTGEs.

Acceptable Means of Compliance

NIL

Guidance Material

NIL

21.T2.3 Categorisation of TTGEs

Regulation

TTGEs shall be categorised depending on their procurement / development process.

Acceptable Means of Compliance

Based on the procurement/ development process, TTGEs shall be categorised as:

Type-A: Procurement of off-the-shelf TTGEs/ Catalogued TTGEs/ Standard TTGEs

Type-B: Procurement and adaptation of Generic TTGEs/ Common TTGEs /TTGEs readily available from legacy aircsystems

Type-C: Ab-initio design & development of TTGEs

Guidance Material

NIL

21.T2.4 Identification of TTGE Requirements

Regulation

The requirements for TTGEs for aircsystem and airborne stores development programs shall be identified at the project proposal finalization stage itself and all the procurement activities for aircsystem / airborne stores shall necessarily include these requirements.

Acceptable Means of Compliance

- a. User services shall project the requirements of TTGEs including approval aspects at the project proposal stage itself.
- b. The Main Contractor shall identify the necessary facilities to be supplied as TTGE for the operational exploitation of Air Systems / Airborne Stores.
- c. Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO shall be involved during the development of TTGEs so as to address the servicing and maintenance aspects.

Guidance Material

NIL

21.T2.5 Approval of TTGEs

Regulation

TTGEs required for usage associated with military airborne applications shall be subjected to an approval process so as to ensure that these are safe to use and are capable of providing the required functionality.

Acceptable Means of Compliance

- a. **Type-A:** TTGEs which are standard in nature and procured from off-the-shelf sources need not be subjected to any approval provided the specifications of such TTGEs meet the end use requirements. Such TTGEs shall be accepted after verifying their functional performance, calibration status and the approval status, if any.
- b. **Type-B:** TTGEs which are generic and common or are readily available from legacy aircsystems (such as service trolley, ladder etc.) shall be fully approved by DGAQA.
- c. **Type-C:** For the ab-initio designed & developed TTGEs, the responsibility of the approval of TTGEs shall be with DGAQA based on the Technical Specification approved by CEMILAC.

Guidance Material

NIL

21.T2.6 Approval Basis

Regulation

The TTGE development agency shall identify Approval Basis (AB) acceptable to the TAA. Compliance to AB shall form one of the basis for the approval of TTGE.

Acceptable Means of Compliance

- a. Since TTGEs are deliverable to the user services, these shall be further classified based on their role and operational environment. Approval basis shall be finalised based on this classification.
- b. JSS 55555 or its equivalent document shall be the basis for qualification testing of ab-initio designed & developed TTGEs (i.e. Type-C) TTGEs deliverable to user services.
- c. The classification given below shall help in arriving at the qualification test requirements for the TTGEs based upon their location / deployment environment. The applicable qualification tests based on the class of TTGEs shall be finalised from JSS 55555 or its equivalent document. These documents, however, shall be used only as guideline and shall be tailored further in consultation with all the stakeholders.
 1. **Class 1:** TTGEs permanently installed or stored in an aircsystem for use in flight.
 2. **Class 2:** TTGEs used in the vicinity of an aircsystem, in tracked and wheeled vehicles
 3. **Class 3:** Partially protected TTGEs
 4. **Class 4:** TTGEs used in light buildings, structures and vehicles where it is protected from direct rain, sun etc.

5. **Class 5:** TTGEs used in permanent buildings
6. **Class 6:** TTGEs considered to be state of the art in design and construction for which special operational requirements are necessary and which are not compatible with environmental requirement of Class 1 to 5. Environmental requirements for these TTGEs shall be defined in the detailed technical specifications after discussion with all the stakeholders based on application and end use.

d. A Quality Assurance Plan (QAP) for the TTGEs shall be prepared by the development agency and approved by DGAQA / internal QA group of Main Contractor, as applicable.

Guidance Material

NIL

21.T2.7 Technical Specifications

Regulation

The TTGE development agency shall bring out the detailed Technical Specifications document based on the user requirements.

Acceptable Means of Compliance

- a. The Technical Specifications document prepared by OEM shall be acceptable for Type-A TTGEs.
- b. The Technical Specifications document for Type-B & Type-C TTGEs shall be prepared by the TTGE development agency in consultation with the Main Contractor of the aircsystem and airborne stores utilising the TTGEs.
- c. The document shall address the end use requirements and shall take into account the user requirements, if available.
- d. The responsibility for the approval of Technical Specifications for the test rigs shall be based upon the category of the test rigs, as identified in **RA 21.T2.3** and shall be as given below:

Type-A: Approval of Technical Specifications from CEMILAC & DGAQA shall not be required. However, the Main Contractor of aircsystem / airborne store shall ensure that the technical Specifications prepared by TTGE OEM are acceptable to the end user.

Type-B: Technical Specifications for Type -BTTGEs shall be approved by DGAQA.

Type-C: Technical Specifications for Type -CTTGEs shall be approved by CEMILAC in consultation with Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO.

Guidance Material

The format for Technical Specifications for TTGEs prescribed by TAA and available as part of Manuals to be used.

21.T2.8 Design and Development

Regulation

The TTGE development agency shall follow a design & development process that results in TTGE meeting the end use requirements and the Approval Basis.

Acceptable Means of Compliance

- a. The design and development activities shall follow a System Engineering Life Cycle Process.
- b. The QA Process to be followed during TTGE development and production shall be approved by DGAQA. DGAQA may delegate certain inspection and testing responsibilities to the internal QA of the development agency.
- c. Post placement of order with the identified development agency, the design review for Type-C TTGEs shall be conducted. The design review shall be carried out by the committee constituted with the members from all the stakeholders involved in development, production, approval and end use of the TTGEs.
 - a. Design review is not required for Type-A and Type-B TTGEs.
 - b. Safety and maintainability features shall be included in the design of the TTGEs.
 - c. Adequate internal diagnosis features, BITE/POST features etc. shall be included in the design.
 - d. Hardware Design details and installation drawings shall be provided by the development agency to certification authorities as part of review processes.
 - e. The design standard of preparation (SOP) of the TTGE shall be finalised by the development agency and approved by DGAQA. The design SOP shall include Bill of Materials (BOM) and Drawings.
 - f. The design shall be considered to be adequate for prototype realisation / fabrication based on the approval and baselining of the design standard of preparation.
 - g. Acceptance Test Procedure of the test rig shall be prepared by the development agency and approved by DGAQA.
 - h. A configuration control mechanism shall be implemented during the design and development phase by the development agency.
 - i. All deviations /non-conformances arising during design & development phase or from acceptance testing phase of the TTGE shall be documented and disposed of as per the process put in place by the development agency in consultation with the Main Contractor of airsystem / airborne stores. This process shall ensure that any deviation from the requirements listed in the certification basis is disposed of with the approval of appropriate Waiver Board, if available and TAA responsible for the certification of the test rig.

Guidance Material

NIL

21.T2.9 TTGE Software

Regulation

The TTGE development agency shall follow a proper process for development, evaluation and approval of the software of TTGE, if any.

Acceptable Means of Compliance

- a. The TTGE software shall be developed and tested in accordance with an established Software Development Life Cycle Process.
- b. The criticality level of the software of the TTGEs used for a subsystem of an aircsystem or an airborne store shall be arrived at by giving due consideration to the criticality level of such subsystem / airborne store.
- c. The software requirement specifications (SRS) for Type-A & Type-B need not be approved by CEMILAC or DGAQA. For Type-C TTGEs, the SRS shall be approved by CEMILAC.
- d. The TTGE software shall be evaluated as per the applicable regulations given in Subpart C6.
- e. The TTGE software approval as per approved SRS shall be carried out by CEMILAC for Type-C TTGEs only. Approval of software of Type-A and Type-B TTGEs shall not be required.
- f. The development agency of the Type-C TTGE containing software shall identify the means of compliance for the software aspects and demonstrate compliance for obtaining approvals.

Guidance Material

- a. Refer SUBPART C6 for further details on software certification process
- b. Refer AMC under RA 21.T2.12 for the minimum set of software documents required for TTGEs.

21.T2.10 Fabrication of TTGEs

Regulation

Fabrication of TTGEs shall be carried out by the development agency as per approved and baselined standard of preparation.

Acceptable Means of Compliance

- a. The development agency shall fabricate the TTGEs as per the approved and baselined configuration.
- b. DGAQA / Internal QA of the development agency duly authorised by DGAQA shall carryout necessary inspection of the units as per approved QAP.

Guidance Material

NIL

21.T2.11 Identification of TTGEs

Regulation

The TTGE development agency shall have a mechanism in consultation with the Main Contractor for unique identification of the TTTGE.

Acceptable Means of Compliance

- a. TTGEs shall have proper configuration identification mechanism.
- b. Subpart Q shall be followed for identifying the applicable regulations for identification.

Guidance Material

Refer SUBPART Q for further details

21.T2.12 Qualification Testing

Regulation

Since the TTGEs are required to be delivered to the user services, these shall be subjected to applicable qualification tests.

Acceptable Means of Compliance

- a. Type-A TTGEs shall not be subjected to qualification testing.
- b. Normally Type-B TTGEs shall not be subjected to qualification testing. However, since some of these TTGEs are being adapted from legacy aircsystems, the delta qualification testing required, if any shall be identified by the Main Contractor of aircsystem / airborne stores in consultation with DGAQA.

c. For Type-C TTGEs, based on the approved technical specifications, BOM and Drawings, maintenance evaluation and demonstration shall be carried out in coordination with servicing development organizations of user services such as MAG(AVN)/CSDO/NASDO etc., Subsequently, TTGE shall be subjected to qualification testing as per qualification test plan (QTP) approved by DGAQA.

d. The extent of qualification testing shall be arrived at based on the identified class of the Type -CTTGEs as per **RA 21.T2.6**.

e. A qualification test report (QTR) prepared by the TTGE development agency and approved by DGAQA or internal QA group of the development agency duly authorised by DGAQA shall form one of the basis for the acceptance of Type-C TTGEs.

Guidance Material

Refer JSS 55555

21.T2.13 Documentation Requirements

Regulation

The TTGE development agency shall have a proper mechanism for preparation, identification and configuration control of all the necessary documents required for the development, approval and end use of the TTGEs.

Acceptable Means of Compliance

The following is the broad list of documents which shall be prepared by the TTGE development agency and these shall be indicated as part of deliverables in the technical specifications. This list of documents shall be used as a guideline only and shall be tailored further based on type and class of TTGE in consultation with all the stakeholders.

- a. Technical Specifications
- b. Design Document
- c. Quality Assurance Plan (QAP)
- d. All applicable drawings (Part drawings, Mechanical and Electrical assembly drawings, schematics drawings, etc) including Master Drawing Index (MDI)
- e. Bill of Material (BOM).
- f. Qualification Test Procedure (QTP)
- g. Qualification Test Report (QTR)
- h. Acceptance Test Plan (ATP)
- i. Acceptance Test Report (ATR)
- j. Manuals – TTGE User Manual / Installation Manual / Operating Manual & Maintenance Manual including calibration requirement, product support, list of spare parts etc.

k. Software Documents (Minimum Set):

1. Software Requirement Specification (SRS)
2. Software Quality Assurance Plan (SQAP)
3. Software Development Plan (SDP)
4. Software Configuration Management Plan (SCMP)
5. Independent Verification & Validation (IV & V) Plan & Report

Guidance Material

A broad list of the attributes which shall be included in various documents are brought out in **Annexure-1 to Subpart T** which can be used with proper tailoring.

21.T2.14 Acceptance of TTGEs for Approval

Regulation

The TTGE shall be subjected to the acceptance testing prior to its approval for intended usage.

Acceptable Means of Compliance

- a. The acceptance mechanism based on the type of TTGE shall be as follows: -
 - i. **Type-A:** Type-A TTGE with identified part number as per requirement specified shall be accepted by the DGAQA based on ATP/ATR, Certificate of Compliance (CoC) from OEM and successful demonstration to end user on applicable platform.
 - ii. **Type-B:** As per the technical specifications approved by DGAQA, TTGEs shall be accepted by the internal QA group of the main contractor duly authorised by DGAQA based on ATP / ATR, QTP / QTR (as applicable) and other applicable documents.
 - iii. **Type-C:** As per technical specifications approved by CEMILAC, TTGE shall be accepted by DGAQA / internal QA group of main contractor duly authorised by DGAQA based on ATP / ATR, QTP / QTR (as applicable) and other applicable documents.
- b. The TTGE development agency shall prepare a TTGE acceptance test plan (ATP) document which shall be approved by DGAQA.
- c. Standard test equipment shall be used to verify the correctness of the parameters of the TTGEs. Airborne LRUs/subsystems shall be used for verification only when other methods are not available.
- d. The acceptance testing shall be carried out by the TTGE development agency and shall be witnessed by DGAQA or the internal QA group of the Main Contractor.

e. An acceptance test report (ATR) prepared by the TTGE development agency and approved by DGAQA shall form one of the basis for the acceptance of all types of TTGEs.

f. The TTGE development agency shall prepare a compliance report against the approval requirements listed in the approval basis as per RA 21.T2.6 and also the Technical Specifications as per RA 21.T2.7.

g. Along with the compliance report and all the other applicable documents, the TTGE development agency shall approach DGAQA for issuing certificate of approval for Type-B & Type-C TTGEs.

h. On satisfactory completion of all the approval activities and having satisfied itself with the correctness and completeness of the compliance report and other applicable documents, DGAQA shall provide necessary certificate to the TTGE development agency towards acceptance of the TTGE.

Guidance Material

NIL

21.T2.15 Production of TTGEs

Regulation

Production of TTGEs shall be carried out as per approved SOP and by following a robust QA process.

Acceptable Means of Compliance

a. Issue of necessary certificate by DGAQA towards acceptance of the TTGE shall enable the TTGE development agency to start regular production activities as per the approved SOP.

b. The development agency for the TTGE undertaking regular production shall have necessary Quality Management System in place with appropriate approval from DGAQA.

c. During the regular production of TTGE as per approved SOP, DGAQA / internal QA of the Main Contractor duly authorised by DGAQA shall provide the inspection coverage.

d. ATP during production phase shall be conducted as per DGAQA approved ATP. Approval shall be obtained for any change in the ATP or SOP.

e. If TTGEs are produced by an agency other than the development agency, proper ToT as per **RA 21.T2.16** shall be carried out.

Guidance Material

NIL

21.T2.16 Transfer of Technology (ToT)

Regulation

If the production of TTGE is required to be carried out by an agency other than the development agency, a proper Transfer of Technology (TOT) to Production agency by the TTGE development agency shall be carried out.

Acceptable Means of Compliance

- a. The transfer of technology (ToT) guidelines issued by CEMILAC shall be followed in consultation with all the other stakeholders.
- b. The Production agency shall have requisite approval from DGAQA for taking up such activities.

Guidance Material

NIL

21.T2.17 Modifications / Up-gradations of TTGEs

Regulation

Modifications / up-gradations of the already approved TTGEs shall be carried out by ensuring compliance to the applicable regulations from this Subpart 21.T2, which shall be arrived at in consultation with the TAA responsible for the approval of the TTGE type and by taking into account the extent of modification / up-gradation required.

Acceptable Means of Compliance

- a. The modifications / up-gradations arising out of alteration of existing functionalities / addition of new functionalities to the already approved TTGEs shall be handled using this regulation.
- b. The changes to approved TTGEs due to obsolescence management requirements shall be handled using this regulation.
- c. The applicability of the regulations from the full set of regulations of Subpart 21.T2 shall be finalised by carefully reviewing the extent of modification / up-gradation / changes required in the already approved TTGEs and also the extent of technical documentation available for the TTGE to be modified / up-graded.
- d. The proposal for identifying the applicable regulations towards modification / up-gradation shall be prepared by the TTGE development agency or any other agency identified for modification / up-gradation and final acceptance of the same shall be by the TAA responsible for the approval of TTGE type. This proposal shall also identify the extent of documentation required for the approval of modification / up-gradation of the TTGE.

- e. Servicing Development Organizations of User Services such as MAG (Avn) /CSDO/NASDO shall be involved during the modification / up-gradation of TTGEs so as to address the servicing and maintenance aspects.

Guidance Material

Modification / up-gradation can arise due to hardware / software changes required or also due to the change in the installation environment.

DRAFT

Guidance Material on Contents of Major Documents for Test Rigs and TTGEs

A broad list of the attributes which shall be included in various documents are brought out below which can be used with proper tailoring: -

1 Technical Specifications

The technical specifications of the Test Rigs /TTGEs shall broadly contain the following (as applicable) but not limited to:

- Objective & scope of the Test Rig /TTGE
- Physical requirement w.r.t. dimensions, weight, material, coating/painting etc.
- Electrical requirement w.r.t. power supply requirement, power consumption,
- Bonding, insulation, components rating requirement (if any) etc.
- Electrical and Mechanical Interface requirements
- Cooling requirements, if any
- Functional & performance requirements including testing parameters for each LRU being tested on Test Rig/ TTGE
- Software requirements, if any
- Environmental / Qualification requirements w.r.t. applicable standards
- Specific engineering practices to be followed during development for Mechanical & electrical/electronic part fabrication and software development of the rig
- Packaging, Marking, Transportability requirements
- Calibration, maintenance, warranty/reliability requirements
- Supporting instruments/testers/accessories requirement, if any as part of deliverables
- Requirement of supporting infrastructure, if any.
Documents & reports of products as part of deliverables

2 Drawings

Drawings should contain necessary foot notes, Critical Notes, Critical dimensions, circuits, Part numbers, Material, Grade, Surface finish, tolerances, Title Block, Specific Note (if applicable), Process details etc.,

3 Bill of Materials (BOM)

Bill of Materials (BOM) shall contain, Nomenclature/description of the material, Part No., Grade, Temperature range (if applicable), Manufacturer / Supplier, Packaging (if applicable), Quantity etc. Consumables are also required to be included in the BOM.

4 Design Document

Design Document shall broadly include:

- Design Architecture
- Mechanical / Electrical design including interface details
- Stress/load analysis
- De-rating analysis (applicable for electrical/electronic equipment and shall be identified based on whether it is ab-initio designs or uses off-the-shelf design parts)
- Reliability, life and periodic preventive maintenance requirements
- Software Requirements, if any
- Compliance Matrix w.r.t. approved technical specification

5 Acceptance Test Plan (ATP)

Acceptance Test Plan shall broadly include:

- Details of Test Rig / TTGE
- Standard of preparation and drawing applicability
- Objective and aim of the test
- Details of the test equipment to be used. Calibration of test equipment and instruments and their records
- Test Setups, Test Procedures
- Measurements to be taken and instrumentation required, if any
- Record sheet(s)
- Pass / Fail criterion

6 Qualification Test Procedure (QTP)

Qualification Test Procedure, if applicable shall broadly include:

- Details of Test Rig / TTGEs to be tested
- Objective and aim of the test
- Details of the test equipment to be used. Calibration of test equipment and instruments and their records
- Details of applicable tests including Environmental Test
- Test Setups, Test Procedures
- Measurements to be taken and instrumentation required
- Record sheet(s)
- Pass / Fail criteria

SUBPART U: NAA RECOGNITION PROCESS (MUTUAL RECOGNITION)

Rationale:

NAA Recognition is a structured process by which Indian TAA can evaluate a foreign Airworthiness Authority and assess the potential to use their certification approvals for Indian Military. Recognition can be undertaken on a reciprocal basis, known as 'Mutual', or alternatively on a 'unilateral' basis.

When an Airsystem / Airborne store is procured by Indian Services or an Indian Main contractor, it needs to be validated for its airworthiness. The validation has to be carried out by Indian Technical Airworthiness Authorities. Another approach is to accept the certification issued by a Competent Airworthiness Authority (either Military or Civil) from the country of origin of the Airsystem/Airborne stores. In order to ensure that the foreign agency has the adequate processes to provide the same level of assurance, Indian TAA may carry out a structured process to recognize the foreign TAA.

In cases that do not require an elaborate Recognition process, the TAAs and NAAs may sign a project specific Memorandum of Understanding.

Note: The term 'NAA Recognition' applies only for National Airworthiness Authorities of other countries. The term shall not be used with non-state agencies like Airworthiness Groups/QA of OEMs, third party agencies like DERs, Testing agencies etc. Any interactions with these parties shall be at working level and governed accordingly.

Contents:

21.U.1 Recognition of Airworthiness Authorities of Other Nations

21.U.2 Recognition of MAA of other Nations

21.U.3 Recognition of CAA of other Nations

21.U.4 Project Specific Memorandum of Understanding

Abbreviations:

BASA – Bilateral Aviation Safety Agreement
CAA – Civil Airworthiness Authority
DGCA – Directorate General of Civil Aviation
MAA – Military Airworthiness Authority
MoD – Ministry of Defence
MR – Mutual Recognition
NAA – National Airworthiness Authorities
TAA – Technical Airworthiness Authority
TR – Transitive Recognition

21.U.1 Recognition of Airworthiness Authorities of Other Nations

Regulation

Indian Technical Airworthiness Authorities may recognize the National Airworthiness Authorities (NAA) of other countries after ensuring that the countries have an airworthiness assurance process equal to or above the minimum standards established in India.

Acceptable Means of Compliance

CEMILAC and DGAQA may recognize 'the Airworthiness Authorities' of other nations prior to accepting their approvals. The Airworthiness Authorities could either be Civil Airworthiness Authorities or National Military Airworthiness Authorities. In either case, the Airworthiness Authorities shall be representatives of the respective National Government. Indian TAAs shall only recognize the Airworthiness Authorities of countries recognized by Indian Government. TAA shall take prior consent from Government of India before commencement of recognition activities. The Recognition Certification / Recognition Agreement shall be signed by an Indian Government Official not below the rank of Joint Secretary.

Guidance Material:

The type of Recognition being sought between the TAA and other NAA needs to be established and agreed at the beginning of the process. The nature of recognition can be one of the following:

- a. Mutual Recognition (MR) –where an Indian TAA and other country NAA are involved, identify that there are advantages in using each other's assurance activity. This form of Recognition could be bi-lateral or multi-lateral.
- b. One-Way Recognition–where an Indian TAA along with one or more other NAAs working together on a particular programme, wish to recognise the outputs of another Authority, but the Need for the Recognition is not reciprocal. This approach would be advantageous for participating NAAs to be able to use any existing certification or organisational approvals already granted by the Authority. This form of recognition is unilateral.
- c. Transitive Recognition (TR) – Where a TAA satisfies its Recognition requirements by using an existing recognition between other authorities rather than conduct its own Recognitions process. e.g. If Authority A recognises Authority B, Authority C could use this simplified process to Recognise Authority A or B (provided that the recognition differences accepted by Authorities A and B are also acceptable to Authority C). This form of Recognition does not require another NAA signature on a Recognition Agreement or on a 'Recognition Certificate.'

21.U.2 Recognition of MAA of other Nations

Regulation

Indian Technical Airworthiness Authorities may recognize the Military Airworthiness Authorities (MAA) of other countries after ensuring that the countries have an airworthiness assurance process equal to or above the minimum standards established in India.

Acceptable Means of Compliance

CEMILAC and DGAQA, either together or individually may recognize the Certification and QA aspects respectively of the other MAA. The other MAA shall strictly be a governmental organization of the nation. The recognition may be mutual, one-way or transitive. The recognition shall be only with MAAs of other nations with which Indian Government has existing defence co-operation or planning defence co-operation in future. Such recognition can strictly be time-bound with a period not exceeding 3 years.

Guidance Material

Indian TAAs may develop the minimum standards and structured procedures required for recognition. The TAA shall take clearance from MoD for the scope and extent of the recognition. Only after getting the due clearance from MoD, Indian TAA may engage with the other MAA. Indian TAA shall sign a Non-disclosure agreement with the other NAA to ensure that the proprietary data are not shared with non-stakeholders of the recognition. The TAAs shall plan and carry out the activities required for recognition. Once satisfied, in case of Mutual recognition, a 'Recognition Agreement' may be signed by the Indian TAA and the other MAA. In case of One-way or Transitive Recognition, a Recognition Certificate may be signed by the Indian TAA. Re-validation process of the recognition can start 6 months prior to the expiry of the recognition.

21.U.3 Recognition of CAA of other Nations

Regulation

Indian Technical Airworthiness Authorities may recognize the Civil Airworthiness Authorities (CAA) of other countries after ensuring that the countries have an airworthiness assurance process equal to or above the minimum standards established in India.

Acceptable Means of Compliance

CEMILAC and DGAQA, either together or individually may recognize the Certification and QA aspects respectively of the other CAA. The other CAA shall strictly be a governmental organization of the nation. The recognition may be mutual, one-way or transitive. The recognition shall be only with CAAs of other nations that are recognized Indian Government. Such recognition can strictly be time-bound with a period not exceeding 5 years.

Guidance Material

- a. Indian TAAs may develop the minimum standards and structured procedures required for recognition. Indian TAA shall sign a Non-disclosure agreement with the other CAA to ensure that the proprietary data are not shared with non-stakeholders of the recognition. The TAAs shall plan and carry out the activities required for recognition. Once satisfied, in case of Mutual recognition, a 'Recognition Agreement' may be signed by the Indian TAA and the other CAA. In case of One-way or Transitive Recognition, a Recognition Certificate may be signed by the Indian TAA. Re-validation process of the recognition can start 6 months prior to the expiry of the recognition.
- b. Generally, most CAAs do not prefer mutual recognition with MAAs. In such cases, one-way recognition and Transitive recognitions may be acceptable. One form of Transitive recognition could be recognizing the Bilateral Agreements already signed by DGCA with CAAs of other nation. The provisions of such agreements are given in Part – 8 of DGCA AED Handbook.

21.U.4 Project Specific Memorandum of Understanding

Regulation

The Indian TAAs may sign MoUs with other MAA/CAA which are programme / project specific, wherein the TAA may accept airworthiness approvals specific to the scope for those projects.

Acceptable Means of Compliance

CEMILAC and DGAQA, either together or individually sign MoUs with other MAAs/CAAs. The other NAA shall strictly be a governmental organization of the nation. The recognition may be mutual or one-way. Due clearance from GoI shall be taken before signing of the MoU.

Guidance Material

In cases where 'Recognition' is not planned, the TAA and NAA may enter into a Memorandum of Understanding. Such MoUs may be project specific. Necessary NDAs shall be signed between the airworthiness authorities of both the countries. Indian TAAs shall develop their procedure for signing such MoUs.

GLOSSARY

AAA	Ageing Aircraft Audit
AB	Approval Basis
ACP	Airworthiness Certification Plan
AD	Airworthiness Directive
ADM	Anti-Deterioration Maintenance
ADS	Air System Document Set
AFQMS	Approval of Firm & its Quality Management System
AGS	Aircraft General Standard
AHSP	Authorized Holder of Sealed Particulars
AIM	Airworthiness Information Management
ALARP	As Low As Reasonably Practicable
ALMs	Air Launched Missiles
AMC	Acceptable Means of Compliance
AMI	Advance Modification Intimations
AMM	Aircraft Maintenance Manual
AM(M)	Accountable Manager (Maintenance)
AMO	Approved Maintenance Organization
AMP	Aircraft Maintenance Programme
AMT	Accelerated Mission Test
AMTC	Amended Military Type-Certificates
APU	Auxiliary Power Unit
AQL	Acceptable Quality Level
ARC	Airworthiness Review Certificate
ARP	Aerospace Recommended Practice
ASDO	Air System Design Organizations
ASMS	Air Safety Management System
ASPO	Airsystem Production Organisation
ATE	Automated Test Equipment
ATP	Acceptance Test Plan
ATR	Acceptance Test Report
AWG	Airworthiness Group
BASA	Bilateral Aviation Safety Agreement
BOM	Bill of Materials
BRDs	Base Repair Depots
CAA	Civil Airworthiness Authority
CAMO	Continuing Airworthiness Management Organization
CB	Certification Basis
CCCB	Central Configuration Control Board

CCP	Configuration Control Process
CDR	Critical Design Review
CEH	Complex Electronic Hardware
CFT	Captive Flight Trials
CM	Configuration Management
CMC	Ceramic Matrix Composites
CMP	Configuration Management Plan
CoA	Certificate of Airworthiness
CoC	Certificate of conformance
CoD	Certificate of Design
CofG	Centre of Gravity
CONOPS	Concept of Operation
CP	Certification Plan
CPCs	Corrosion Preventive Compounds
CSU	Clearance for Service Use
CVE	Compliance Verification Engineers
CWP	Contractors' Working Parties
DAE	Defence Air Environment
DAL	Drawing Applicability List
DAO	Design Approved Organization
DAOS	Design Approved Organization Scheme
DAS	Design Assurance System
DDP	Declaration of Design Performance
DDP	Department of Defence Production
DDR	Detail Design Review
DFC	Development Flight Clearance
DGAQA	Directorate General of Aeronautical Quality Assurance
DIC	Defect Investigation Committee
DO	Design Organisation
DoA	Design Organisation Approval
DOE	Design Organization Exposition
ECN	Engineering Change Note
ED	Environmental Damage
EDPC	Environmental Damage Prevention and Control
ENSIP	Engine Structural Integrity Program
ESOP	Equipment Standard of Preparation
FAB	Failure Analysis Board
FC	Flight Clearance
FCC	Flight Clearance Certificate
FCN	Flight Clearance Note
FDR	Flight Data Recorder

FFR	Final Flight Release
FI	Fatigue Index
FILMSS	Function, Interchangeability, Life, Maintenance, Safety and Strength
FOC	Final Operational Clearance
FOL	Fuel Oil Lubricants
FPCM	Flight Plan Coordination Memo
FRACAS	Failure Reporting, Analysis and Corrective Action System
FTB	Flying Test Bed
GM	Guiding Materials
GoI	Government of India
HFRA	High Failure Rate Aggregates
HILS	Hardware In-Loop Simulation
IA	Indigenization Agency
IFR	Initial Flight Release
IMAO	Indian Military Airworthiness Organisations
IMTSO	Indian Military Technical Standard Order
IMTSOA	Indian Military Technical Standard Order Approval
IOC	Initial Operational Clearance
IPC	Institute of Printed Circuit
IPR	Intellectual Property Rights
IQT	Incremental Qualification Testing
IR	Infrared Radiation
IRAN	Inspect and Repair as Necessary
ISAT	Intensified Simulated Alternating Test
ISD	In Service Date
ISR	Initial Service Release
ISTA	Instructions for Sustaining Type Airworthiness
ITEAP	Integrated Test, Evaluation and Acceptance Plan
LCC	Local Concession Committee
LCCB	Local Configuration Control Board
LMC	Local Modification Committee
LoA	Letter of Acceptance
LQT	Limited Qualification Testing
LRUs	Line Replaceable Units
LTC	Local Technical Committee
LTCC	Local Type Certification Committee
MAA	Military Airworthiness Authority
MAOS	Maintenance Approved Organisation Scheme
MAR	Military Airworthiness Review
MARC	Military Airworthiness Review Certificate
MCP	Military Certification Process

Mil CAMO	Military Continuing Airworthiness Management Organization
MDI	Master Drawing Index
MDOA	Military Design Organisation Approval
MMEL	Master Minimum Equipment List
MMC	Metal Matrix Composites
MMO	Military-run Maintenance Organization
MO	Maintenance Organizations
MoD	Ministry of Defence
MOE	Maintenance Organization Exposition
MoU	Memorandum of Understanding
MPTF	Military Permit to Fly
MR	Mutual Recognition
MRB	Material Review Board
MRO	Maintenance and Repair Organizations
MTC	Military Type Certificate
MTOW	Maximum Take Off Weight
NAA	National Airworthiness Authorities
NAYs	Naval Aircraft Yards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NADCAP	National Aerospace and Defence Contractors Accreditation Program
NCR	Non Conformance Report
NCRB	Non-Conformance Review Board
NCRP	Non-Conformance Review Process
OCR	Operational Capability Release
OEMs	Original Equipment Manufacturers
ORDAQA	Office of the Regional Director of Aeronautical Quality Assurance
OSD	Out of Service Date
PAT	Production Acceptance Test
PATS	Production Acceptance Test Schedule
PC	Provisional Clearance
PCD	Performance Cycle Deck
PDR	Preliminary Design Review
PFR	Preliminary Flight Rating
PMC	Polymer Matrix Composites
PO	Production Organization
PoA	Production Organisation Approval
POE	Production Organisation Exposition
PQT	Periodic Quality Tests
PQT	Production Quality Tests
PR	Production Release
PSWG	Project Safety Working Group

QAP	Quality Assurance Plan
QMS	Quality Management System
QT	Qualification Tests
QTP	Qualification Test Plan
QTP	Qualification Test Procedure
QTR	Qualification Test Report
RA	Regulatory Articles
RCMA	Regional Centre for Military Airworthiness
RCS	Radar Cross Section
RFP	Request for Proposal
RFT	Release Flight Trials
RMTC	Restricted Military Type Certificate
RTS	Release to Service
RSD	Release to Service Documents
RTSR	Release to Service Recommendation
SB	Service Bulletins
SCMP	Software Configuration Management Plan
SCN	Software Change Note
SDP	Software Development Plan
SI	Servicing Instructions
SLP	Spares Latest Pattern
SMP	Service Modification Parties
SMS	Safety Management System
SOF	Safety of Flight
SofA	Statement of Acceptance
SOO	Special Order Only
SOFT	Safety of Flight Testing
SOP	Standard of Preparation
SQAP	Software Quality Assurance Plan
SQEP	Suitable Qualified and Experienced Personnel
SQR	Service Qualitative Requirement
SRS	Software Requirement Specifications
SSA	System Safety Assessment
SSDO	Sub System Design Organizations
STC	Supplementary Type Certificate
STI	Special Technical Instructions
TA	Type Approval
TAA	Technical Airworthiness Authority
TARB	Test Adequacy Review Board
TBO	Time between Overhaul
TC	Type Certificate

TCB	Type Certification Basis
TCE	Type Certification Exposition
TCL	Total Calendar Life
TCDS	Type Certification Data Sheet
TCR	Type Certification Report
TEMP	Test and Evaluation Master Plan
TI	Technical Information
TLMP	Through-Life Management Plan
ToT	Transfer of Technology
TR	Transitive Recognition
TRC	Test Release Certificate
TRRC	Test Readiness Review Committee
TSO	Technical Standard Order
TTGE	Tools, Testers & Ground Equipment
TTL	Total Technical Life
UAS	Unmanned Air Systems
UET	User Evaluation Trials
UMC	Under Ministry Control
UON	Urgent Operating Notice