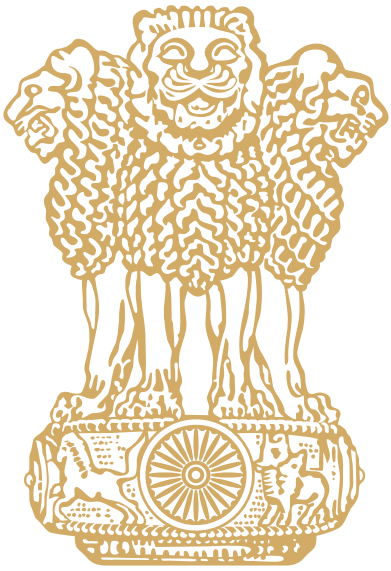
INDIAN MILITARY TECHNICAL AIRWORTHINESS REQUIREMENTS

IMTAR - 21

Version 2.0

(Supersedes Version 1.0)

DESIGN, DEVELOPMENT, PRODUCTION AND CERTIFICATION OF MILITARY AIR SYSTEMS AND AIRBORNE STORES



सत्यमेव जयते

MINISTRY OF DEFENCE

GOVT. OF INDIA

AUGUST 2023

Intentionally Left Blank

FOREWORD

The activities in the design, development and production of military air systems and airborne stores have so far been regulated largely by the Ministry of Defence document DDPMAS which was first released in 1975 and later revised in 2002. The current DDPMAS Version 1.0, comprising of a layered structure of Framework and Procedures, Indian Military Technical Airworthiness Requirements and Manuals, was released in 2021 after a comprehensive review and restructuring to bring it in-line with the international approach.

Taking into account the expansion of military aviation technology and projects in the country and with more and more private industry participation in **Atmanirbhar Bharat Abhiyan,** this document has been further revised to streamline and fast track certification activities imbibing the global best practices in airworthiness certification and quality assurance. DDPMAS which was the Framework and Procedure document for Indian military airworthiness has now been suitably renamed as Indian Military Airworthiness Procedure (IMAP) document. This revised and renamed IMAP-2023 document supersedes DDPMAS Version 1.0.

In line with the revised and renamed IMAP-2023, the Indian Military Technical Airworthiness Requirements (IMTAR-21) Version 1.0 has also been revised and updated to IMTAR-21 Version 2.0. The technical airworthiness requirements for all the phases of the development lifecycle of military air systems and airborne stores are captured in this document. This IMTAR-21 Version 2.0 document needs to be read in conjunction with IMAP-2023 document.

IMTAR-21 Version 2.0 is conceived to be a live document with provision for updates. The amendments will be issued formally by CEMILAC with the approval of Joint Airworthiness Committee (JAC) empowered for the purpose.

For all the technical airworthiness requirements during design, development, production and other associated activities related to military aviation, the provisions stipulated in this document shall be complied with.

Skamat

(Dr Samir V Kamat)
Secretary (Defence R&D)
Dated: 03 August 2023

GSharv

(Giridhar Aramane)
Secretary (Defence Production)
Dated: 4 August 2023

Intentionally Left Blank

PROCEDURE FOR AMENDMENT

Any agency may propose an amendment. Proposals for amendments are to be sent to CEMILAC. The amendments will be issued after due deliberations and approval of JAC.

The amendments will be serially numbered. Incorporation of an amendment in this document will be recorded by inserting the amendment number, JAC approval reference number and inserting the date of making the amendments.The original document shall be under the custody of CE (A), CEMILAC. The copy of the amendment sheet along with the amendment pages will be made available to the stakeholders.

Sl. No	Amendment No.	Date of Amendment	Amended Page Nos	Remarks (Details of Amendment)	JAC Approval Reference No.

Intentionally Left Blank

CONTENTS

FOREWORD----------**i**

PROCEDURE FOR AMENDMENT ---------- **iii**

ABBREVIATIONS ---------- **ix**

DEFINITIONS---------- **xvii**

INTRODUCTION ---------- **1**

SUBPART A
GENERAL PROCEDURE FOR INDIAN MILITARY AIRWORTHINESS ---------- **A-1**

SUBPART B
AB-INITIO DEVELOPMENT OF AIR SYSTEM LEADING TO RMTC/MTC AND PRODUCTION ---------- **B-1**

SUBPART B1
AB-INITIO DEVELOPMENT OF AIRCRAFT ----------**B1-1**

SUBPART B2
AB-INITIO DEVELOPMENT OF UNMANNED AIRCRAFT SYSTEMS (UAS) ----------**B2-1**

SUBPART B3
AB-INITIO DEVELOPMENT OF AIR LAUNCHED MISSILES (ALM) ----------**B3-1**

SUBPART B4
AB-INITIO DEVELOPMENT OF AERO ENGINES ----------**B4-1**

SUBPART C
AB-INITIO DEVELOPMENT OF AIRBORNE STORES LEADING TO TA/LoA/IMATSOA----------**C-1**

SUBPART C1
AB-INITIO DESIGN & DEVELOPMENT OF AIRBORNE STORES LEADING TO ISSUE OF TYPE APPROVAL---------- **C1-1**

SUBPART C2
AB-INITIO DESIGN & DEVELOPMENT OF AIR ARMAMENT STORES AND AIR LAUNCHED WEAPONS LEADING TO ISSUE OF TYPE APPROVAL---------- **C2-1**

SUBPART C3
DEVELOPMENT OF AIRBORNE MATERIALS LEADING TO LoA --- C3-1

SUBPART C4
AB-INITIO DEVELOPMENT OF AIRBORNE STORES
LEADING TO LoA ---------- C4-1

SUBPART C5
AIRBORNE STORES, FOR WHICH IMATSO EXISTS,
LEADING TO IMATSO APPROVAL (IMATSOA) ---------- C5-1

SUBPART C6
AIRBORNE/GROUND SYSTEM SOFTWARE AND COMPLEX
ELECTRONIC HARDWARE (CEH) ---------- C6-1

SUBPART D
MODIFICATIONS OF AIR SYSTEMS
LEADING TO AMTC/SMTC ---------- D-1

SUBPART E
MODIFICATIONS OF AIRBORNE STORES ---------- E-1

SUBPART F
PRODUCTION OF AIR SYSTEMS AND AIRBORNE STORES ---------- F-1

SUBPART G
ORGANISATION APPROVALS ---------- G-1

SUBPART G1
DESIGN ORGANISATION APPROVAL SCHEME (DOAS) ---------- G1-1

SUBPART G2
PRODUCTION ORGANISATION APPROVAL SCHEME (POAS) ------- G2-1

SUBPART G3
MAINTENANCE ORGANISATION APPROVAL SCHEME (MOAS) --- G3-1

SUBPART H
CERTIFICATE OF AIRWORTHINESS (COA) FOR AIR SYSTEMS ----- H-1

SUBPART I
RESEARCH AIR SYSTEMS AND AIRBORNE STORES ---------- I-1

SUBPART K
INDIGENOUS SUBSTITUTIONS OF AIRBORNE STORES ---------- K-1

SUBPART L
CONTINUED & CONTINUING AIRWORTHINESS ---------- L-1

SUBPART M
REPAIR OF AIR SYSTEMS AND AIRBORNE STORES ---------- M-1

SUBPART N
BOUGHT-OUT AIR SYSTEMS AND AIRBORNE STORES ---------- N-1

SUBPART P
FLIGHT TESTING OF AIR SYSTEMS AND AIRBORNE STORES ------- P-1

SUBPART Q
IDENTIFICATION OF AIR SYSTEMS AND AIRBORNE STORES -------Q-1

SUBPART R
CIVIL CERTIFIED MILITARY AIR SYSTEMS ---------- R-1

SUBPART S
CUSTOMER FURNISHED EQUIPMENT AND
CUSTOMER SPECIFIED EQUIPMENT ---------- S-1

SUBPART T
TEST RIGS AND TOOLS, TESTERS &
GROUND EQUIPMENT (TTGE)---------- T-1

SUBPART T1
TEST RIGS----------T1-1

SUBPART T2
TOOLS, TESTERS & GROUND EQUIPMENT (TTGE) ----------T2-1

SUBPART U
MUTUAL RECOGNITION OF NATIONAL AIRWORTHINESS
AUTHORITIES (NAA) ---------- U-1

Intentionally Left Blank

ABBREVIATIONS

AA - - - - - Army Aviation
AAA - - - - Ageing Aircraft Audit
AATT - - - - Army Aviation Test Team
AB - - - - - Approval Basis
ACAS - - - - Assistant Chief of Air Staff
ACNS - - - - Assistant Chief of Naval Staff
ACP - - - - Airworthiness Certification Plan
AD - - - - - Airworthiness Directive
ADA - - - - Aeronautical Development Agency
ADG - - - - Additional Director General
ADM - - - - Anti-Deterioration Maintenance
ADS - - - - Air System Document Set
AFQMS - - - Approval of a Firm and its Quality Management System
AHSP - - - - Authority Holding Sealed Particulars
AIM - - - - Airworthiness Information Management
ALARP - - - As Low As Reasonably Practicable
ALGM - - - Air Launched Guided Munition
ALM - - - - Air Launched Missile
AMC - - - - Acceptable Means of Compliance
AMI - - - - Advance Modification Intimations
AMM - - - - Aircraft Maintenance Manual
AMO - - - - Approved Maintenance Organisation
AMP - - - - Aircraft Maintenance Programme
AMT - - - - Accelerated Mission Test
AMTC - - - Amended Military Type Certificate
APU - - - - Auxiliary Power Unit
AQL - - - - Acceptable Quality Level
ARC - - - - Airworthiness Review Certificate
ARP - - - - Aerospace Recommended Practice
ASDO - - - - Air System Design Organisation
ASDOA - - - Air System Design Organisation Approval
ASMO - - - Air System Maintenance Organisation
ASMOA - - - Air System Maintenance Organisation Approval
ASPO - - - - Air System Production Organisation
ASPOA - - - Air System Production Organisation Approval
ASR - - - - Air Staff Requirements
ASTE - - - - Aircraft and Systems Testing Establishment
ATC - - - - Air Traffic Control

ATE - - - - Automated Test Equipment
ATP - - - - Acceptance Test Procedure
ATR - - - - Acceptance Test Report
AUW - - - - All Up Weight
AWG - - - - Airworthiness Group
BASA - - - - Bilateral Aviation Safety Agreement
BEL - - - - Bharat Electronics Limited
BNE - - - - Buyer Nominated Equipment
BOM - - - - Bill of Materials
BRD - - - - Base Repair Depot
BRD - - - - Base Repair Depot
CAA - - - - Civil Airworthiness Authority
CAMO - - - Continuing Airworthiness Management Organisation
CB - - - - - Certification Basis
CCCB - - - - Central Configuration Control Board
CCP - - - - Configuration Change Process
CDR - - - - Critical Design Review
CEH - - - - Complex Electronic Hardware
CEMILAC - - Centre for Military Airworthiness and Certification
CFE - - - - Customer Furnished Equipment
CFT - - - - Captive Flight Trials
CGAIS - - - Coast Guard Aeronautical Inspection Service
CM - - - - - Configuration Management
CMC - - - - Ceramic Matrix Composites
CMDS - - - - Counter Measure Dispensing System
CMP - - - - Configuration Management Plan
CoA - - - - Certificate of Airworthiness
CoC - - - - Certificate of Conformity
CoD - - - - Certificate of Design
CONOPS - - - Concept of Operations
COTS - - - - Commercial Off-The Shelf
CP - - - - - Certification Plan
CPCs - - - - Corrosion Preventive Compounds
CQA (IAF) - - Chief Quality Assurance (IAF)
CQSP - - - - Common Quality Surveillance Plan
CR&J - - - - Carriage Release and Jettison
CRPO - - - - Chief Research and Project Officer
CSDO - - - - Central Servicing Development Organisation
CSE - - - - Customer Specified Equipment
CSIR - - - - Council for Scientific and Industrial Research
CSU - - - - Clearance for Service Use

CTP- - - - - Chief Test Pilot
CVE - - - - Compliance Verification Engineers
CWP - - - - Contractors' Working Parties
D&D - - - - Design and Development
DAE - - - - Defence Air Environment
DAL - - - - Drawing Applicability List
DAO - - - - Design Approved Organisation
DAP - - - - Defence Acquisition Procedure
DAS - - - - Design Assurance System
DDG - - - - Deputy Director General
DDP - - - - Department of Defence Production
DDR - - - - Detail Design Review
DFC - - - - Development Flight Clearance
DG - - - - - Director General
DGAQA - - - Directorate General of Aeronautical Quality Assurance
DGCA- - - - Directorate General of Civil Aviation
DIC- - - - - Defect Investigation Committee
DO - - - - - Design Organisation
DOA - - - - Design Organisation Approval
DOAS- - - - Design Organisation Approval Scheme
DoDP - - - - Declaration of Design and Performance
DOE - - - - Design Organisation Exposition
DPM - - - - Defence Procurement Manual
DPSU - - - - Defence Public Sector Undertaking
DRCL - - - - Designer Research Capability Level
DRDO- - - - Defence Research and Development Organisation
ECN - - - - Engineering Change Note
ECS- - - - - Electronics and Communication System
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
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 Oils and Lubricants

FONA - - - - Flag Officer Naval Aviation
FPCM - - - - Flight Program Clearance Memo
FQT - - - - Full Qualification Tests
FRACAS - - - Failure Reporting, Analysis and Corrective Action System
FRRB - - - - Flight Readiness Review Board
FTB- - - - - Flying Test Bed
GM - - - - - Guiding Materials
GoI - - - - - Government of India
GOS - - - - Ground Operating System
GSQR - - - - General Staff Qualitative Requirements
GSS- - - - - Ground Support System
HAL - - - - Hindustan Aeronautics Limited
HFRA - - - - High Failure Rate Aggregates
HILS - - - - Hardware In-Loop Simulation
HQ - - - - - Head Quarters
IA - - - - - Indian Army
IAF - - - - - Indian Air Force
ICG - - - - - Indian Coast Guard
ICGSQR - - - Indian Coast Guard Staff Qualitative Requirements
IDDM - - - - Indigenously Designed Developed & Manufactured
IFR - - - - - Initial Flight Release
IMATSO - - - Indian Military Aviation Technical Standard Order
IMATSOA - - Indian Military Aviation Technical Standard Order Approval
IMTAR - - - Indian Military Technical Airworthiness Requirements
IN - - - - - Indian Navy
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
IV&V - - - - Independent Verifcation & Validation
JAC - - - - - Joint Airworthiness Committee
JRI - - - - - Joint Receipt Inspection
JSQR - - - - Joint Services Qualitative Requirements
LCC - - - - Local Concession Committee

LMC - - - - Local Modification Committee
LoA - - - - Letter of Approval
LQT - - - - Limited Qualification Tests
LRU - - - - Line Replaceable Unit
LTC- - - - - Local Technical Committee
LTCC - - - - Local Type Certification Committee
MAG (Avn) - - Maintainability Advisory Group (Aviation)
MAR - - - - Military Airworthiness Review
MARC - - - Military Airworthiness Review Certificate
MCP - - - - Military Certification Process
MDI - - - - Master Drawing Index
MIDHANI - - Mishra Dhatu Nigam Limited
Mil CAMO - - Military Continuing Airworthiness Management Organisation
MMC - - - - Metal Matrix Composites
MMEL - - - Master Minimum Equipment List
MMO - - - - Military-run Maintenance Organisation
MOA - - - - Maintenance Organisation Approval
MOAA - - - Minimum One Airworthiness Audit
MOAS - - - Maintenance Organisation Approval Scheme
MoCA - - - Ministry of Civil Aviation
MoD - - - - Ministry of Defence
MOE - - - - Maintenance Organisation Exposition
MoM - - - - Minutes of Meeting
MoU - - - - Memorandum of Understanding
MR - - - - - Mutual Recognition
MRB - - - - Material Review Board
MRO - - - - Maintenance and Repair Organisations
MSS - - - - Missile & Strategic Systems
MTC - - - - Military Type Certificate
MTOW - - - Maximum Take Off Weight
NAA - - - - National Airworthiness Authorities
NABL - - - - National Accreditation Board for Testing and Calibration Laboratories
NADCAP - - National Aerospace and Defence Contractors Accreditation Program
NAL - - - - National Aerospace Laboratories
NAQAS - - - Naval Aeronautical Quality Assurance Service
NASDO - - - Naval Aircraft Servicing and Development Organisation
NAY - - - - Naval Aircraft Yard
NCR - - - - Non Conformance Report
NCRB - - - - Non Conformance Review Board
NCRP - - - - Non Conformance Review Process
NFTC - - - - National Flight Test Centre

NFTS - - - - Naval Flight Test Squadron
NSQR - - - - Naval Staff Qualitative Requirements
OCR - - - - Operational Capability Release
OEM - - - - Original Equipment Manufacturer
ORDAQA - - Office of Regional Director Aeronautical Quality Assurance
OSD - - - - Out of Service Date
PAT - - - - - Production Acceptance Test
PATP - - - - Production Acceptance Test Plan
PATS - - - - Production Acceptance Test Schedule
PC - - - - - Provisional Clearance
PCD - - - - Performance Cycle Deck
PDI - - - - Pre-Dispatch Inspection
PDR - - - - Preliminary Design Review
PFR- - - - - Preliminary Flight Rating
PMC - - - - Polymer Matrix Composites
POA - - - - Production Organisation Approval
POAS - - - - Production Organisation Approval Scheme
POE - - - - Production Organisation Exposition
PQT - - - - Periodic Qualification Test
PR - - - - - Production Release
PSU - - - - Public Sector Undertaking
PSWG - - - - Project Safety Working Group
QA - - - - - Quality Assurance
QAP - - - - Quality Assurance Plan
QAS - - - - Quality Assurance Service
QCI - - - - - Quality Council of India
QMS - - - - Quality Management System
QT - - - - - Qualification Tests
QTP - - - - Qualification Test Plan/Procedure
QTR - - - - Qualification Test Report
RA - - - - - Regulatory Articles
RAQAS - - - Regional Aeronautical Quality Assurance Service
RCMA - - - Regional Centre for Military Airworthiness
RCS - - - - Radar Cross Section
RDAQA - - - Regional Director Aeronautical Quality Assurance
RFP- - - - - Request for Proposal
RFT- - - - - Release Flight Trials
RMTC - - - - Restricted Military Type Certificate
RSD - - - - Release to Service Document
RTS- - - - - Release to Service
RTSR - - - - Release to Service Recommendation

SAM - - - - Safety & Arming Mechanism
SB - - - - - Service Bulletin
SCMP - - - - Software Configuration Management Plan
SCN - - - - Software Change Note
SCRB - - - - System Certification Review Board
SDO - - - - Store Design Organisation
SDOA - - - - Store Design Organisation Approval
SDP- - - - - Software Development Plan
SI - - - - - Servicing Instructions
SLP - - - - - Spares Latest Pattern
SMO - - - - Store Maintenance Organisation
SMOA- - - - Store Maintenance Organisation Approval
SMP - - - - Service Modification Parties
SMS - - - - Safety Management System
SMTC - - - - Supplemental Military Type Certificate
SofA - - - - Statement of Acceptance
SOC - - - - Signal Out Certificate
SOE - - - - Standard of Equipment
SOF- - - - - Safety of Flight
SOFT - - - - Safety of Flight Tests
SOO - - - - Special Order Only
SOP - - - - Standard of Preparation
SPO - - - - Store Production Organisation
SPOA - - - - Store Production Organisation Approval
SQAP - - - - Software Quality Assurance Plan
SQEP - - - - Suitable Qualified and Experienced Personnel
SQR - - - - Staff Qualitative Requirements
SRS- - - - - Software Requirement Specifications
SSA- - - - - System Safety Assessment
STI - - - - - Special Technical Instruction
TA - - - - - Type Approval
TAA - - - - Technical Airworthiness Authorities
TAB - - - - Type Approval Basis
TARB - - - - Test Adequacy Review Board
TBO - - - - Time between Overhaul
TC - - - - - Type Certificate
TC&PI - - - Technical Coordination & Public Interface
TCB - - - - Type Certification Basis
TCDS - - - - Type Certificate Data Sheet
TCL - - - - Total Calendar Life
TCR - - - - Type Certification Report

TEMP - - - - Test and Evaluation Master Plan
TI - - - - - Technical Information
TLMP - - - - Through-Life Management Plan
ToT - - - - - Transfer of Technology
TRC - - - - Test Release Certificate
TRL - - - - Technology Readiness Level
TTGE - - - - Tools, Testers and Ground Equipment
UAS - - - - Unmanned Aircraft System
UAV - - - - Unmanned Aerial Vehicle
UON - - - - Urgent Operating Notice

DEFINITIONS

Acceptable Means of Compliance (AMC)
AMC represents the preferred means by which the Technical Airworthiness Authorities (TAA) expect the intented requirement / criteria to be met.

Air System
Air Systems include fixed or rotary wing Aircraft, Unmanned Aircraft, Air Launched Missiles and Aero Engines.

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

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, sonobuoys, rescue boats and similar items which are deployed from Air Systems are included as Air Armament.

Air Launched Missiles (ALMs)
ALMs 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 Air System unlike air armament which is an Airborne Store.

Airworthiness
Airworthiness is the continued capability of the military Air Systems and Airborne Stores to perform satisfactorily and fulfill mission requirements, throughout the specified life in the specified environments with acceptable levels of safety and reliability. The acceptable levels are to be mutually agreed between Users, Main Contractor and Technical Airworthiness Authorities.

Airworthiness Certification Plan (ACP)
ACP is a document that brings out the details towards compliance to the agreed Type Certification Basis (TCB)/Type Approval Basis (TAB) of the Air System/Airborne Stores and the level of involvement of TAA and other stakeholders at each stage of the development.

Airworthiness Certification Criteria
It is a foundational and a guidance document that contains the relevant standards/tailored standards to be used by the Main Contractors to define their Air Systems and Airborne Stores airworthiness certification basis.

Airworthiness Non-Compliances

The non-compliances of the requirements given in the Airworthiness Certification Plan (ACP) viz, test, analysis, reports, simulation etc.

Airworthiness Violation

The violation of the general airworthiness practices.

Air System Design Organisation (ASDO)

ASDOs are organisations involved in design & development and modification of an Air System. ASDO shall be responsible for the overall design or through-life configuration management of the design of the Air System, and for co-coordinating the design and integration of the Airborne Stores designed by other design organisations.

Air System Maintenance Organisation (ASMO)

ASMOs are organisations involved in the maintenance of an Air System. ASMO shall be responsible for the overall maintenance of the Air System, and for co-ordinating the overhauling & maintenance of the Airborne Stores maintained by other organisations.

Air System Production Organisation (ASPO)

ASPOs are organisations involved in manufacturing of an Air System. ASPO shall be responsible for the overall manufacturing of the Air System, and for integration of the Airborne Stores manufactured by other organisations.

Amended Military Type Certificate (AMTC)

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

Applicant

An organisation seeking Airworthiness Approvals/Clearances/Certificates or Organisation Approvals from TAA.

Authority Holding Sealed Particulars (AHSP)

AHSP is the authority responsible for collecting, collating, developing, updating, holding and supplying sealed particulars of the defence items in accordance with the laid down procedure. AHSP for aviation stores is being held by various DPSUs, Ordnance Factories, DGAQA, DRDO labs, individual Services for different aviation stores.

Certificate of Airworthiness (CoA)

CoA is the formal document issued by DGAQA or competent authority to certify that an Air System is airworthy. Every individual Aircraft 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 (CoD)

CoD 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.

Clearance for Service Use (CSU)

CSU is an approval by CEMILAC for use of an Airborne Store by the User Services. CSU shall be the basis for operation of the Airborne Store by the services. Maintenance manuals, manuals on TTGE, and all other documents/training requirements required for ensuring the continuing airworthiness shall be referred in the CSU.

Continued Airworthiness

All processes to be carried out to verify that the conditions under which the initial airworthiness approvals have been granted, continue to be fulfilled at any time during its period of validity. This includes all upgrades/modifications to the in-service Air System to enhance its usefulness & capability and to also address obsolescence/life extension.

Continuing Airworthiness

All of the processes ensuring that, at any time in its operating life, an Air System and the Airborne Stores complies with the airworthiness requirements in force and is in a condition for safe operation. This includes following the prescribed scheduled maintenance practices, implementing the servicing & technical instructions and daily inspections practices to ensure that the Air System is airworthy for operations.

Continuing Airworthiness Management Organisation (CAMO)

Servicing/maintenance management organisation/department/mechanism within the Air Systems operator's organisational structure to track, monitor and manage the servicing/ maintenance related activities of the Air Systems to ensure their continuing airworthiness.

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 concurrently with the design and development.

Delegated TAA

Identified personnel in the Airworthiness Group & Internal QA Group of D&D organisation authorised by CEMILAC and DGAQA to perform the roles of TAA under Research Air Systems / Airborne Stores (RAS) phase.

Designer Research Capability Level (DRCL)

This is the capability of the organization with respect to research and design & development of Air System/Airborne Store.

Design Organisation Approval (DOA)

An approval given to a design organisation under Design Organisation Approval Scheme (DOAS) of CEMILAC.

Design Organisation Approval Scheme (DOAS)

The Design Organization Approval Scheme (DOAS) is a means which ensures that the Design Organization has all the processes/procedures, human resources and infrastructure for

the responsibilities that the Design Organization has to take towards Design, Development, Airworthiness Certification and Continued Airworthiness of Air System/Airborne Stores in the identified scope.

Development Flight Clearance (DFC)
DFC is an approval given to an Airborne Store for integration onto an Air System to carry out development flight trials.

Failure Reporting Analysis and Corrective Action System (FRACAS)
FRACAS is a system, that provides a process for reporting, classifying, analysing failures and planning corrective actions in response to those failures.

Final Operational Clearance (FOC)
Clearance issued by CEMILAC to an Air System for regular operations by the Services, when a type design has complied with and demonstrated all of the User requirements and the requirements of design and safety.

Flight Clearance Certificate (FCC)
FCC is an approval given to an Air System and is an authorization for the flight test agency to carry out development flight trials within the listed system/operating limitations and cleared envelopes.

Flight Test Agency of the Respective User Services
Flight Test Agency within the services, that is authorized by the Service HQ to carry out flight testing of Air System/ Airborne Stores for the Services, such as ASTE, NFTS, AATT, etc,. herein referred to as the flight test agency of the respective User Services.

Flight Test Plan
A flight test plan typically defines the flight testing requirements for a particular phase of flight, including objectives, Air System, trial dates, venue, pre-requisites, SOP, configuration, tests to be conducted, environment, support and instrumentation needs. Flight Test Plans are prepared for important phases of flight tests.

Flight Test Schedule
A flight test schedule is like a flight test plan at individual sortie level. It contains details of specific tests to be conducted during the sortie. For the purpose of this document, the term Flight Test Schedule includes Taxi Test Schedule also, which is intended for taxi tests.

Flight Test Specification
Flight test specification is the flight test demonstration requirements for an Air System/ Airborne Store that are to be verified through flight tests towards compliance of requirements in TCB/TAB. These are a set of tests that have to be successfully flown to comply with TCB/ TAB.

Flying Program
Flying program as envisaged in this document is the set of requirements (SOP, configuration, fuel, etc.) necessary for preparation of the aircraft, as provided by the Flight Test Agency.

Independent Verification & Validation (IV&V)
Verification and validation performed by a team that is technically and managerially independent of the development team.

Indian Military Aviation Technical Standard Order (IMATSO)
An IMATSO is a minimum performance standard/specification issued by CEMILAC for specified Airborne Stores to be used on military Air Systems. Airborne Stores with IMATSO approval are eligible for use on any Air System, provided the IMATSO standard meets the Air System requirements.

Indian Military Aviation Technical Standard Order Approval (IMATSOA)
An approval given to an Airborne Store that meets the relevant IMATSO standard/ specification. However, an IMATSOA, by itself, is not an authorization for installation on any Air System.

Indian Military Technical Airworthiness Requirements (IMTAR)
IMTAR document provides the technical airworthiness requirements applicable during design, development, production and certification of military air systems and airborne stores. Compliance to these requirements shall be the basis for TAA to issue necessary clearances / approvals / certificates.

Initial Operational Clearance (IOC)

Clearance issued to an Air System by CEMILAC 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 the safety of the Air System. The restrictions are due to non-compliance to some of the User requirements.

Initial Airworthiness Approval
The approval issued by CEMILAC for the initial type design. Initial Airworthiness Approval includes, Military Type Certificate (MTC), Restricted Military Type Certificate (RMTC), Release to Service Document (RSD), Type Approval, Clearance for Service Use (CSU), Indian Military Aviation Technical Standard Order Approval (IMATSOA) and Letter of Approval (LoA).

Inspection Note / Form Q423
Each and every produced and released aeronautical equipment or Airborne Stores is accompanied with an Inspection Note/Form Q423 issued by DGAQA, stating satisfactory inspection of the equipment or Airborne Stores.

Letter of Approval (LoA)
LoA is an approval given to a class of Airborne Stores like Materials, Electronic modules, finished parts and other items that are not covered under Type Approval or IMATSOA.

Licensee
The organisation to whom the license to produce an Air System/Airborne Store has been conferred upon by the licensor.

Licensor

The Original Equipment Manufacturer (OEM) of the Air System/Airborne Store, issuing the license for production, is referred to as the Licensor.

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, production planning department, quality department of the Main 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 organisation of the respective User Services, Service Head Quarters, DGAQA, Main Contractor's representatives in Design, Production Engineering, Methods Engineering and Quality Control. Wherever flight testing is involved, flight testing agency representative may also be a co-opted member. LMC chairman may constitute LTC for technical evaluation of modification.

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 identified Airborne Stores to be indigenised. It is chaired by CEMILAC with members from, Department of indigenisation, the Design & Quality representatives of Main Contractor, DGAQA and User Services. Wherever flight testing is involved, flight testing agency representative may also be a co-opted member.

Main Contractor

Main Contractor is the development/modification/ production agency who is entrusted with the total responsibility for development/modification/production/delivery and follow on support of the Air System/ Airborne Store. When multiple agencies are involved, the respective roles and responsibilities may be defined in an agreement/ MoU among the agencies involved. Where there is no ambiguity or when used in a generic sense, the term Main Contractor is used throughout this document.

Maintenance Organisation (MO)

MOs are organisations involved in maintenance of Air Systems and Airborne Stores used in an Air System. MO shall be responsible for the through-life configuration management of the maintenance of Air Systems and Airborne Stores installed in an Air System.

Maintenance Organisation Approval (MOA)

An approval given to an organisation competent to carry out maintenance of Air Systems or Airborne Stores.

Maintenance Organisation Approval Scheme (MOAS)
MOAS is a mechanism by which the competence of an organisation to undertake maintenance of Air System and Airborne Stores can be assessed.

Maintenance Organisations of the respective User Services
Organisations within the Services, that are authorized by the Service HQ to perform the servicing development related activities of the Air System/ Airborne Stores for the Services, such as CSDO, NASDO, MAG(Avn), etc. herein referred to as the Maintenance Organisations of the respective User Services.

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 Remotely Piloted Aircraft during development or during operations for military use, registered or intended to be registered with Ministry of Defence.

Military Type Certificate (MTC)
MTC is a certificate that the Air System of a particular type design complies with all the agreed Design, Safety and Airworthiness requirements.

Military Type Certificate Holder
The ASDO to whom the Military Type Certificate (MTC/RMTC) is awarded is the Military Type Certificate Holder.

Original Equipment Manufacturer (OEM)
The original equipment manufacturer is the original and the only firm manufacturing the specified Air System/Airborne Store of a specific make, as distinguished from the stockist/ distributors or suppliers of such items/equipment and no other manufacturer exists for that item.

Office of Regional Director Aeronautical Quality Assurance (ORDAQA)
ORDAQA is a field unit of DGAQA which progresses, on behalf of DGAQA, all aspects of quality assurance of the Air Systems/Airborne Stores during design & development, production and in-service phase.

Production Organisation (PO)
POs are organisations involved in manufacturing and repair of Air Systems and Airborne Stores that are used in an Air System. PO shall be responsible for the through-life configuration management of the Air Systems and Airborne Stores produced and installed in an Air System.

Production Organisation Approval (POA)
An approval given to an organisation as competent to carry out manufacture and repair of Air Systems or Airborne Stores.

Production Organisation Approval Scheme (POAS)

POAS is a mechanism by which the competence of an organisation to undertake manufacture and repair of Air System and Airborne Stores can be assessed.

Provisional Clearance

A provisional clearance is issued to an Airborne Store for a limited period, pending issue of Type Approval / LoA 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 therein.

Quality Assurance Plan (QAP)

QAP is a document that details the quality assurance related activities throughout the design & development, production and maintenance of the Air System and Airborne Stores with the involvement of DGAQA and the QA departments of the Main Contractor/User Services and approved by DGAQA.

Quality Assurance Departments of the User Services

The departments within the respective User Services, that perform the Quality Assurance activities for the Services, such as NAQAS, RAQAS, QAS, CGAIS, CQA etc, herein referred to as the Quality Assurance department of the respective User Services.

Regional Centre for Military Airworthiness (RCMA)

RCMA is a field unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the Air Systems/Airborne Stores during design and development, production and in-service phase.

Recognition

Recognition is a structured process by which Indian TAA can evaluate foreign National Airworthiness Authorities (counterpart of CEMILAC and DGAQA) and assess the potential to use their certification approvals for Indian military applications. Recognition can be undertaken on a reciprocal basis, known as 'mutual', or on a unilateral/multilateral basis. It can also be in the form of a bilateral agreement.

Release to Service Document (RSD)

Document issued by CEMILAC to the Services during IOC or FOC of an Air System that authorizes regular flying by the Services within the stipulated limitations and cleared envelopes. RSD is to be issued before or along with the delivery of the first Air System to the User Services which is produced to the production standard and is issued with the SOC by DGAQA.

Restricted Military Type Certificate (RMTC)

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 can be issued for a provisional period until the Type Design can be demonstrated to be accurate and complete.

Safety of Flight Tests (SOFT)

An abridged version of the qualification tests for a non-safety critical Airborne Store, sufficient enough to establish confidence in the safety of a few development flights, for the purpose of data gathering to facilitate further developmental activities. Development Flight Clearance will be issued by CEMILAC based on SOFT reports duly coordinated by DGAQA.

Service Bulletin (SB)

Service Bulletin is a document issued by the Air System/Airborne Store OEM to communicate details of modifcations which need to be embodied in the Air System/Airborne Store.

Servicing Instructions (SIs)

SIs are instructions by the Air System manufacturer to the Air System operator, regarding additional/renewed servicing and maintainability aspects of the Air System.

Special Technical Instructions (STIs)

Special Technical Instructions are instructions by the Air System manufacturer to authorise remedial actions by the Air System operator when a fault or a potential fault impairs the safety, serviceability or operational capabilities of an Air System.

Staff Qualitative Requirements (SQR)

SQR is the document released by the User Services, which describes in qualitative and quantitative terms, the requirements for an Air System or Airborne Store, viz, ASR/NSQR/ GSQR/ICGSQR/JSQR/PSQR.

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 in public domain so that any party may manufacture the part.

Standard of Preparation (SOP)

The frozen build standard of the Air System/Airborne Store including its approved drawings and list of approved equipment/items.

Store Design Organisation (SDO)

SDOs are organisations involved in the design & development and modification of Air-borne Stores used in an Air System. SDO shall be responsible for the through-life configu-ration management of the designed Air borne Stores.

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.

System Certification Review Board (SCRB)

SCRB is a board constituted by CE(A), CEMILAC, if required, to address issues related to design and certification. The board will be chaired by CE(A) / concerned Director from CEMILAC / national level domain expert with system domain specialists from CEMILAC and co-opted experts in the field from Industry / Academia, as members.

Test Adequacy Review Board (TARB)

TARB is a board constituted by the Main Contractor in consultation with CEMILAC to review the adequacy of ground testing of systems/subsystem as part of design validation. The board will be chaired by a domain expert and will have system experts, CEMILAC, DGAQA as members. Flight test agency of User Services may also be co-opted wherever required.

Technical Airworthiness Authorities (TAA)

CEMILAC and DGAQA, the organisations dealing with Technical Airworthiness of the Military Air Systems/Airborne Stores are jointly referred as TAA.

Technology Readiness Level (TRL)

This is the level at which the technology within the organization currently exists for the actual system development in terms of enabling technology, infrastructure and facilities as evaluated with reference to Annexure-1 of Sub-Part I.

Tools, Testers and Ground Equipment (TTGE)

TTGE includes the following:

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

Testers: All testers and Test Equipment which are used to test/verify functions/ parameters of the parts/equipment/LRUs/Air System.

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

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 Main Contractor submits the Type Record with all relevant documents, to the satisfaction of CEMILAC.The test reports along with compliance document shall be duly coordinated by DGAQA.

Type Approval Basis (TAB)

The 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 Certificate Holder

A Type Certificate Holder is the custodian of the Air System's type design approved under a Military Type Certificate.

Type Certification Basis (TCB)

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

Type Certificate Data Sheet (TCDS)

TCDS, is a document that contains information of the Air System type design, operating limitations, applicable regulations/standards of compliance, and any other conditions or limitations prescribed for the Type design. The TCDS of the type design is issued along with the MTC based on the Air System type record submitted by the Main Contractor.

Type Record

Type Record is a collection of documents giving a description of the Air System/Airborne Store, Technical Specifications, Qualification/Type Test details, results of all applicable tests, applicable drawings, lifing details and the Certificate of Design. It also includes information on dimensions, materials and processes necessary to define & produce the product. It should also indicate the instructions for continued airworthiness, operating limitations and other information for the safe operation.

Unmanned Aircraft System (UAS)

An Unmanned Aircraft System comprises of unmanned air sysem and associated elements (including communication links and the components that control the unmanned Air System) 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. UAV is a component of UAS.

Urgent Operating Notice (UON)

Any operating instruction that is critical to the safety of flight and where updating of applicable publications may take time, shall be immediately intimated to applicable operating bases through an Urgent Operating Notice (UONs).

User Services

User Services refers to Indian Army, Indian Navy, Indian Airforce, Indian Coast Guard and such Services under the Ministry of Defence.

Intentionally Left Blank

INTRODUCTION

Introduction

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

The life cycle of an airsystem/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 airsystem/airborne store life cycle. These procedures and technical requirements facilitates 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 airworthiness requirements are called the Indian Military Technical Airworthiness Requirements (IMTAR).

Applicability

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

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

This document shall apply to the new projects initiated post its release. The applicability of this document to the ongoing Air Systems/Airborne Stores programmes, shall be decided based on the stage of completion and in consultation with the Stakeholders.

In case of conflict with the IMAP-2023 document, the provisions in IMAP-2023 shall prevail.

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 airsystem /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
Subpart C	Ab-initio Development of Airborne Stores Leading to TA / LoA / IMATSOA
	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: Development Of Airborne Materials Leading To LoA
	C4: Ab-initio Development of Airborne Stores leading to LoA
	C5: Airborne Stores, for which IMATSO Exists, Leading to IMATSO Approval (IMATSOA)
	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 Organisation Approval Scheme
	G2: Production Organisation Approval Scheme
	G3: Maintenance Organisation Approval Scheme
Subpart H	Certificate of Airworthiness (CoA) for Air Systems
Subpart I	Research Air Systems and Airborne Stores
Subpart K	Indigenous Substitutions of Airborne Stores
Subpart L	Continued & Continuing Airworthiness
Subpart M	Repair of Air Systems and Airborne Stores
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 Air Systems
Subpart S	Customer Furnished Equipment and Customer Specified Equipment
Subpart T	Test Rigs And Tools, Testers & Ground Equipment (TTGE)
	T1: Test Rigs
	T2: Tools, Testers & Ground Equipment (TTGE)
Subpart U	Mutual Recognition of National Airworthiness Authorities (NAA)

Organisation of Subpart

Each Subpart contains all the applicable technical airworthiness requirements brought out as 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 airsystem/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.

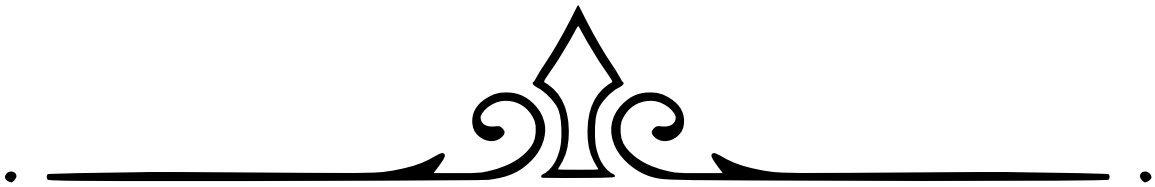
Rationale : Each Subpart identifies a Rationale as a basis for the regulations.

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

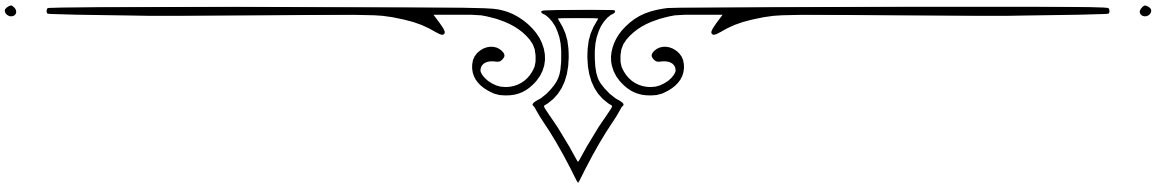
Regulation: The Regulation is described and is uniquely numbered with the Regulatory Clause.

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.



SUBPART A
GENERAL PROCEDURE FOR INDIAN MILITARY AIRWORTHINESS



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 an Air System/Airborne Store are discussed. This Subpart also brings out the roles and responsibilities of CEMILAC and DGAQA, the Technical Airworthiness Authorities (TAA) in India. CEMILAC is the Airworthiness Assurance Authority and DGAQA is Quality Assurance Authority.

2.0 PROCEDURES

The General Procedures followed for Airworthiness and Certification of an Air System/ 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 Air System or Airborne Store . 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 air system 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 and 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 Type Certificate/Approval for the Air System/Airborne Stores after ensuring compliance to the airworthiness requirements.

After the issuance of Type Certificate/Approval, the programme enters the production phase with production clearance by DGAQA. Airworthiness is to be ensured during the production and the in-service phase of the air system/airborne store. Figure A.1 illustrates the generic procedure during the process of project initiation and development.

2.2 Ab-initio Development Phase

Once the project is sanctioned, the Main Contractor selects one of the two options for the airworthiness certification i.e, either Concurrent design and certification or Certification commencing after completion of all design activities. In the second case, CEMILAC may stipulate additional tests or seek repetition of test or analysis (duly justified) to accord clearance/certification.

Based on the Qualitative Staff Requirements, the Main Contractor prepares the Air System Requirement/ Technical Specifications which captures the requirements at the Air System/airborne store level and addresses all the system/subsystem interface issues.

The Type Certification Basis (TCB) along with the acceptable means of Compliance and the Airworthiness Certification Plan (ACP) are prepared by the Main Contractor in consultation with CEMILAC.

Airworthiness certification during Design Development involves two phases viz., the Design Evaluation phase and the Testing phase, which includes Ground and Flight testing. Design Evaluation involves evaluating the adequacy of the design to meet the user, design and safety requirements, while testing validates the design for nominal and failure cases.

The design evaluation phases include project definition phase, preliminary design and detailed design phase. The project definition identifies major systems/equipment, Weight, Sizing and Configuration. This is a prelude to the preliminary design. In preliminary design, the trade–off in design and design parameters for safety, functionality and 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 is carried out.

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

As part of spiral/staircase approach to certification, Main contractor shall capture the complete functional / testing requirements for the final configuration of Air System/Airborne Store during the D&D phase itself. However, the testing (FTP/ATP) may be carried out in three phases i.e. Design & Development phase, Limited Series Production (LSP) phase and final Production phase as per the operational/performance requirements specified for these phases. Accordingly, the main contractor may define the tests/test specifications to be included in these three phases of FTP/ATP.

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 Air System are prepared by the Main Contractor.

The prototype is realised based on the baselined SOP and ground & 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 ground & flight testing requirements. The detailed requirements for identification are given in Subpart Q.

The Flight Clearance Certificate (FCC) approved by CEMILAC, bringing out the cleared build, system limitation, operating limitations, cleared envelopes and conditions of release, authorises flight testing by the flight test agency. The flight testing follows the requirements generated in the Flight Test Specification approved by CEMILAC. The Flight test plan bringing out the planned set of activities and the flight test objectives are prepared by the flight Test agency for important phases of tests. Flight clearance based on Airworthiness of the Air System is accorded by CEMILAC through the Flight Program Clearance Memo (FPCM). Form 1090 or the Certificate of Flight 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. Figure A.3 illustrates the generic procedure for Ab-Initio flight testing. 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 Record for the Air System or the Type Record for the Airborne Store to CEMILAC. CEMILAC, on satisfactory compliance to all user, design, safety and documentation requirements, issues the Military Type Certificate (MTC) for the Air System or Type Approval for an Airborne Store to the Main Contractor and Release to Service Document (RSD) to the User Services for regular operations. A Type Certificate Data Sheet (TCDS) capturing the basic information of the Air System is also issued with the MTC. It is imperative that all Publications and Tools, Testers and the Ground Equipment (TTGE) required for ensuring the Continuing Airworthiness of the Air System 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 a 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 Air System. 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 or Research Air System that are developed to demonstrate contemporary technologies for military aviation, that may be produced in limited numbers, not for regular operations by the User Services 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 is jointly signed by a authorised member of the design agency and CEMILAC.

The Department of Defence Production, 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 pre-production/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, interchange-ability, 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 Modifications. 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 are placed before LMC for consideration.

Depending on the modification, the design standard of production of Air System/ 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.

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

Periodic Qualification Tests (PQT)/ Line Qualification Tests for all the Air System components and equipment need to be finalised with design, production QA and DGAQA. The ground test and flight test for the acceptance of the Air System 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 Air System 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 interchangeability. The detailed technical requirements for identification are given in Subpart Q.

After successful completion of the production, meeting all the test requirements satisfactorily, the Air System/Airborne Store is cleared for induction and regular operation by DGAQA through the Certificate of Airworthiness (CoA)/Release Note in the form of Signal out Certificate. The detailed technical requirements for Certificate of Airworthiness are given in Subpart ‘H’.

Figure A.4 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 Air System/Airborne Store within the scope of the licence agreement.

The manufacture and testing are 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 Air System in service undergoes 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/QA of the respective Services. Modifications/Upgrades are addressed through Local Modification Committee (LMC), constituted by MoD, wherein the procedures described in section 2.3 are applicable. Upgrades undergo design evaluation and testing for which the procedures described in section 2.2 are applicable. Figure A.3 also illustrates the procedure for flight testing of in-service Air System for modifications and upgrades. 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 Air System complies with the airworthiness requirements as applicable and is in a condition for safe operation. This is ensured by following the stipulated periodic maintenance procedure, Daily inspection 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 in consultation with CEMILAC.

It may also so happen that a specific Air System (unique Tail number) might have suffered damages during operation. If there is a possibility to recover the component and bring 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 Subpart M.

2.5 Indigenous substitution

Indigenous substitution mainly deals with development, prototyping, testing, evaluation and clearance of an Airborne Store as a replacement of the existing Airborne Stores procured from foreign sources. 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), other IAF Depots, Naval Aircraft Yards (NAYs), Army Base Workshops etc. In cases where, some of these activities are achieved by way of sub-contracting to suitable vendors, the indigenisation agency shall ensure that the vendors comply with the airworthiness certification requirements. LTCC shall be constituted on the indigenisation agency. LTCC is the authority to assess & classify the criticality of the airborne stores to be indigenously substituted. Airborne Store, whose failure / malfunctioning endangers the safety of the Air System / flight crew or results in aborting the mission is called as a critical Airborne Store. Airborne Store, which is not classified as critical, is treated as non-critical. The Airborne Stores, identified to be critical, CEMILAC shall broadly progress the airworthiness certification activities leading to clearance as per the requirements for ab-initio development of airborne stores as given in Subpart C. The

airborne stores, identified to be non-critical the airworthiness certification coverage leading to its clearance is by the LTCC itself.

For the non-critical store, the indigenisation agency shall put up the detailed plan for indigenisation including technical specification, development and test plan to the LTCC for review and ratification. Qualification tests shall be carried out at NABL/ Govt. approved test houses / Laboratories. Quality Assurance aspects during production shall be ensured by the internal QA of the indigenisation agency. On completion of the activities, the indigenisation agency shall submit the test reports and compliance to LTCC for clearance.

The detailed procedures for development, prototyping, testing, evaluation, approval and production of items being used as indigenous substitutions are given in Subpart K. Figure A.5 illustrates the schematics for indigenous substitution.

2.6 Organisation Approval

Airworthiness has to be ensured throughout the life cycle of the Air System. Ensuring airworthiness throughout the life cycle of the Air System, implies that, the Air System 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 that the Organisation has all the processes/procedures, human resources and infrastructure for the responsibilities that the Organisation has to take towards Design, Development, Production, Maintenance, Airworthiness Certification and Continued Airworthiness of Air System/Airborne Stores in the identified scope and in the relevant domain, 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 will be 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 foreign companies 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 an 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 Air System/Airborne Store, Customer Furnished Equipment (CFE), Civil certified aircraft for military use are detailed in Subpart N, Subpart S and Subpart R respectively.

2.9 Roles and Responsibilities of Stakeholders

Regional Centre for Military Airworthiness (RCMA) is an unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the Air System/ 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 Air System/Airborne Stores during Design, Development and production phases.

The Main Contractor is responsible for the design and development of the Air System/ Airborne Store and the flight test agency is responsible for flight testing the Air System and Airborne Store.

The User Services are responsible for specifying the Qualitative requirements and for facilitating the design development at all phases.

The broad roles and responsibilities, not limited to, of all the stakeholders are discussed herein. It is to be noted that in the following sections RCMA and CEMILAC, ORDAQA and DGAQA are used synonymously.

3.0 Responsibilities of CEMILAC

a. CEMILAC is the regulatory authority for Airworthiness Certification of Air System and Airborne Stores for Indian military applications.

b. CEMILAC evaluates design features of all military Air Systems/ 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 Air System and Airborne Stores.

c. 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 that are necessary for maintenance of airworthiness of aircraft in service.

d. CEMILAC is a part of evolution of Route to Certification, Type Certification Basis/ Type Approval Basis/Airworthiness Certification Plan (TCB/TAB/ACP) for ab-initio design and development.

e. Participate in all design reviews such as Preliminary Design Review/ Critical Design Review (PDR/CDR) and provide inputs on airworthiness and certification aspects as required.

f. Review and approve specifications of test rigs and Tool Testers Ground Equipment (TTGE)

g. CEMILAC approves the Development and Qualification Test Schedule and specify the test and analysis requirements for clearance of airborne systems and stores.

h. Participate in Test Adequacy Review Board (TARB) and ensure test adequacy.

i. Participate in the evolution of the flight test specifications for flight test demonstration towards Certification.

j. Conduct System Certification Review Board (SCRB) for system clearance, if found necessary.

k. CEMILAC participates in Flight Readiness Review Board (FRRB) and Safety Review Board (SRBs) during design and development.

l. CEMILAC witnesses where necessary, ground tests and verify adequacy of loading and testing conditions. Where loading and testing are inadequate, CEMILAC shall advise the contractor for revision of testing to the appropriate loading and test conditions.

m. CEMILAC analyses ground test results/flight results and examines adequacy. Additional tests should be called for where necessary. CEMILAC shall attend the debriefing meeting where necessary.

n. Issue Flight Clearance Certificate (FCC)and approve Flight Program Clearance Memo (FPCM) for day-to-day flight testing of ab-initio Air System.

o. Facilitate private industry participation in-line with the Make-In-India Policy of the Govt, CEMILAC issues Type Approval, Indian Military Aviation Technical Standard Order Approval (IMATSOA), Letter of Approval (LoA) for the Airborne Stores even if there is no EOI/ LOI/ PO.

p. CEMILAC issues Military Type Certificate, Restricted Military Type Certificate, Amended Military Type Certificate, Supplemental Military Type Certificate (MTC/ RMTC/AMTC/SMTC) to the Air System

q. CEMILAC advices Service Head Quarters on the suitability of induction of Air System/Airborne Stores , ab-initio, bought out and licence produced from compliance to airworthiness certification norms.

r. CEMILAC shall approve of Standard of Preparation (SOP) for the air system/ Airborne Store.

s. CEMILAC shall define periodically the standard for production/overhaul aircraft; examine and approve changes to ground and flight test schedules; examine cases from

strength, safety, interchangeability aspects of deviations put up by the contractor/ DGAQA for non-compliance.

t. CEMILAC shall examine and approve all draft SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Service Bulletins, Lifing Policy that are required to be issued for the maintenance of airworthiness standard of aircraft manufactured at the contractor's works.

u. 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, CEMILAC 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.

v. During certain phase of production of Air System/Airborne Stores the Main Contractor 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.

w. CEMILAC is also a signatory for Production Acceptance Flight Test specification.

x. CEMILAC shall be Chairman for Local Type Certification Committee, Local Modification Committee, Local Technical Committee, Local Concession Committee and Lifing Committee.

y. CEMILAC advices the User Service on concessions for non-compliance of modifications, SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Repair Schemes etc.

z. CEMILAC participates and ensures adequacy of investigations on defects/ incidents/ accidents, carried out by the contractor on design aspects.

aa. CEMILAC may depute Visiting Technical Officers to certain firms/organisations to attend to specific assignments regarding type or development clearance of Airborne Stores.

ab. All modifications and upgrades to In-service Air System such as avionics and weapons are design evaluated, tested and approved for fleet modification by CEMILAC

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

ad. CEMILAC provides airworthiness & certification coverage encompassing approval of technical specifications, Qualification Test Procedure, for indigenous substitution of Airborne Stores for issuance of Type Approval.

ae. To facilitate the Make II, Make-in-India Policy of the Govt, CEMILAC accords Design Organisation Approval to Firms, Air System Design Organisation Approval (ASDOA) & Store Design Organisation Approval (SDOA), for Air System and airborne stores.

af. CEMILAC facilitates Mutual Recognition of foreign airworthiness certification Authorities in unilateral, bilateral or multilateral mode for Joint ventures and consortiums on programmes for Indian Military Applications.

ag. CEMILAC in association with Department of Defence Standardisation is responsible for drafting and releasing Joint Standard Specification (JSS) and Joint Standard Guidelines (JSG) for military aviation.

ah. CEMILAC is also responsible to evolve Airworthiness Certification Criteria, and also define & tailor standards as applicable.

ai. CEMILAC, from time to time issues Airworthiness directives, Circulars, Airworthiness Forms and templates and Compendiums of certified products to facilitate wider industrial reach.

aj. To keep abreast with the latest developments in the field of Airworthiness & Certification and non-invasive techniques to meet the current and future needs

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/repaired at various production organisations 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 that all supplies and equipment delivered under the Ministry of Defence contracts / orders, conform to the stipulated requirements, through adequate inspection, testing, quality audits and effective supervisory inspection control over the firm's Quality Assurance organisation, which designate DGAQA as the Inspection Authority. The responsibilities of DGAQA are broadly defined as follows:

i. Exercise control over the Quality Assurance Organisation of the firm and report to Head Quarters 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. DGAQA in-

coordination with contractors/QA evolves Production Acceptance Test (PAT) during Productionisation of Air-borne Stores.

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, it shall be referred to CEMILAC for design aspects. Deviation affecting operational aspects shall be referred to Air/Naval/Army HQrs/CEMILAC for decision.

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

vi. Assist HQ, 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/repaired 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/repaired under the Ministry of Defence contracts MoD contracts/orders, DRDO orders, DPSU orders are accepted and so certified by DGAQA on the Contractors Advice and Inspection Note/Inspection certificates. 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 the Main Contractor

a. Generate detailed design requirements from the top level User requirements, in consultation with User.

b. Prepare Aircraft and System Requirements Specifications.

c. Prepare Technical Specifications for the Systems/ Sub Systems/LRUs to be developed and have them approved by CEMILAC.

d. During the initial development phase, seek clarification from User services to derive detailed design requirements from the PSQR.

e. Evolve TCB/TAB/ACP and QAP in consultation with TAA, as applicable

f. Ensure the Air System/ Airborne Store is designed as per the requirements specified in TCB/TAB

g. Carry out necessary analysis and testing as per method of verification of compliance specified in ACP and provide the analysis / test reports to CEMILAC

h. Conduct regular debriefs / reviews of status of tests and test results to concerned stakeholders (CEMILAC, Program Management, User rep, Flight Test Agency)

i. Seek concessions/ waivers from the User service, should such a necessity arise.

j. Provide clarification to CEMILAC as and when required on design aspects and analysis/ test results.

k. Conduct failure analysis, Defect investigations involving all the stakeholders.

3.3 Responsibilities of User Services

a. User Service to provide user requirements for development of an Air System/ Airborne Store.

b. The User may intimate the standards to be followed for development of the Air System/ Airborne Store, if required.

c. User may participate in program reviews to understand the status of the project, provide user inputs as and when required

d. User to facilitate in obtaining the tail number for an ab-initio Air System

e. User shall carry out User Evaluation Trials (Operational and Maintenance Evaluation) before accepting the Air System/ Airborne Store

f. User Services to provide the task directive for any major modification or upgrades to an in-service Air System

g. User Services to allot the Air System /tail numbers for modification and upgrades.

3.4 Responsibilities of Flight Test Agency

a. Participate in design reviews and provide inputs regarding flight testing whenever required.

b. Be a part of the team evolving the flight test specification.

c. Evolve flight test plans and flight test schedule in accordance with the flight test specification.

d. Seek necessary clearances from the competent authorities for air space clearance.

e. Ensure that flight tests are conducted within the operating limits and flight envelope limits cleared by CEMILAC in the FCC.

f. Participate in detailed flight data analysis

g. Ensure that crew undertaking flight tests are qualified.

h. Facilitate in preparation of the flight test/trial report wherever applicable.

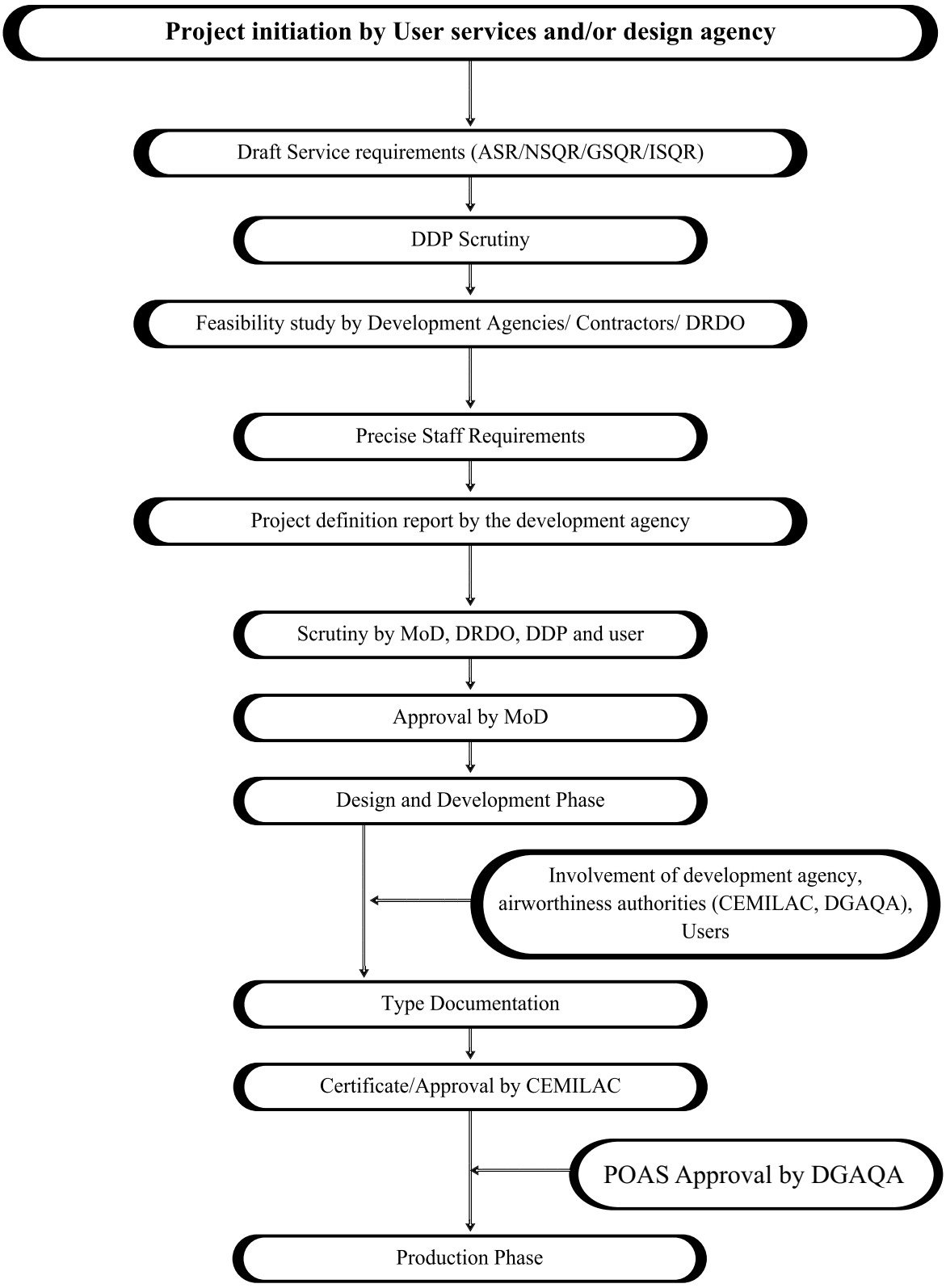


Figure A.1 Procedure for Project initiation & development

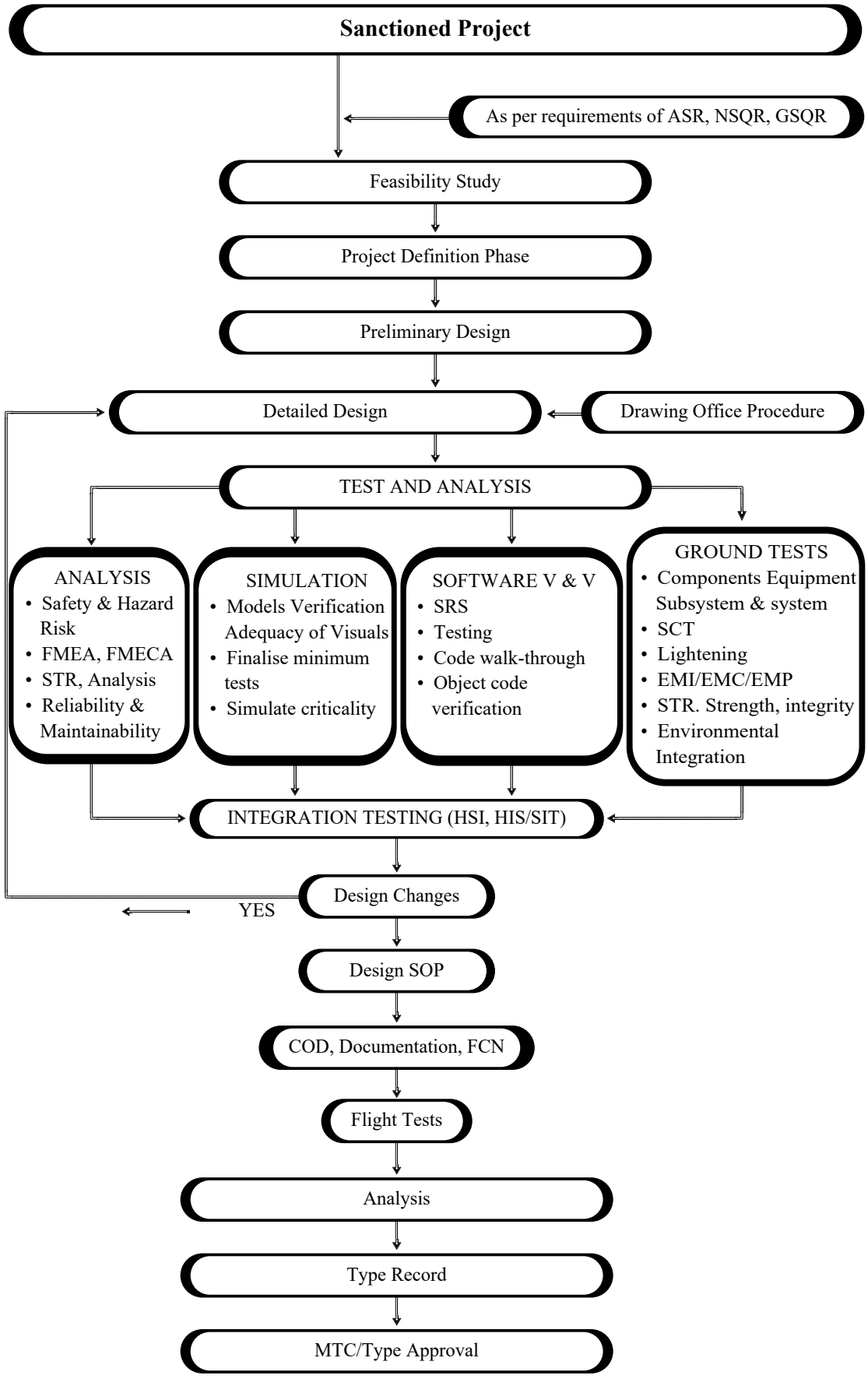


Figure A.2 Procedure for Ab-initio development

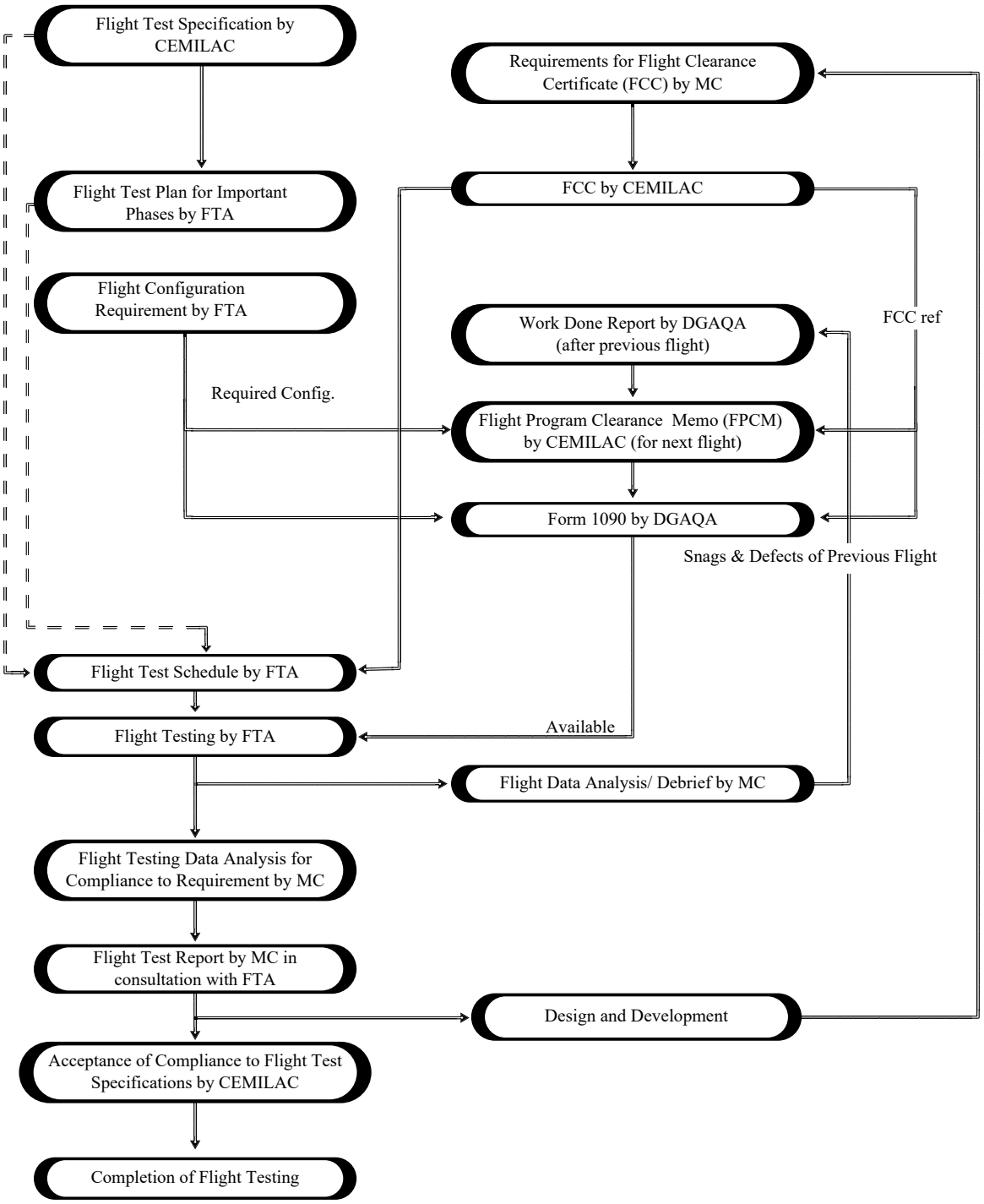


Fig A.3 Ab Initio Fight Test Process

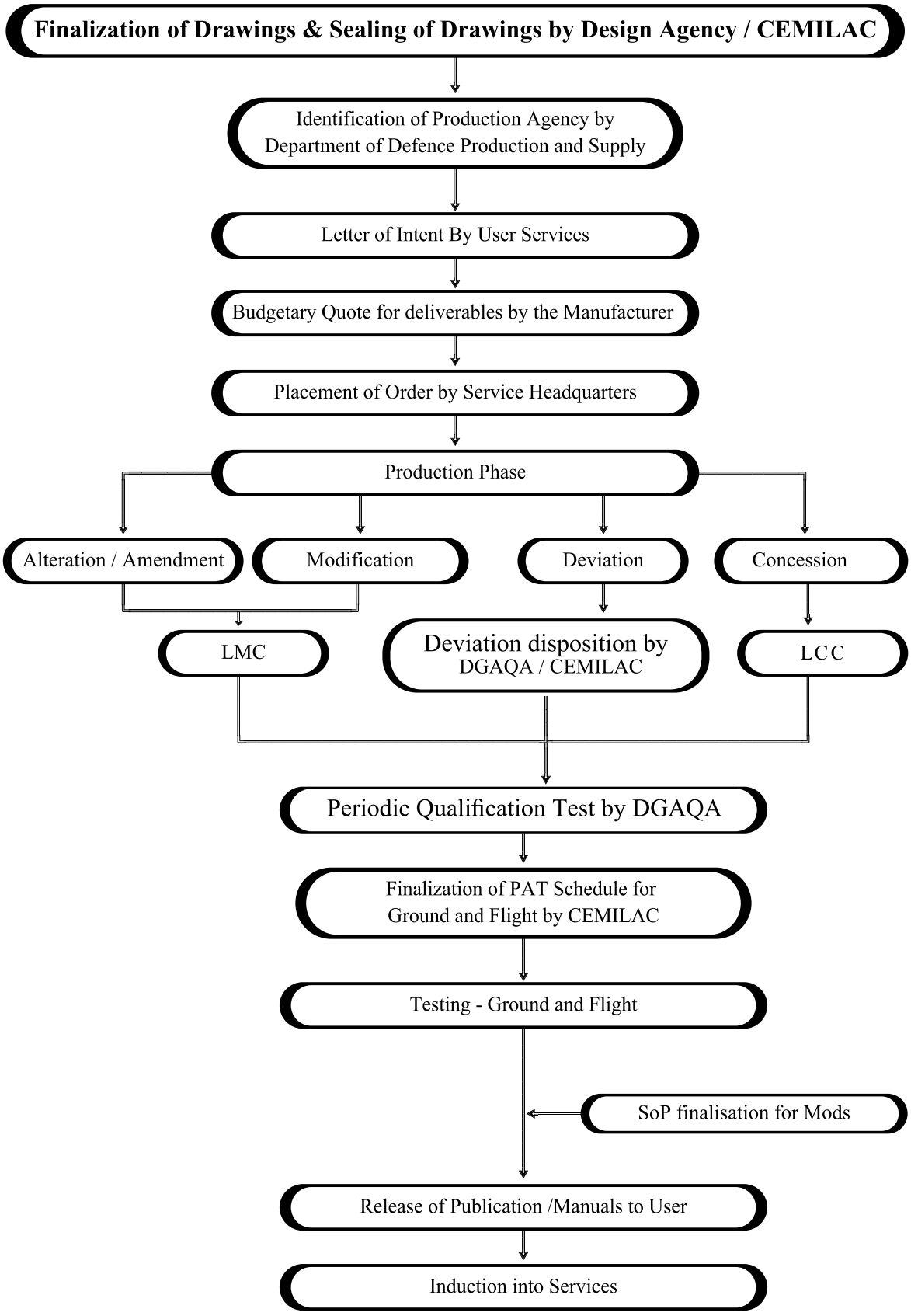


Figure A.4 Procedure for Production phase

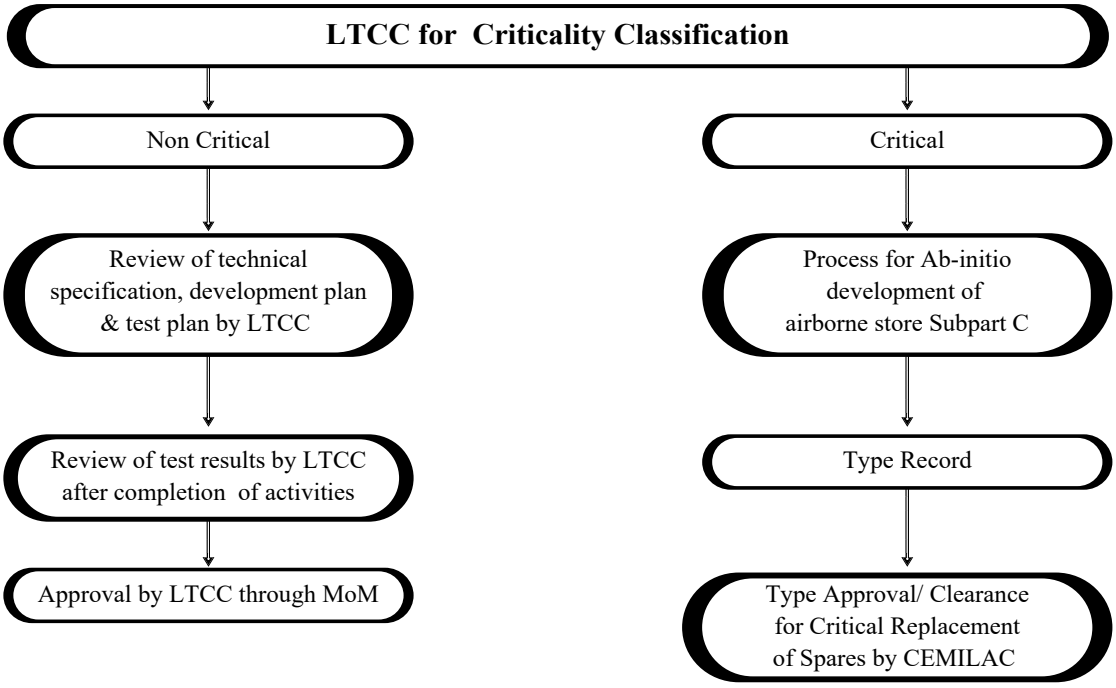


Figure A.5 Procedure for Indigenous Substitution

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

RATIONALE

Air System includes Piloted Aircraft (Fixed Wing-Rotary Wing), Unmanned Air System (UAS), Air Launched Missile (ALM) and Aero 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 for the User Services.

On completion of design, development and evaluation of Air System and upon showing compliance with the type 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 Air Systems are covered under Subpart B1.

   ii. Ab-initio development of Unmanned Air System (UAS). The regulations for such Air Systems are covered Subpart B2.

   iii. Ab-initio development of Air Launched Missile (ALM). The regulations for such Air Systems are covered Subpart B3.

   iv. Ab-initio development of Aero Engines. The regulations for such Air Systems are covered Subpart 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 are developed as Technology Demonstrators, which may have future potential applications with Indian Military Services, the development shall be as per the regulations given in Subpart I, Research Air Systems.

CONTENTS

SUBPART B
AB-INITIO DEVELOPMENT OF
AIR SYSTEM LEADING TO RMTC/MTC AND PRODUCTION ---------- B-1

SUBPART B1
AB-INITIO DEVELOPMENT OF AIRCRAFT ----------B1-1

SUBPART B2
AB-INITIO DEVELOPMENT OF UNMANNED
AIRCRAFT SYSTEMS (UAS) ----------B2-1

SUBPART B3
AB-INITIO DEVELOPMENT OF
AIR LAUNCHED MISSILES (ALM) ----------B3-1

SUBPART B4
AB-INITIO DEVELOPMENT OF AERO ENGINES ----------B4-1

Intentionally Left Blank

SUBPART 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 and airworthiness requirements.

Intentionally Left Blank

CONTENTS

21.B1.1	**Applicability**	**B1-5**
21.B1.2	**User Requirements**	**B1-5**
21.B1.3	**Certification of Ab-initio Developed Aircraft for Indian Military Applications**	**B1-6**
21.B1.4	**Application for Airworthiness Certification of Aircraft**	**B1-6**
21.B1.5	**Demonstration of Air System Design Organisation (ASDO) Capability**	**B1-7**
21.B1.6	**Airworthiness Certification Criteria/Special Conditions**	**B1-7**
21.B1.7	**Aircraft Requirement Specifications**	**B1-8**
21.B1.8	**Type Certification Basis (TCB)**	**B1-9**
21.B1.9	**Criticality Classification**	**B1-10**
21.B1.10	**Airworthiness Certification Plan (ACP)**	**B1-10**
21.B1.11	**Quality Assurance Plan (QAP)**	**B1-11**
21.B1.12	**Identification**	**B1-12**
21.B1.13	**Design & Development**	**B1-12**
21.B1.14	**Configuration Management**	**B1-14**
21.B1.15	**Test Rigs/Equipment**	**B1-15**
21.B1.16	**Test and Evaluation**	**B1-16**
21.B1.17	**Deviations**	**B1-17**
21.B1.18	**Flight Tests**	**B1-18**
21.B1.19	**Compliance with Type Certification Basis (TCB)**	**B1-19**
21.B1.20	**Issue of Restricted Military Type Certificate (RMTC)/IOC**	**B1-19**
21.B1.21	**Issue of Military Type Certificate (MTC)/FOC**	**B1-20**
21.B1.22	**Issue of Release to Service Document (RSD) Along with Manuals**	**B1-21**
21.B1.23	**Production**	**B1-21**
21.B1.24	**Changes Requiring SMTC/AMTC/New MTC**	**B1-22**
21.B1.25	**Responsibilities of MTC Holder**	**B1-22**
21.B1.26	**Transferability**	**B1-23**
21.B1.27	**Duration and Continued Validity**	**B1-25**
21.B1.28	**Record Keeping**	**B1-26**
21.B1.29	**Instructions for Sustaining Type Airworthiness**	**B1-26**

Intentionally Left Blank

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 User requirements by an Indian agency for military applications.

ACCEPTABLE MEANS OF COMPLIANCE

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

GUIDANCE MATERIAL

a. This regulation does not cover lighter than Air Vehicles.

b. This regulation is not applicable for Aircraft developed by a Foreign Agency.

c. This regulation can also be applied in the case of ab-initio developed aircraft by an Indian vendor for export purpose.

d. This regulation is not applicable for research aircraft as the 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 ASR/NSQR/GSQR/ICGSQR/JSQR/PSQR 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 ASR/NSQR/GSQR/ICGSQR/JSQR/PSQR 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 Applications

Regulation

Ab-initio designed and developed military aircraft by an 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 issuance of MTC by CEMILAC.

b. Certification shall follow the regulations 21.B1.4 to 21. B1.29

Guidance Material

Nil

21.B1.4 Application for Airworthiness Certification of Aircraft

Regulation

Main Contractor shall apply to TAA for the airworthiness certification of 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 organisation 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 Air System Design Organisation (ASDO) Capability

Regulation

The organisation responsible for the design of the aircraft shall demonstrate its capability by holding an appropriate Air System Design Organisation (ASDO) 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 to Subpart G1.

   i. In case the organisation is in the process of obtaining the approvals from CEMILAC, the evidence in this regard needs to be submitted.

Guidance Material

Refer Subpart G1

21.B1.6 Airworthiness Certification Criteria/Special Conditions

Regulation

The ASDO shall ensure that the aircraft is designed & developed based on the approved Airworthiness Certification Criteria and the Special Conditions identified & agreed, if any.

Acceptable Means of Compliance

a. Airworthiness Certification Criteria as per the User 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 the User Services and CEMILAC.

c. Formal approval should be sought from the User Services and 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. Equivalent 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 Requirement Specifications

Regulation

The Main Contractor shall bring out the top level Aircraft Requirement Specifications in consultation with the User.

Acceptable Means of Compliance

Aircraft Requirement 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. Main Contractor should have obtained User concurrence for the specification document.

GUIDANCE MATERIAL

a. Service qualitative requirements from User Services.

b. Relevant information from the CONOPS document that impacts design and certification may be shared by the User Service on a need-to-know basis.

c. Main Contractor's preliminary investigations/studies defining the project.

d. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the User requirements.

e. The document shall pave way for defining the detailed individual subsystem Technical Specification to facilitate design.

f. Compliance to the Aircraft Requirement Specification shall also form one of the bases for the issuance of MTC.

21 B1.8 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 User Requirements, Airworthiness Certification Criteria (21.B1.6) and Aircraft Requirement Specification (21.B1.7).

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 stakeholders to look into the adequacy of the proposed TCB.

21.B1.9 CRITICALITY CLASSIFICATION

REGULATION

Criticality classification of all Airborne Stores and sub-systems used in the Aircraft under development shall be carried out.

ACCEPTABLE MEANS OF COMPLIANCE

a. System Safety Assessment (SSA) shall be carried out at the Aircraft level to identify the criticality level of various Airborne Stores and sub-systems used in the Aircraft under development based upon their functional importance. The criticality level shall be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of the airborne store / subsystem / LRU endangers the safety of the aircraft or crew.

   ii. Mission Critical: The failure of the airborne store / subsystem / LRU results in aborting the aircraft mission.

   iii. Non-Critical: The failure of the airborne store / subsystem / LRU does not endanger the safety of the aircraft and crew and does not result in aborting the mission.

b. A Criticality Classification Document containing the criticality level details of all the airborne stores shall be finalised by the Main Contractor in consultation with User Services and TAA.

c. For Non-Critical Airborne Store, TAA shall enable self-approvals during Test & Evaluation phase so as to minimize stage-gated approvals to enhance process efficiency and accelerate D & D timelines.

d. Provisions related to airworthiness certification and quality assurance of non-critical airborne stores shall be identified during the initial stages itself and included in ACP and QAP respectively.

GUIDANCE MATERIAL

NIL

21.B1.10 AIRWORTHINESS CERTIFICATION PLAN (ACP)

REGULATION

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

ACCEPTABLE MEANS OF COMPLIANCE

Main Contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stakeholders. 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, 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 design & 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 organisations.

c. ACP may consider the nature of the project like criticality & complexity, roles of all the stakeholders, development and test & evaluation process, maturity of ASDO etc.

21.B1.11 QUALITY ASSURANCE PLAN (QAP)

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 stakeholders. This 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. However, 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 organisations.

21.B1.12 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.B1.13 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 which shall elaborate the design and development life cycle activities, responsibilities and milestones.

b. ASDO shall evolve various other plan documents such as System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP) etc.,

c. Review Process: ASDO shall carry out various reviews such as Requirement Review, Design Reviews, Test Adequacy & Readiness Review, Compliance Reviews etc. at appropriate stages.

d. ASDO shall prepare documents related to Reviews, Design, Analysis, Simulation and Quality Assurance etc.,

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.B1.14)

g. The design shall be considered to be adequate for prototype realisation as marked by baselining the Drawings and Equipment Standard of Preparation (ESOP).

h. Main Contractor shall ensure with the involvement of TAA that no feature or characteristics of the SOP for prototype realization is untested or unsafe.

i. Fabrication of prototype shall be carried out under a DGAQA approved Quality Assurance Process.

GUIDANCE MATERIAL

a. The design & development plan shall be in accordance with 21.B1.8 to 21.B1.12 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 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 15 days 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.

k. Service HQ may be involved concurrently in the development for facilitating in programme development.

21.B1.14 Configuration Management

Regulation

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

Acceptable Means of Compliance:

a. Main Contractor shall prepare a Configuration Management Plan (CMP) document.

b. 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 design & development.

Guidance Material

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 (CCBs) 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 shall have 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 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 be 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 has to make a configuration management plan to fulfil the objectives of configuration management through Configuration Control Board.

21.B1.15 TEST RIGS/EQUIPMENT

REGULATION

The Main Contractor shall ensure availability of test rigs/test equipment, approved by the competent authorities, and are capable of performing the intended testing and evaluation all through the aircraft development life cycle.

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 outlined 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 upto date, wherever applicable and these are also periodically maintained.

GUIDANCE MATERIAL

Refer Subpart T and Subpart C6

21.B1.16 TEST AND EVALUATION

REGULATION

All equipment, systems and their integration on the platform shall be test evaluated for its design and airworthiness requirements.

ACCEPTABLE MEANS OF COMPLIANCE

a. Test rigs to be certified as per 21.B1.15.

b. Test plan/Test schedule document at LRU level, system level and at aircraft integration level to be prepared by the Main Contractor and approved by CEMILAC.

c. The Main Contractor may constitute the Test Adequacy Review Boards (TARBs) in consultation with CEMILAC, wherever needed for major systems / subsystems, with the involvement of domain experts to review the adequacy of the testing proposed.

d. Self-approvals of test plan and procedures shall be enabled by CEMILAC for Non-Critical airborne stores and associated test rigs and TTGEs subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

e. Tests have to be witnessed by DGAQA or the QA of the Main Contractor, upon delegation by DGAQA.

f. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne stores and associated test rigs and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements

g. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

h. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for vendor / sub-contractors.

i. Test reports have to be prepared by the Main Contractor duly signed by DGAQA and submitted to CEMILAC.

j. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

k. Along with all the test reports, a Certificate of Design (CoD) duly signed by the Chief of Design shall be provided to CEMILAC for issuing clearances for undertaking developmental flight trials of prototype Air Systems.

Guidance Material

a. LRU qualification to be in-line with the environmental mapping of the platform and applicable airworthiness codes as per the TCB.

b. Test schedule of systems/ system on systems to capture both normal and failure mode of testing and presented with the pass-fail criteria.

21.B1.17 Deviations

Regulation

The Main Contractor shall ensure that a systematic process to handle deviations/non-conformances/defects during all the life cycle phases of aircraft development program is in place.

Acceptable Means of Compliance

a. A defined process shall be in place at Main Contractor to handle the deviations arising during design and development of an aircraft.

b. 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 extent possible.

c. The deviations in D&D shall be put by the QA of the Main Contractor to DGAQA through applicable format for disposal.

d. DGAQA may refer to CEMILAC for design aspects. Depending on the impact of the deviation, CEMILAC may refer to NCRB. NCRB shall consists of TAA, domain experts, design representatives and co-opted members. The recommendation of NCRB shall be the basis for deviation disposition by CEMILAC.

e. Deviations resulting in unsafe operation of aircraft shall not be accepted and it must be mitigated through design improvements.

f. The deviations which are not possible to be mitigated through design improvements but not resulting in unsafe conditions shall be listed and indexed as concessions or waivers w.r.t User requirements by Main Contractor with User concurrence.

g. Concessions shall have PDC for their mitigation as design improvements post issuance of RMTC with the concurrence of User.

h. Waivers shall be obtained by Main Contractor from User for those deviations, which are not possible to mitigate as design improvements in the present configuration of aircraft.

GUIDANCE MATERIAL

Nil

21.B1.18 FLIGHT TESTS

REGULATION

Aircraft shall be flight tested for design validation, airworthiness and User requirements to facilitate compliance to Type Certification Basis.

ACCEPTABLE MEANS OF COMPLIANCE

a. Emphasis shall be given to validate the maximum possible certification 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 flight testing agency of the User Services mapped to flight test specification for compliance to TCB.

d. Flight testing shall be conducted as per Subpart P.

GUIDANCE MATERIAL

Nil

21.B1.19 Compliance with Type Certification Basis (TCB)

Regulation

After successful completion of all the phases of aircraft development program, the Main Contractor shall prepare compliance to requirements listed in TCB.

Acceptable Means of Compliance

a. TCB shall be complied based on the agreed means of compliance mentioned in the document.

b. Main Contractor shall take concurrence from the User Services for the compliance of User aspects in TCB.

c. Flight test points shall be evolved by the flight testing department of Main Contractor or flight testing agency of the User Services mapped to User requirements for compliance to Flight Test Specification.

Guidance Material

Nil

21.B1.20 Issue of Restricted Military Type Certificate (RMTC)/IOC

Regulation

RMTC/IOC for the aircraft shall be issued by CEMILAC to the 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 and Air System Type Record 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 for issuance of RMTC/IOC & TCDS.

d. CEMILAC shall issue the RMTC/IOC for the aircraft stating limitations if any, based on satisfactory compliance to TCB.

e. The Main Contractor or the identified production agency shall obtain Production Organisation Approval (POA) from DGAQA as per Subpart G2 to initiate regular production.

GUIDANCE MATERIAL

Nil

21.B1.21 ISSUE OF MILITARY TYPE CERTIFICATE (MTC)/FOC

REGULATION

MTC/FOC for the aircraft shall be issued by CEMILAC to the Main Contractor after ensuring compliance to TCB and User requirements.

ACCEPTABLE MEANS OF COMPLIANCE

a. Main Contractor shall submit compliance to TCB and Air System Type Record to CEMILAC after obtaining User concurrence.

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 for issuance of MTC/FOC & TCDS.

d. CEMILAC, after verifying compliance to TCB, shall issue MTC/FOC for the aircraft stating limitations if any, to the Main Contractor.

e. The Main Contractor or the identified production agency shall obtain production organisation approval from DGAQA as per Subpart G2 to initiate regular production. In case production has already been initiated based on RMTC, the same can be continued further as per the approved revised build standard.

GUIDANCE MATERIAL

NIL

21.B1.22 Issue of Release to Service Document (RSD) Along with Manuals

Regulation

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. Build Standard, Configurations, Envelopes, aircraft operating limitation as agreed with CEMILAC and concessions & waivers as agreed with Users shall be submitted by Main Contractor for issuance of RSD to User Services.

c. Manuals shall be classified into flight publication and technical publication.

d. Flight publication shall be prepared by Main Contractor in consultation with design team and flight test agency and submitted to CEMILAC for approval. The same shall be released to all the stakeholders after CEMILAC approval.

e. 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.

f. CEMILAC shall not approve the technical publications.

Guidance Material

Technical publications include maintenance manuals, servicing manuals, overhaul schedules, repair manuals, etc.

21.B1.23 Production

Regulation

The MTC/RMTC holder or identified production organisation shall carry out production under the DGAQA approved quality management process.

Acceptable Means of Compliance

The MTC/RMTC holder or identified production organisation shall have production organisation approval from DGAQA as per Subpart G2 before taking up production of the type certified aircraft as per Subpart F.

Guidance Material

a. MTC/RMTC is a design-cum-production certificate. Hence MTC/RMTC holder can take up production of aircraft after obtaining production organisation approval.

b. In case the MTC/RMTC holder wants to take up production through production partner, then the MTC/RMTC holder may enter into a licensed production agreement.

21.B1.24 Changes Requiring SMTC/AMTC/New MTC

Regulation

a. Changes proposed to an already type certified aircraft shall be analysed and approved in the form of issue of Supplemental Military Type Certificate (SMTC) or Amended Military Type Certificate (AMTC) to the existing MTC.

b. Major changes in the type certified aircraft 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 Supplemental 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 aircraft shall require recertification programme as per the regulations given in this Subpart B1.

Guidance Material

Changes may be required in the design to due to production requirements, new User requirements, improvements in design or to address limitations. Such changes may be put up through the Local Modification Committee (LMC).

21.B1.25 Responsibilities of 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 issues of the aircraft 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.B1.26 TRANSFERABILITY

REGULATION

The transfer of Military Type Certificate, including RMTC, shall be made only to an organisation having requisite infrastructure (ASDO approved) 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 MTC holder can only transfer the MTC with the approval of CEMILAC.

GUIDANCE MATERIAL

The following is not considered transfer:

a. The TC holder changing its name.

b. Changes to the Registered Address or Relocating their facility (i.e., Works).

c. The acquisition of the TC holder by another company if the acquired company (i.e. TC Holder) continues to exist as the same legal entity to which the TC was issued, provided.

i. The acquired company (TC Holder) continues to retains possession of the Design documents, Type Records and the responsibilities under the original TC.

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, CEMILAC rep 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 Type Certificate (TC) Holder's name

In case of Change of name, the TC 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 Registrar of Companies (RoC) with 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.

C. 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:

i. 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.

ii. 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) CEMILAC is not cognizant of the extent of transfer of knowledge/responsibility.

iii. Under the above conditions, the following are the options

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.

B. If the above is not done, the MTC is automatically cancelled. The acquirer/new company needs to reapply for the TC.

21.B1.27 Duration and Continued Validity

Regulation

RMTC subject to any constraints, shall remain valid for a period not exceeding 5 years; MTC shall remain valid for a period not exceeding 10 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 MTC and RSD.

b. CEMILAC shall suspend or revoke a Military Type Certificate/RSD if the MTC holder has not met the responsibility as given in 21.B1.25 and 21.B1.29 or if the aircraft in service have not been able to meet the safety and operational requirements.

c. The MTC holder shall apply to CEMILAC for the renewal of MTC six months prior to the expiry of the Certificate.

Guidance Material

a. CEMILAC may consider suspending or revoking a RMTC/MTC when the RMTC/ MTC holder or the licensed manufacturer does 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 the RSD.

21.B1.28 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 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 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.

21.B1.29 Instructions for Sustaining Type Airworthiness

Regulation

The Main Contractor shall ensure that the complete set of regularly updated Instructions for Sustaining Type Airworthiness (ISTA) are provided to the User Services.

Acceptable Means of Compliance

a. The MTC holder shall update the TCDS and disseminate the information to TAA, Users and the other relevant stakeholders.

b. The MTC holder shall apply to CEMILAC for update of the RSD and disseminate the RSD updated by CEMILAC to Users, TAA and other relevant stakeholders.

Guidance Material

a. Changes may be required in the TCDS 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 done to all the stakeholders by the Main Contractor after obtaining the necessary approval from TAA.

b. Changes may be required during continued and continuing airworthiness like issue of Service Instructions, Special Technical Instructions, service bulletins, UON etc. which need to be forwarded to all the stakeholders.

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

RATIONALE

It is necessary that the design and development of UAS leading to Military Type Certificate (MTC) shall meet the appropriate airworthiness requirements. A systematic certification process is required to ensure the UAS is safe for operation and that the design does not pose any hazard to other Users of the airspace or personnel and property in ground. The award of MTC demonstrates that the UAS has met the Type Design and safety requirements. In the context of this Subpart UAS includes both the Air Vehicle and the Ground Segment.

Intentionally Left Blank

CONTENTS

21.B2.1	Categorisation	B2-5
21.B2.2	Applicability	B2-5
21.B2.3	User Requirements	B2-6
21.B2.4	Certification of Ab-initio Developed UAS for Indian Military Application	B2-6
21.B2.5	Application for Airworthiness Certification of UAS	B2-7
21.B2.6	Demonstration of Air System Design Organisation (ASDO) Capability	B2-7
21.B2.7	Criticality Classification	B2-8
21.B2.8	Airworthiness Certification Criteria/Special Conditions	B2-9
21.B2.9	UAS Requirement Specifications	B2-10
21.B2.10	Type Certification Basis (TCB)	B2-10
21.B2.11	Airworthiness Certification Plan (ACP)	B2-11
21.B2.12	Quality Assurance Plan (QAP)	B2-12
21.B2.13	Identification	B2-12
21.B2.14	Design & Development	B2-13
21.B2.15	Configuration Management	B2-14
21.B2.16	Test Rigs/Equipment	B2-16
21.B2.17	Test and Evaluation	B2-16
21.B2.18	Deviations	B2-18
21.B2.19	Flight Tests	B2-19
21.B2.20	Compliance with Type Certification Basis	B2-19
21.B2.21	Issue of Restricted Military Type Certificate (RMTC)/IOC	B2-20
21.B2.22	Issue of Military Type Certificate (MTC)/FOC	B2-20
21.B2.23	Issue of Release to Service Document (RSD) along with Manuals	B2-21
21.B2.24	Production	B2-22
21.B2.25	Changes Requiring SMTC/AMTC/New MTC	B2-22
21.B2.26	Responsibilities of MTC Holder	B2-23
21.B2.27	Transferability	B2-23
21.B2.28	Duration and Continued Validity	B2-25
21.B2.29	Record Keeping	B2-26
21.B2.30	Instructions for Sustaining Type Airworthiness	B2-26
21.B2.31	Ground Segment	B2-27

Intentionally Left Blank

21.B2.1 CATEGORISATION

REGULATION

Main Contractor shall declare the category of the UAS to TAA.

ACCEPTABLE MEANS OF COMPLIANCE

a. Declaration of the UAS Category by the Main Contractor shall be based on guidelines given in Annexure 21.B2.A.

b. The applicable proportional regulatory regime shall be as per Table 21.B2.1 of Annexure 21.B2. A for declared category of the UAS.

GUIDANCE MATERIAL

NIL

21.B2.2 APPLICABILITY

REGULATION

The regulation brought in this Subpart is applicable to ab-initio development of Large UAS (Fixed wing and Rotary wing or any hybrid) categorized & certification mandated as per 21.B2.1 by an Indian agency for military applications. All category of recoverable UAS which are weaponised will undergo additional certification for integration of the munition as per Subpart C2 or Subpart B3.

ACCEPTABLE MEANS OF COMPLIANCE

a. The regulations mentioned in Subpart B2 are to be compiled for the issuance of MTC for the ab-initio developed Large Category UAS.

b. UAS other than large category shall meet the airworthiness criteria mentioned in Drone Rules 2021 of MoCA and Certification Scheme for Unmanned Aircraft Systems of Quality Council of India (QCI) tailored suitably to include Military / User requirements.

c. If required specifically by the User services, involvement of TAA in some cases of small and medium UAS can also be there provided the requirement for the same is identified during the initial stages of acquisition/procurement itself & included in the RFP.

GUIDANCE MATERIAL

a. Refer Annexure 21.B2.A.

b. All UAS warrant airworthiness certification. Certification by TAA is limited to Large UAS, following the categorisation and its certification mandate as per Annexure 21.B2.A.

c. The Drone Rules 2021 of MoCA and Certification Scheme for Unmanned Aircraft Systems of Quality Council of India (QCI) published by MoCA.

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 ASR/NSQR/GSQR/ICGSQR/JSQR/PSQR released by Indian military services.

b. Specific requirements by Main Contractor for Indian military applications.

Guidance Material

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

b. Based on the feasibility study and related additional inputs, the User Services may release specific qualitative requirements such as ASR/NSQR/GSQR/ICGSQR/JSQR/PSQR.

c. Main Contractor may take inputs from the Services for finalising specific requirements of the UAS.

21.B2.4 Certification of Ab-initio Developed Large UAS / Weaponized UAS For Indian Military Application

Regulation

Ab-initio designed and developed military Large category/Weaponized UAS by an Indian agency shall be Military Type Certified by TAA.

Acceptable Means of Compliance

a. Airworthiness certification of ab-initio designed and developed Large category UAS shall be carried out with the involvement of TAA leading to issuance of MTC by CEMILAC.

b. Certification shall follow the regulations 21.B2.5 to 21.B2.31.

Guidance Material

Airworthiness certification is for both the air segment i.e the UAV as well as the ground segment i.e the Ground Operating System (GOS) and Ground Support System components 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.B2.1 shall apply to TAA for the airworthiness certification of Large Category UAS / Weaponized 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 organisation 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 Main Contractor for QA coverage during the development.

21.B2.6 Demonstration of Air System Design Organisation (ASDO) Capability

Regulation

Main Contractor responsible for the design of the UAS shall hold an Air System Design Organisation (ASDO) Approval from CEMILAC based on the Design Organisation Approval Scheme (DOAS) or in the process of applying for such an approval.

ACCEPTABLE MEANS OF COMPLIANCE

a. Design Organisation Approval from CEMILAC in compliance to 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.

GUIDANCE MATERIAL

Refer Subpart G1.

21.B2.7 CRITICALLY CLASSIFICATION

REGULATION

Criticality classification of Airborne Stores and sub-systems used in the Unmanned Air System under development shall be carried out.

ACCEPTABLE MEANS OF COMPLIANCE

a. System Safety Assessment (SSA) shall be carried out at the UAS level to identify the criticality level of various Airborne Stores and sub-systems used in the UAS under development based upon their functional importance. The criticality level can be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of the airborne store / subsystem / LRU endangers the safety of the of the UAS, operating crew or ground crew.

   ii. Mission Critical: The failure of the airborne store / subsystem / LRU results in aborting the UAS mission.

   iii. Non Critical: The failure of the airborne store / subsystem / LRU does not endanger the safety of the UAS and crew and does not result in aborting the mission.

b. A Criticality Classification Document containing the criticality level details of all the airborne stores shall be finalised by the Main Contractor in consultation with User Services and TAA.

c. For Non-Critical Airborne Store and corresponding GOS element, TAA shall enable self-approvals during Test & Evaluation phase so as to minimize stage-gated approvals to enhance process efficiency and accelerate D & D timelines.

d. Provisions related to airworthiness certification and quality assurance of non-critical airborne store shall be identified during the initial stages itself and included in ACP and QAP respectively.

GUIDANCE MATERIAL

NIL.

21.B2.8 AIRWORTHINESS CERTIFICATION CRITERIA/SPECIAL CONDITIONS

REGULATION

Main Contractor shall ensure that the Large Category UAS is designed & developed based on approved Airworthiness Certification Criteria and the special conditions identified and agreed.

ACCEPTABLE MEANS OF COMPLIANCE

a. Airworthiness Certification Criteria as per the User 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 the User Services and CEMILAC.

c. Formal approval should be sought from the User Services and CEMILAC for the use of alternative standards.

GUIDANCE MATERIAL

a. Alternative standards may be proposed by Main Contractor. However, these need to meet an acceptable level of safety and are consistent with the intent of the benchmark requirements.

b. Equivalent 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, 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.B2.9 UAS Requirement Specifications

Regulation

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

Acceptable Means of Compliance

a. UAS Requirement Specification document to be made by Main Contractor in consultation with the User Services 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. Relevant information from the CONOPS document that impacts design and certification may be shared by the User Service on a need-to-know basis.

c. Main Contractor's preliminary investigations/studies defining the project.

d. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the User requirements.

e. The document shall pave way for defining the detailed individual subsystem technical specification to facilitate design.

f. Compliance to the UAS Requirement Specification shall also form the basis for the issuance of MTC.

21.B2.10 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 User Requirements, Airworthiness Certification Criteria/Special Conditions (21.B2.8) and UAS Requirement Specification (21.B2.9).

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 stakeholders 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.B2.11 Airworthiness Certification Plan (ACP)

Regulation

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

Acceptable Means of Compliance:

Main Contractor shall prepare an Airworthiness Certification Plan (ACP) with the involvement of all stakeholders. 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 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 organisations.

c. ACP may consider the nature of the project like criticality & complexity, roles of all the stakeholders, development, test & evaluation process, maturity of the ASDO etc.,

21.B2.12 Quality Assurance Plan (QAP)

Regulation

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 stakeholders. This QAP shall be approved by DGAQA.

b. The QAP shall clearly state the roles of the Quality Assurance department of 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. However, 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 organisations.

21.B2.13 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 shall be in accordance with Subpart Q.

Guidance Material

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

21.B2.14 Design & Development

Regulation

Main Contractor shall have a design & development process that results in UAS meeting the User requirements and the Type Certification Basis.

Acceptable Means of Compliance

a. The design and development activities of both the Air vehical & Ground Segment shall follow a System Engineering Life Cycle Process. A System Engineering Plan document shall be prepared which shall elaborate the design and development life cycle activities, responsibilities and milestones.

b. Main Contractor shall evolve other plan documents such as System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP) etc.,

c. Review Process: ASDO shall carry out various reviews such as Requirement Review, Design Reviews, Test Adequacy & Readiness Review, Compliance Reviews etc.,

d. ASDO shall prepare documents related to Reviews, Design, Analysis, Simulation, Quality Assurance etc.,

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. B2.15).

g. The design shall be considered to be adequate for prototype realisation as marked by baselining the Master Drawing Index (MDI) and Equipment Standard of Preparation (ESOP).

h. Main Contractor shall ensure with the involvement of TAA that no feature or characteristics of the SOP for prototype realization is untested or unsafe.

i. Fabrication of prototype shall be carried out under a DGAQA approved Quality Assurance Process.

Guidance Material

a. The design & development plan shall be in accordance with 21.B2.8 to 21.B2.13 above.

b. 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 User requirements, 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 15 days 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 baselining to be established for prototype realisation.

k. Service HQ may be involved concurrently in the development for facilitating in programme development.

21.B2.15 Configuration Management

Regulation

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

ACCEPTABLE MEANS OF COMPLIANCE

a. Main Contractor shall prepare a Configuration Management Plan (CMP) document.

b. 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. Main Contractor shall have a configuration management process during the design and development.

GUIDANCE MATERIAL

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 fulfill the objectives of configuration management through Configuration Control Boards.

21.B2.16 Test Rigs/Equipment

Regulation

Main Contractor shall ensure availability of test rigs/test equipment, approved by the competent authorities, that are capable of performing the intended testing and evaluation all through the UAS development life cycle.

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. Main Contractor shall ensure availability of required test rigs/test equipment including TTGEs at the appropriate stages of design & development phase of UAS as outlined in the approved Airworthiness Certification Plan (ACP).

c. 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. Main Contractor shall ensure that the test rigs/test equipment and TTGEs have their calibration validity upto date, wherever applicable and that these are also periodically maintained.

Guidance Material

Refer Subpart T and Subpart C6

21.B2.17 Test and Evaluation

Regulation

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. Test Rigs to be certified as per 21.B2.16.

b. Test plan/Test schedule document at LRU level, system level and at aircraft integration level to be prepared by the Main Contractor and approved by CEMILAC.

c. The Main Contractor may constitute the Test Adequacy Review Boards (TARBs) in consultation with CEMILAC, wherever needed for major systems / subsystems, with the involvement of domain experts to review the adequacy of the testing proposed.

d. Self-approvals of test plans and procedures shall be enabled by CEMILAC for Non-Critical airborne stores and associated test rigs and TTGEs subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

e. Tests to be witnessed by DGAQA or the QA of Main Contractor, upon delegation by DGAQA.

f. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne stores and associated test rigs and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

g. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

h. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for vendor / sub-contractors.

i. Test reports to be prepared by the Main Contractor duly signed by DGAQA and submitted to CEMILAC.

j. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

k. Along with all the test reports, a Certificate of Design (CoD) duly signed by the Chief of Design shall be provided to CEMILAC for issuing clearances for undertaking developmental flight trials of prototype UAS.

Guidance Material

a. LRU qualification to be in-line with the environmental mapping of the platform and applicable airworthiness codes as per the TCB.

b. Test schedule of systems/ system on systems, to capture both normal and failure mode of testing and presented with the pass-fail criteria.

c. The test equipment and all measuring equipment used for tests are to be adequate for the test and are appropriately calibrated.

d. Test reports to be in accordance with the test plans and to record the configuration of the test items tested. The test report shall be coordinated by DGAQA.

21.B2.18 DEVIATIONS

REGULATION

Main Contractor shall ensure that a systematic process to handle deviations/non-conformances/defects during all the life cycle phases of UAS development program is in place.

ACCEPTABLE MEANS OF COMPLIANCE

a. A defined process shall be in place at Main Contractor to handle the deviations arising during design and development of UAS.

b. All deviations arising from rig/ground/flight testing of UAS shall be listed as design limitations by Main Contractor. These limitations to be mitigated with design improvements to the maximum extent possible.

c. The deviations in D&D shall be put by the QA of the Main Contractor to DGAQA through applicable format for disposal.

d. DGAQA may refer to CEMILAC for design aspects. Depending on the impact of the deviation, CEMILAC may refer to NCRB. NCRB shall consists of TAA, domain experts, design representatives and co-opted members. The recommendation of NCRB shall be the basis for deviation disposition by CEMILAC.

e. Deviations resulting in unsafe operation of UAS shall not be accepted and it must be mitigated through design improvements.

f. The deviations which are not possible to be mitigated through design improvements but not resulting in unsafe conditions shall be listed and indexed as concessions or waivers w.r.t User requirements by Main Contractor with User concurrence.

g. Concessions shall have PDC for their mitigation as design improvements post issuance of RMTC with the concurrence of User.

h. Waivers shall be obtained by Main Contractor from User for those deviations, which are not possible to mitigate as design improvements in the present configuration of UAS.

GUIDANCE MATERIAL

Nil

21.B2.19 Flight Tests

Regulation

Large Category UAS shall be flight tested for design validation, airworthiness and User requirements to facilitate compliance to Type Certification Basis.

Acceptable Means of Compliance

a. Emphasis shall be given to validate the maximum possible certification requirements at dynamic rigs, simulators, test beds etc.

b. Flight testing of UAS 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 Main Contractor or flight testing agency of the User Services mapping to User requirements for compliance to Flight Test Specification.

d. Flight testing shall be conducted as per Subpart P.

Guidance Material

Nil

21.B2.20 Compliance with Type Certification Basis

Regulation

After successful completion of all the phases of Large Category UAS development program, Main Contractor shall prepare compliance to requirements listed in TCB.

Acceptable Means of Compliance

a. TCB shall be complied based on the agreed means of compliance mentioned in the document.

b. Main Contractor shall present the compliance of TCB to CEMILAC for issuance of RMTC or MTC.

Guidance Material

Nil

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

Regulation

RMTC/IOC for the Large Category UAS shall be issued 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 and Air System Type Record, 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. UAS limitations 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 shall issue RMTC/IOC & TCDS for the UAS stating any limitations if any, to the Main Contractor based on satisfactory compliance of TCB.

e. Main Contractor or the identified production agency shall obtain Production Organisation Approval (POA) from DGAQA as per Subpart G2 to initiate regular production.

Guidance Material

Nil

21.B2.22 Issue of Military Type Certificate (MTC)/FOC

Regulation

MTC/FOC for Large Category UAS shall be issued by CEMILAC to Main Contractor after ensuring compliance to TCB and User requirements.

Acceptable Means of Compliance

a. Main Contractor shall submit to CEMILAC the compliance to TCB and Air System Type Record.

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 for issuance of MTC/FOC & TCDS.

d. CEMILAC, after verifying compliance to TCB shall issue MTC/FOC for the UAS stating limitations if any, to the Main Contractor.

e. Main Contractor or the identified production agency shall obtain production organisation approval from DGAQA as per Subpart G2 to initiate regular production. In case production has already been initiated based on RMTC, the same can be continued further as per the approved revised build standard.

GUIDANCE MATERIAL

Nil

21.B2.23 ISSUE OF RELEASE TO SERVICE DOCUMENT (RSD) ALONG WITH MANUALS

REGULATION

Large Category 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. Build Standard, Configurations, Envelopes, UAS operating limitations as agreed with CEMILAC and concessions & waivers as agreed with Users shall be submitted by Main Contractor for issuance of RSD to User Services.

c. Manuals shall be classified into flight publication and technical publication.

d. Flight publication shall be prepared by Main Contractor and submitted to CEMILAC for approval. The same shall be released to all the stake holders after CEMILAC approval.

e. Technical publication shall be prepared by Main Contractor in consultation with the maintenance departments of User Services. Technical Publications shall be released by the Main Contractor to User Services.

f. CEMILAC shall not approve the technical publications.

GUIDANCE MATERIAL

Nil

21.B2.24 PRODUCTION

REGULATION

The MTC/RMTC holder or identified production organisation shall carry out production under the DGAQA approved quality management process.

ACCEPTABLE MEANS OF COMPLIANCE

The MTC/RMTC holder or identified production organisation shall have production organisation approval from DGAQA as per Subpart G2 before taking up production of the type certified UAS as per Subpart F.

GUIDANCE MATERIAL

a. MTC/RMTC is a design-cum-production certificate. Hence MTC holder can take up production of aircraft after obtaining production organisation approval.

b. In case the MTC/RMTC holder wants to take up production through production partner, then the MTC/RMTC holder may enter into licensed production agreement.

21.B2.25 CHANGES REQUIRING SMTC/AMTC/NEW MTC

REGULATION

a. Changes proposed to an already type certified UAS shall be analysed and approved in the form of issue of Supplemental Military Type Certificate (SMTC) or Amended Military Type Certificate (AMTC) to the existing MTC.

b. Major changes in the type certified UAS 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 Supplemental 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 UAS shall require recertification programme as per the regulations given in this Subpart B2.

Guidance Material

Changes may be required in the design to due to production requirements, new User requirements, improvements in design or to address limitations. Such changes may be put up through the Local Modification Committee (LMC).

21.B2.26 Responsibilities of 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.B2.27 Transferability

Regulation

The transfer of Military Type Certificate, including RMTC, shall be made only to an organisation having requisite infrastructure (ASDO Approved) 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 UAS has been withdrawn from Indian service. The TAA issued MTC or RMTC assumes usage within the confines of Main Contractor Regulatory Publications.

b. The MTC holder can only transfer the MTC with the approval of CEMILAC.

Guidance Material

The following is not considered transfer:

a. The TC holder changing its name

b. Changes to the Registered Address or Relocating their facility (i.e., Works).

c. The acquisition of the TC holder by another company if the acquired company (i.e. TC Holder) continues to exist as the same legal entity to which the TC was issued, provided

i. The acquired company (TC Holder) continues to retain possession of the Design documents, Type Records and the responsibilities under the original TC

ii. The acquired company retains the same quality system.

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

A. 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.

B. 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, CEMILAC rep 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.

iv. Case -2 : Change of Type Certificate (TC) Holder name

In case of Change of name, the TC 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.

v. 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.

d. Transferability of Type Certificate

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

i. 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.

ii. 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) CEMILAC is not cognizant of the extent of transfer of knowledge/responsibility.

iii. Under the above conditions, the following are the options

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.

B. If the above is not done, the MTC is automatically cancelled. The acquirer/new company needs to reapply for TC.

21.B2.28 Duration and Continued Validity

Regulation

RMTC subject to any constraints, shall remain valid for a period not exceeding 5 years; a MTC shall remain valid for a period not exceeding 10 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 Military Type Certificate/RSD if the MTC holder has not met the responsibility as given in 21.B2.26 and 21.B2.30 or if the UAS in service have not been able to meet the safety and operational requirements.

c. The MTC holder shall apply to CEMILAC for the renewal of MTC six months prior to the expiry of the Certificate.

Guidance Material

a. CEMILAC may consider suspending or revoking a MTC when the MTC holder or the licensed manufacturer does not meet the obligations during the continued airworthiness activities of the UAS.

b. CEMILAC may obtain from Services the safety record of the UAS at regular intervals. If the operating User Services and the TAA find it necessary, CEMILAC may revoke or suspend a RSD.

21.B2.29 Record Keeping

Regulation

Main Contractor shall ensure that all relevant design information inter-alia documents, drawings, QA records, test procedures, reports, for the identified UAS 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 UAS from Services.

Guidance Material

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

21.B2.30 Instructions for Sustaining Type Airworthiness

Regulation

Main Contractor shall ensure that the complete set of regularly updated Instructions for Sustaining Type Airworthiness (ISTA) are provided to the User Services.

Acceptable Means of Compliance

a. The MTC holder shall update the TCDS and disseminate the information to TAA, Users and the other relevant stakeholders.

b. The MTC holder shall apply to CEMILAC for updating the RSD and disseminate the updated RSD to Users, TAA and other relevant stakeholders.

GUIDANCE MATERIAL

a. 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 done to all the stakeholders by Main Contractor after obtaining the necessary approval from TAA.

b. Changes may be required during continued and continuing airworthiness like issue of service Instructions, Special Technical Instructions, service bulletins, UON etc. which need to be forwarded to all the stakeholders.

21.B2.31 GROUND SEGMENT

REGULATION

Main Contractor shall have design and development process that results in ground segment meeting the user requirements and the Type Certification Basis.

ACCEPTABLE MEANS OF COMPLIANCE

a. The ground segment of UAS may be grouped as the Ground Operating System (GOS) and Ground Support System (GSS).

b. GOS may be further classified into GOS (Primary) & GOS (Secondary). GOS (Primary) consists of datalink and GCS used for controlling the operation of Air Vehicle and the rest of the GOS is classified as GOS (Secondary).

c. Ground Support Systems include all the field level facilities that are required for preparation.

d. GOS (Primary) shall be certified by CEMILAC and GOS (Secondary) shall be certified by DGAQA in accordance with applicable sections of Subpart C.

e. Ground Support Systems shall be certified by DGAQA in accordance with applicable sections of Subpart T2.

f. The Certification aspects and Quality assurance aspects of Ground Segment shall be included in the TCB, ACP and QAP documents prepared as a part of UAS.

GUIDANCE MATERIAL

NIL

ANNEXURE 21.B2.A : 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 classification of UAV is as per international MIL standards and MoCA Drone Rules. The Large category UAV shall be certified by TAA as per complexity/level of autonomy and other certification criteria as per role. UAS other than Large category shall meet the airworthiness criteria mentioned in the Drone Rules of MoCA and Certification Scheme for Unmanned Aircraft Systems of Quality Council of India (QCI). All category of recoverable UAV which are weaponised shall undergo additional certification for integration of the munition.

2.0 UAS Categorisation

Based on the MTOW, UAS are classified as follows:

Category	Weight Class
Small	Upto 25 Kilogram
Medium	Between 25 Kilogram to 150 Kilogram
Large	Greater than 150 Kilogram

3.0 Category of UAS and its Certification Mandate

The following certfiication mandate shall be applicable.

S.No	UAS Categorisation	Regulatory Mandate
1	Small UAS	Design organisation and the procurement agency should ensure that all criteria of certification as mentioned in Certification Scheme for Unmanned Aircraft Systems published by MoCA are met.
2	Medium UAS	Design organisation and the procurement agency should ensure that all criteria of certification as mentioned in Certification Scheme for Unmanned Aircraft Systems published by MoCA are met.
3	Large UAS	Certification by TAA is MANDATORY
4.	Weaponised UAS	Certification by TAA for Weapon integration MANDATORY

Note:

a. All category of recoverable UAS which are weaponised will undergo additional certification for integration of the munition.

IMTAR UAS Category	**Small UAS**	**Medium UAS**	**Large UAS**	**Weaponized UAS**
Registration on the Indian Military Aircraft Register	No	No	Yes	Yes
MTOW	Less than 25 Kg	25 to 150 Kg	Greater than 150 Kg	Any Weight
Categorisation Required	Yes	Yes	Yes	Yes
Trained and Authorised personnel for operations	Yes	Yes	Yes	Yes
FCC by CEMILAC	No	No	Yes	Yes
MTC & Release to Service by CEMILAC	No	No	Yes	Yes
Certificate of Airworthiness by DGAQA	No	No	Yes	Yes
Occurrence Reporting to TAA	No	No	Yes	Yes

Table 21.B2.1 : Proportional Regulatory Regime of UAS

Intentionally Left Blank

SUBPART B3
AB-INITIO DEVELOPMENT OF AIR LAUNCHED MISSILES (ALM)

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.

Intentionally Left Blank

CONTENTS

21.B3.1	Applicability	B3-5
21.B3.2	User Requirements	B3-5
21.B3.3	Feasibility study	B3-6
21.B3.4	Certification of ALM for Indian Military Applications	B3-6
21.B3.5	Application for Airworthiness Certification of ALM	B3-7
21.B3.6	Demonstration of Air System Design Organisation (ASDO) Capability	B3-8
21.B3.7	Airworthiness Certification Criteria/ Special Conditions	B3-8
21.B3.8	ALM Requirement Specifications	B3-9
21.B3.9	Type Certification Basis (TCB)	B3-10
21.B3.10	Criticality Classification	B3-11
21.B3.11	Airworthiness Certification Plan (ACP)	B3-12
21.B3.12	Quality Assurance Plan (QAP)	B3-12
21.B3.13	Identification	B3-13
21.B3.14	Design & Development	B3-13
21.B3.15	Configuration Management	B3-16
21.B3.16	Test Rigs /Test Equipment	B3-18
21.B3.17	Test and Evaluation	B3-18
21.B3.18	Deviations	B3-21
21.B3.19	Flight Tests	B3-22
21.B3.20	Compliance With Type Certification Basis	B3-23
21.B3.21	Application for RMTC/MTC	B3-24
21.B3.22	Issue of Restricted Military Type Certificate (RMTC)/ IOC	B3-24
21.B3.23	Issue of Military Type Certificate (MTC)/FOC	B3-25
21.B3.24	Issue of Release to Service Documents (RSD) Along with Manuals	B3-26
21.B3.25	Production	B3-27
21.B3.26	Changes Requiring SMTC/AMTC/New MTC	B3-27
21.B3.27	Responsibilities of the MTC Holder	B3-28
21.B3.28	Transferability	B3-29
21.B3.29	Duration and Continued Validity	B3-30
21.B3.30	Record Keeping	B3-31
21.B3.31	Instructions for Sustaining Type Airworthiness (ISTA)	B3-31

Intentionally Left Blank

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 applicable to ALMs including non-propulsive guided smart weapon. The air armaments are covered at air-borne stores level as per the regulations given in Subpart C2.

b. These regulations are not applicable for ALM developed by any 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/PSQR released by Indian Military Services.

b. Specific requirements finalized by the Main Contractor for Indian Military applications

c. Relevant Information from the Concepts of operations (CONOPS) document that impacts design and certification provided by the User on a need to know basis.

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 Users Services may release GSQR/ASR/NSQR/ISQR/JSQR/PSQR for a particular ALM.

c. Main Contractor may take inputs from the Users 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-the-art and/or development of new technologies, if any and the associated risk analysis and risk mitigation plans.

b. The feasibility study should be the basis for the Main Contractor 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 issuance of MTC by CEMILAC.

b. Certification shall follow the regulations 21.B3.5 to 21.B3.31.

Guidance Material

a. The system level requirements for the ALMs will follow from the requirements of platform.

b. The approach to development and certification, leading to MTC and the continued airworthiness throughout its life cycle should be set out in beginning of military airworthiness certification process in accordance with the certification criteria adopted. In general, the process has the following 7 phases:

Phase 1 – Identify the requirement for and obtain organisational 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 – Agree to Quality Assurance Plan (QAP)

Phase 6 – CEMILAC review of certification evidences and issue of RMTC/MTC.

Phase 7 – 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 may 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 Users 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 organisational 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 may be accompanied with a request for authorisation of the QA department of the Main Contractor for QA coverage during the design & development phase of non-safety critical (mission critical and non-critical) subsystems/LRUs on

behalf of DGAQA. However, such authorization is not required if AFQMS approval by DGAQA to the Main Contractor exists.

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

Regulation

Main Contractor or the organisation responsible for the design & development of the ALM shall demonstrate its capability by holding an appropriate Air System Design Organisation (ASDO) 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.

Guidance Material

Refer Subpart G1

21.B3.7 Airworthiness Certification Criteria/ Special Conditions

Regulation

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 Users Services requirements shall be used.

b. In cases where the design is not complying to the standards specified by the Users Services or the Users Services have not specified the standards, the same shall be arrived at in consultation with the Users Services and CEMILAC.

c. Formal approval shall be sought from the Users Services and 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. Equivalent 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. As an exception, 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

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 in consultation with the User and approved by CEMILAC.

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

c. The document shall contain broad ALM level environmental specifications based on User requirements.

GUIDANCE MATERIAL

a. Service qualitative requirements from Users Services.

b. Relevant information from the CONOPS document.

c. Main Contractor's preliminary investigations /studies defining the project.

d. The document may specify the proposed configuration of ALM with proposed systems/ subsystems and details of architecture and also top level specifications and interfaces to meet the User requirements.

e. 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 Criticality Classification

Regulation

Criticality classification of sub-systems/ LRUs used in the ALM under development shall be carried out based upon their functional importance.

Acceptable Means of Compliance

a. System Safety Assessment (SSA) shall be carried out at the ALM level to identify the criticality level of various sub-systems and LRUs used in the ALM under development based upon their functional importance. The criticality level shall be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of the subsystem / LRU endangers the safety of the aircraft or crew.

   ii. Mission Critical: The failure of the subsystem / LRU results in aborting the mission.

   iii. Non Critical: The failure of the subsystem / LRU does not endanger the safety of the aircraft and crew and does not result in aborting the mission

b. A Criticality Classification Document containing the criticality level details of all the subsystems / LRUs shall be prepared by the Main Contractor in consultation with User Services and approved by CEMILAC.

c. For Non-Critical Airborne Store, TAA shall enable self-approvals during Test & Evaluation phase so as to minimize stage-gated approvals to enhance process efficiency and accelerate D & D timelines.

d. Provisions related to airworthiness certification and quality assurance of non-critical airborne store shall be identified during the initial stages itself and included in ACP and QAP respectively.

Guidance Material

NIL

21.B3.11 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 stakeholders. 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 organisations.

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 Annexure 21.B3.A.

21.B3.12 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 stakeholders. This 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 organisations.

c. QA department of the Main Contractor will be responsible for the veracity of the information supplied by it to DGAQA.

d. The responsibility of the Main Contractor also includes the sub-contracted portion of work, if any. Such sub-contracting arrangements are to be duly communicated to DGAQA well in advance.

21.B3.13 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.B3.14 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: -

a. System Engineering Life Cycle Process:

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

b. Planning:

The Main Contractor shall evolve various plan documents such as System Development Plan, Quality Assurance Plan (QAP), Airworthiness Certification Plan (ACP), Test and Evaluation Master Plan (TEMP), Configuration Management Plan (CMP) etc.,

c. ENTEST Specifications:

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.

d. QA Coverage :

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 by DGAQA as per the approved QAP.

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.

e. The quality assurance coverage at the level of fully assembled ALMs during the design & development phase shall be by DGAQA as per the approved QAP.

REVIEW PROCESS:

f. The Main Contractor shall carry out reviews such as Requirement Review, Design Reviews, Test Adequacy & Readiness Review, QA review, Flight Readiness Review, Flight Safety Board, Post Flight Analysis, Compliance Reviews etc. at appropriate stages.

g. The Main Contractor shall prepare documents related to Reviews, Design, Analysis and Simulation, Quality Assurance etc.,

FRACAS:

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

CONFIGURATION MANAGEMENT:

i. The Main Contractor shall establish processes for Configuration Management (21. B3.15).

ALM Domain Certification:

j. Since an ALM is a complex system involving multiple inter-disciplinary fields viz. Aerodynamics & Structure, Material, Avionics & software, explosive & propulsion system, electro-mechanical, electro-chemical etc., 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:

k. The design shall be considered to be adequate for prototype realisation as marked by baselining of the Drawings and Equipment Standard of Preparation (ESOP).

l. The hardware realization shall be initiated with a frozen SOP at that particular stage and realization shall be done under the supervision of DGAQA with stipulated QAP.

m. 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 Technical Specifications (TS), Qualification Test Plan (QTP), Development Test Schedule (DTS), Drawing Applicability List (DAL), MDI, Integration Plan (Mechanical & Electrical) and Bill of Materials (BOM).

Software Realization:

n. 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.B3.13 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 Annexure 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 Annexure 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.B3.15 Configuration Management

Regulation

Main Contractor shall establish and implement a means by which the configuration of the ALM is managed throughout its the life cycle 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 & 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.B3.16 Test Rigs /Test Equipment

Regulation

The Main Contractor shall ensure availability of test rigs/test equipment that are capable of performing the intended testing and evaluation during all the life cycle 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 upto date, wherever applicable and these are also periodically maintained.

Guidance Material

Refer Subpart T

21.B3.17 Test and Evaluation

Regulation

The Main Contractor shall ensure 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 and shall follow the testing requirements as per the Airworthiness Certification Plan (ACP) document.

b. The Main Contractor to establish working rigs for systems/ subsystems to functionally test and demonstrate compliance to requirements.

c. The technical specifications of test rigs used during development and production for verification & validation of the Air System/Airborne Store shall be approved by CEMILAC and the test rigs shall be certified by CEMILAC/DGAQA depending upon the type of test rig.

d. 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.

e. The ALM shall be tested in fully assembled configuration on ground (phase checks/ checkout/ functional checks) for interface, communication, mission sequence, functionality, etc., using test rigs wherever applicable, as per the test plans approved by CEMILAC.

f. 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.

g. All the applicable test plan documents shall be prepared by the Main Contractor and approved by CEMILAC prior to start of actual testing activities.

h. The test plans and procedure documents as planned in the ACP shall be reviewed and approved by CEMILAC. CEMILAC may seek review from subject matter experts for ensuring adequacy of the test coverage towards meeting the airworthiness requirements

i. Prior to submission of test plan documents to CEMILAC for approval, the Main Contractor may 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.

j. Self-approvals of test plan and procedures shall be enabled by CEMILAC for Non-Critical airborne stores (subsystems / LRUs) and associated test rigs and TTGEs subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

k. The qualification tests at ALM level, wherever applicable, shall be carried out as per the requirements given in the approved ENTEST Specifications.

l. The guiding principle of qualification testing during the design & development phase shall be 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.

m. 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).

n. The Main Contractor shall involve DGAQA for participation during the ground testing and approval of the test data as planned in the ACP and D&D, QAP document. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Safety Critical airborne stores (Mission-Critical and Non-Critical subsystems / LRUs) and associated test rig and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

o. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for first article inspection for vendor / sub-contractors.

p. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

q. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

r. CEMILAC shall accord developmental flight clearance of prototype Air System based on compliance to the airworthiness requirements deemed necessary and sufficient to carry out flight testing safely.

s. 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.

t. Evaluation of the software shall be undertaken as per the regulations given in Subpart C6.

u. 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 as per DGAQA approved QAP.

v. The level of involvement in reviewing test plan documents/test reports or overseeing any activity shall be as decided by the TAA.

w. A defect arising at any stage during the testing & evaluation phase shall be analyzed and corrective action shall be taken with the involvement of FAB (Refer 21.B3.18). 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 other subsystems such as Structures/ Warhead/Propulsion subsystems etc.

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 Annexure 21.B3.D : ALM Test and Evaluation.

21.B3.18 DEVIATIONS

REGULATION

The Main Contractor shall ensure that a systematic process to handle deviations/ non-conformances/defects during all the life cycle 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 duly approved by TAA.

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 with the approval of TAA.

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 Users 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 Users 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.

ii. Non-Conformances Review Board (NCRB)

iii. Configuration Control Board (CCB)

iv. Parts, Materials and Process Control Board

v. Failure Analysis Board (FAB)

vi. 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.B3.19 FLIGHT TESTS

REGULATION

An ALM under development shall be subjected to flight testing to validate its design, ensure its airworthiness, 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 FCC 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 consisting of Captive Flight Trials (CFT), Separation Tests and Release Flight Trials (RFT).

e. Certificate of Safety for Flight for the Aircraft in the form of Form 1090 shall be issued by DGAQA wherever the QA coverage for integration on Aircraft is provided by DGAQA.

f. The flight test report endorsed by the User/ FTA/ Customer shall be provided to CEMILAC for final clearance.

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, with members from all the stakeholders, 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.B3.20 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.

ACCEPTABLE MEANS OF COMPLIANCE

a. The Main Contractor shall prepare the ALM Type Record 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 the Type Record with proper justification for their temporary/permanent acceptance.

GUIDANCE MATERIAL

Wherever applicable, the supporting evidences to be approved by authorities responsible for the same.

21.B3.21 APPLICATION FOR RMTC/MTC

REGULATION

The Main Contractor shall apply to CEMILAC with the Type Record 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 & TCDS.

GUIDANCE MATERIAL

Nil

21.B3.22 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 Users Services are ready to accept the ALM based on their operational requirements.

ACCEPTABLE MEANS OF COMPLIANCE

a. Prior to issue of RMTC/IOC, Type Record 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 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 Organisation Approval (POA) from DGAQA as per Subpart G2 to initiate production of ALM.

f. RMTC/IOC shall enable the Users 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 details of 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 RMTC.

21.B3.23 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. Type Record 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 organisation 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 Type Record 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 Organisation 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 details of 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.B3.24 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 Users 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 Users Services shall be submitted by the Main Contractor which shall be considered for issuance of RSD to Users Services.

b. Technical and flight publications for the ALM shall be prepared by the Main Contractor in consultation with design team and the same shall be reviewed by maintenance development organisations of Users Services.

c. Technical publications shall be released by the Main Contractor to Users Services and CEMILAC approval shall not be required for these.

GUIDANCE MATERIAL

Nil

21.B3.25 PRODUCTION

REGULATION

The RMTC/MTC holder or identified production organisation shall carry out production of the ALM as per the approved build standard.

ACCEPTABLE MEANS OF COMPLIANCE

a. The RMTC/MTC Holder shall have production organization approval from DGAQA before taking up production of the type certified ALM as per Subpart G2.

b. In case the production of the ALM is to be carried out by a production partner of the RMTC/MTC holder, the necessary Transfer of Technology (TOT) requirements stipulated by TAA shall be fulfilled as part of license agreement.

c. The RMTC/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. RMTC/MTC is a design-cum-production certificate. Hence RMTC/MTC holder can take up production of ALM after obtaining production organisation approval from DGAQA.

b. For details on production organisation 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 Users Services.

21.B3.26 CHANGES REQUIRING SMTC/AMTC/NEW MTC

REGULATION

a. Changes proposed to an already type certified ALM shall be analysed and approved in the form of issue of Supplemental 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 Supplemental 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.

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.B3.27 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 Users Services, the MTC can be withdrawn by CEMILAC till resolution of all the issues related to performance of ALM to the satisfaction of the Users 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.B3.28 TRANSFERABILITY

REGULATION

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 Air System.

b. The transfer of MTC shall be made only in special conditions (stipulated in guidance material) to an organisation 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 organisation having requisite infrastructure (ASDO Approved) 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 Users Services.

GUIDANCE MATERIAL

The following are some of the special conditions having a bearing on transfer of MTC:

a. The MTC holder changing its name.

b. Changes to the Registered Address or Relocation of their facility.

c. 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.B3.29 Duration and Continued Validity

Regulation

a. RMTC shall remain valid for a period not exceeding 5 years.

b. MTC shall remain valid for a period not exceeding 10 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 it production partner shall not be carried out.

b. On expiry of MTC, the further production activities by MTC holder or it production partner shall not be carried out.

c. The MTC holder shall apply to CEMILAC 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 Users 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 Users 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 Users Services the performance and safety record of the ALM at regular intervals. Based on the feedback received, if the Users Services and the TAA find it necessary, CEMILAC may suspend or withdraw a RSD.

21.B3.30 Record Keeping

Regulation

The MTC holder for the ALM shall ensure proper record keeping of all the data and documentation.

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 Users 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.B3.31 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 Users Services.

Acceptable Means of Compliance

a. The Main Contractor shall provide all the relevant ISTA to the Users Services to keep the ALM and its subsystems in airworthy condition at all times.

b. Changes to the ISTA shall be periodically made available by the Main Contractor to the Users Services.

Guidance Material

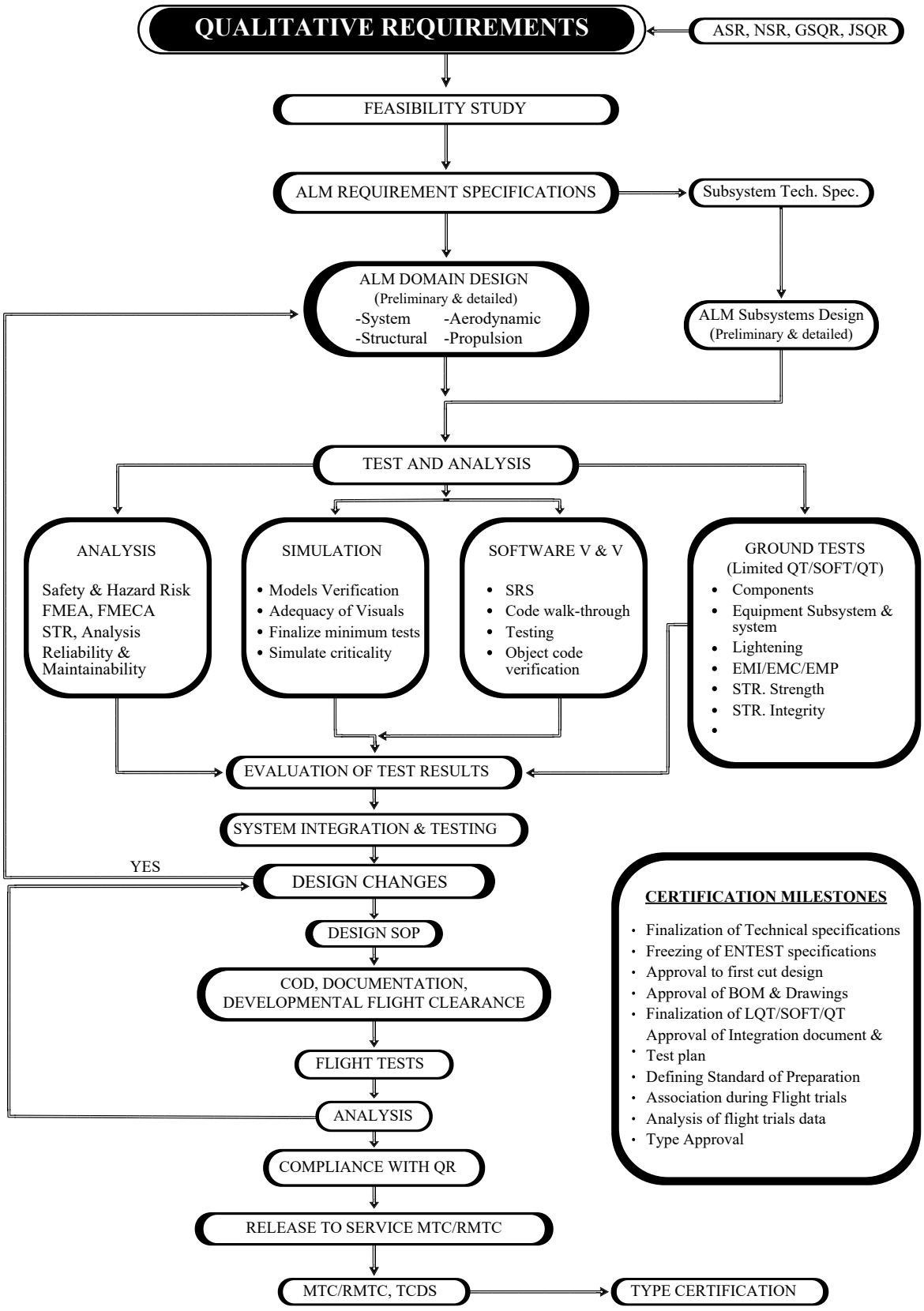
a. The availability of some manuals or portions of variations to the ISTA, dealing with overhaul or other forms of heavy maintenance, may be delayed until after the product has entered into the service, but should be available before any of the products reaches the relevant age or flight hours/cycles,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

b. Changes may be required in the TCDS 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 done to the 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.

ANNEXURE 21.B3.A AIRWORTHINESS CERTIFICATION OF AIR LAUNCHED MISSILES

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



Annexure 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)

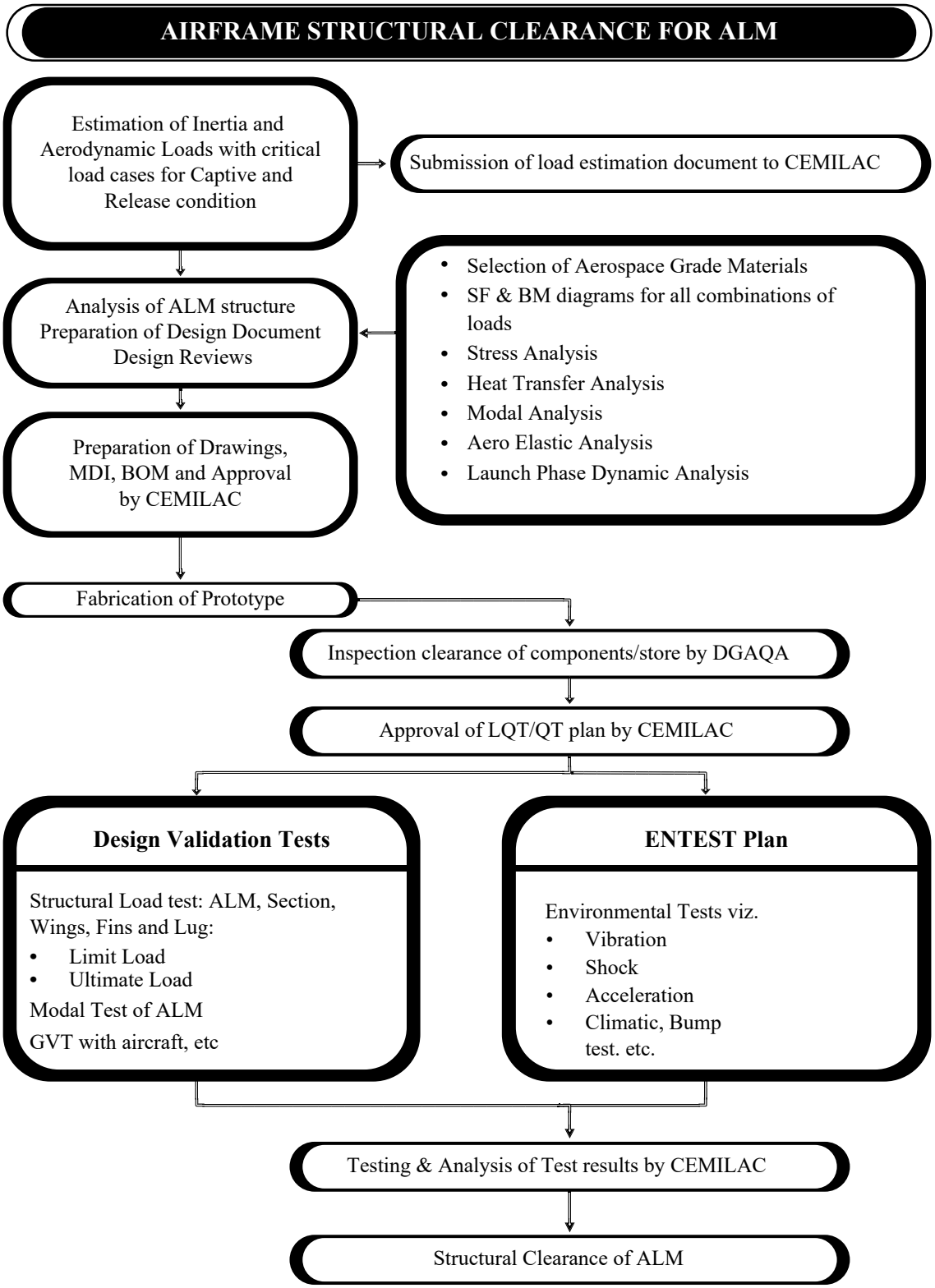
Avionics Subsystem	Propulsion Subsystem	Structures	Aerodynamics
Power Estimation Reliability De-rating Electronic Packaging Signal Integrity Wt budget EMI hardening Thermal Analysis FMECA/FMEA Mechanical Analysis Sneak Circuit Analysis, etc.	Stability Analysis of Combustion. Heat Transfer Analysis of 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, etc.	SF & BM diagrams for all combinations of loads Stress Analysis Heat Transfer Analysis Modal Analysis Aero Elastic Analysis Launch Phase Dynamic Analysis, etc.	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, etc.

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 Lethality studies Life assessment FMECA/FMEA	The detailed list of analyses w.r.t to software is covered in the software section of IMTAR. Therefore, refer Subpart C6 for all such details.	Control Parameters Effectiveness Damping Guidance schemes Electrical Integration Mechanical integration Safety Reliability Failure Modes Reliability Apportionment Verification of redundancy Requirements for meeting reliability goals Interface FMEA Reliability Assessment Hardware Software interaction analysis(HSIA) • Fault Tree Analysis (FTA) • Worst Case Circuit Analysis • Single Point Failure List

ANNEXURE 21.B3.C : GUIDANCE MATERIAL ON ALM DEVELOPMENT PROCESS

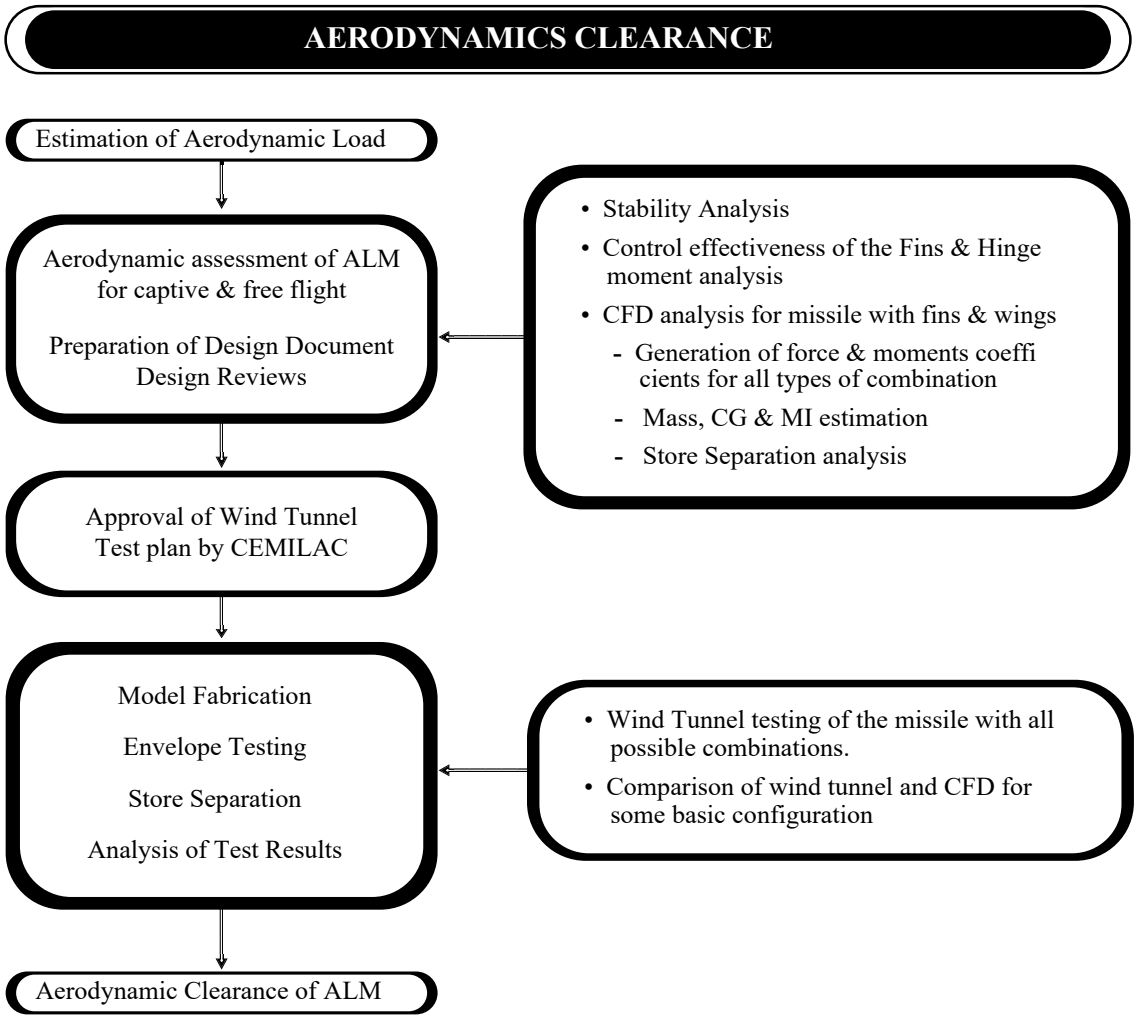
(To be used only as guidelines and not to be cited as the regulatory requirements)

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



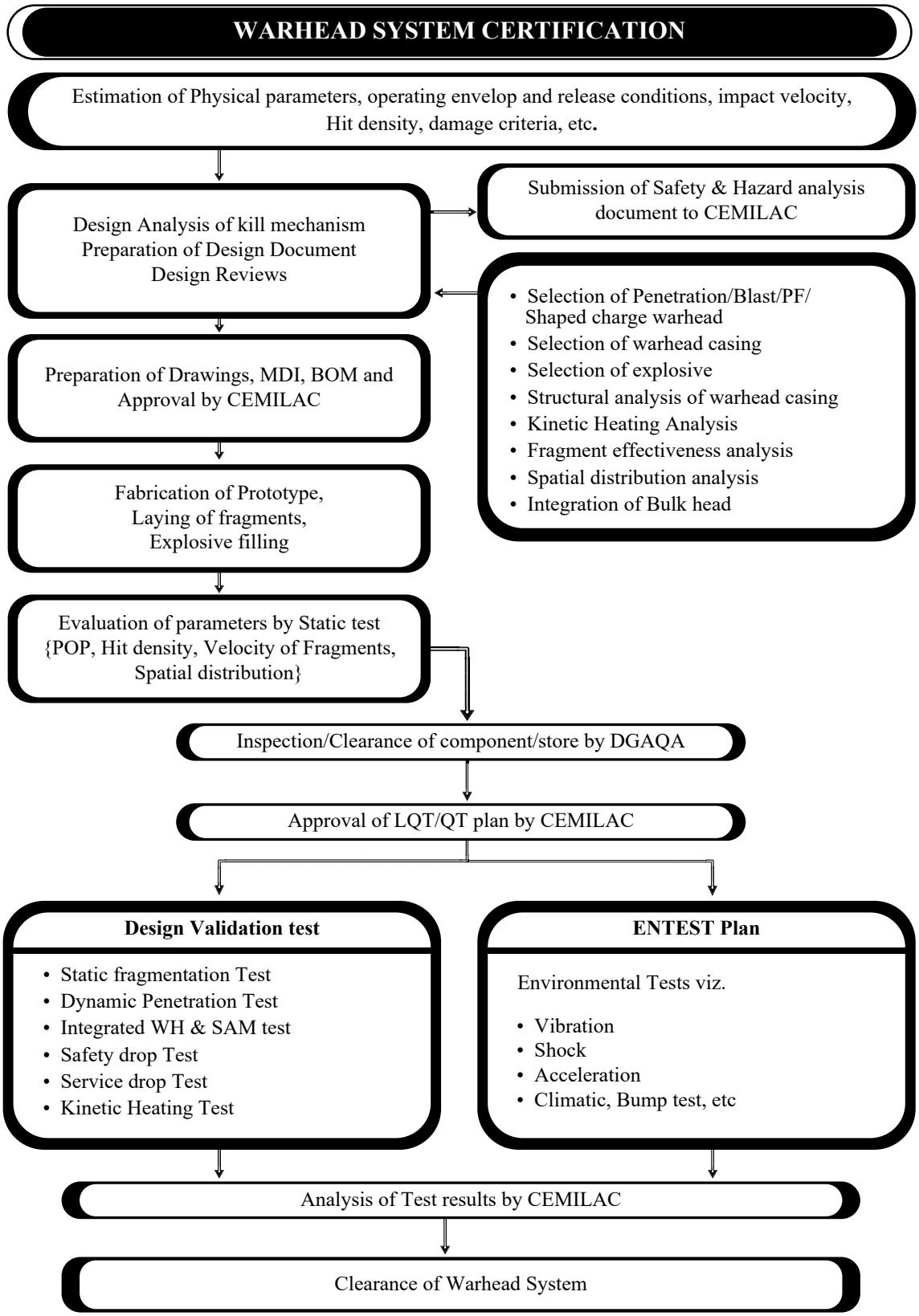
21.B3.C.2: Guidance Material on Aerodynamics Clearance for ALM

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



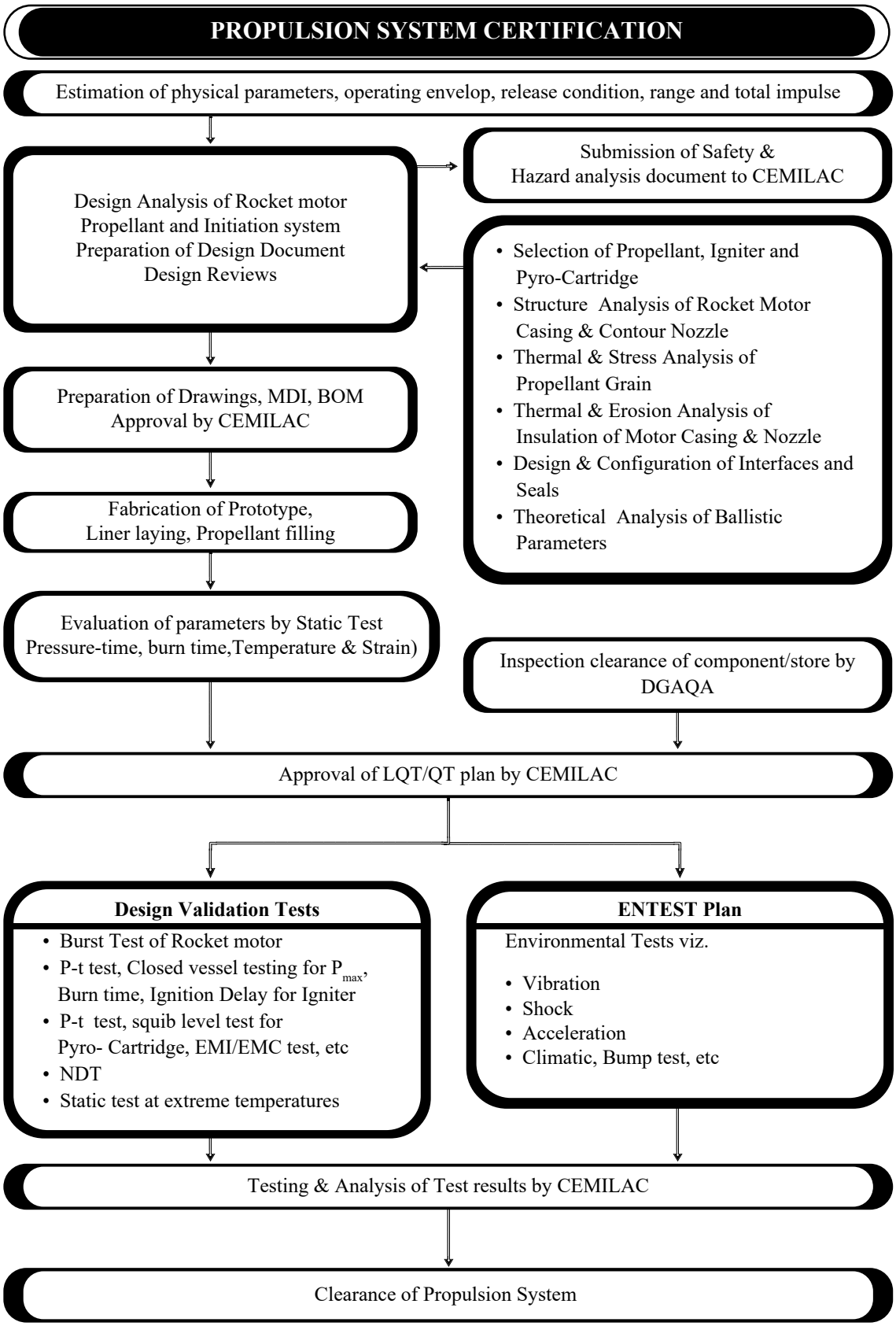
21.B3.C.3: Guidance Material on Warhead Subsystem Clearance for ALM

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



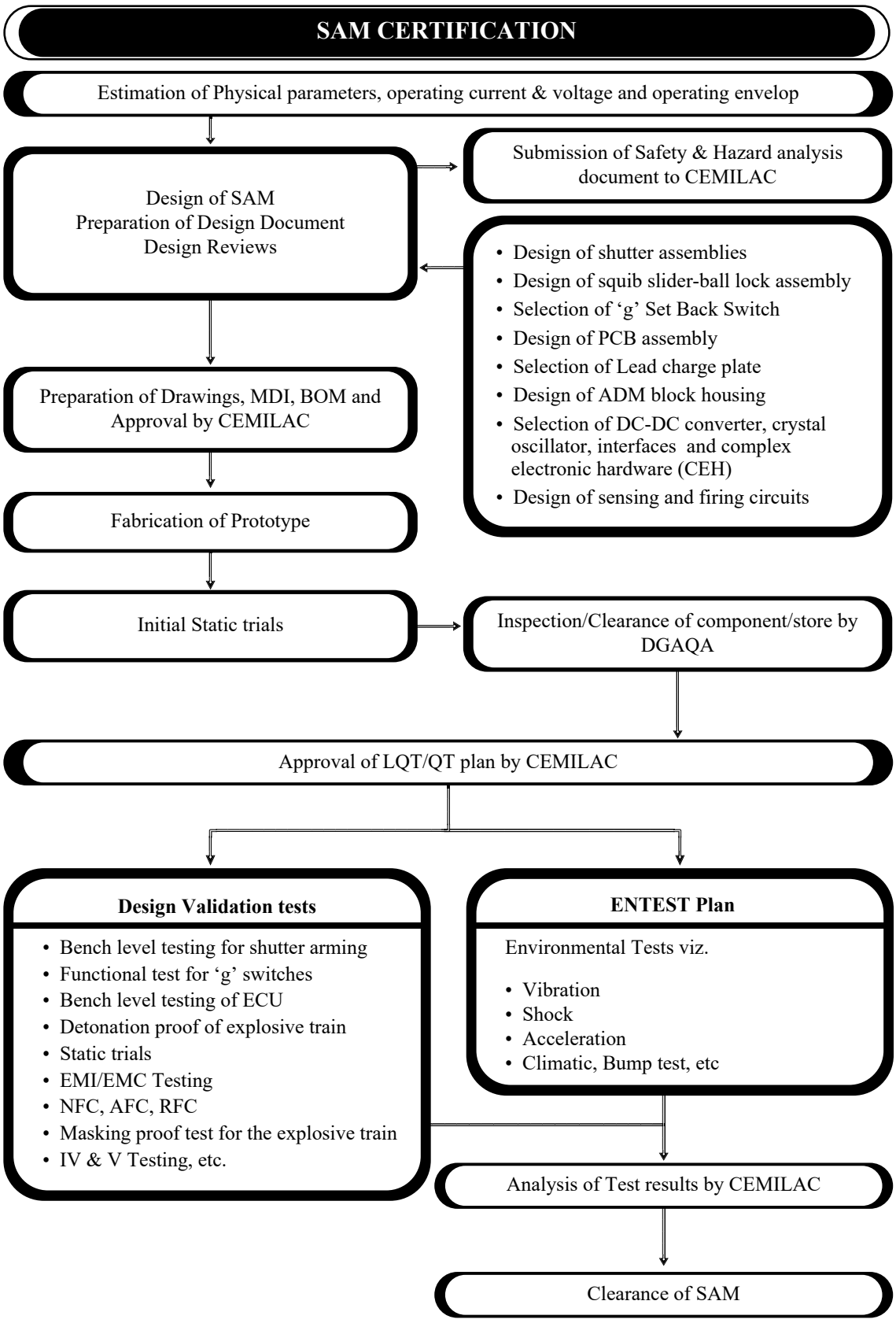
21.B3.C.4: Guidance Material on Propulsion Subsystem Clearance for ALM

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



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)



ANNEXURE 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.B3.D.1 SAFETY OF FLIGHT TESTING (SOFT)

a. 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 regulated per the existing CEMILAC policies as subsystems are consumed in ALWs trials.

b. 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.

c. The necessary Design review should be completed for the subsystem prior to start of SOFT.

d. 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 approves the test schedules.

e. 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.

f. Design changes, if necessary during the SOFT process should be only with the concurrence of CEMILAC.

g. The SOF tests should be carried out by the Main Contractor with coordination of DGAQA/internal QA group, duly authorised by DGAQA.

h. Software certification should be carried out for all the software components in the system.

i. The test results and compliance chart, both endorsed by QA agency shall be analysed by CEMILAC.

j. Pre – requisites before commencement of SOFT/ LQT/IQT/Full QT:

   i. Inspection of components /connectors/PCBs as per BOM/MDI/Drawings/ Schematics/ Data Sheets/CoCs etc. with proper traceability/marking

   ii. Screening of non-mil components as per CEMILAC screening directive No.81/2003 dated 10th Jan 2004.

   iii. The configuration of cables used for EMI/EMC tests shall be preferably same as actual flight cables.

   iv. The fixtures used for ENTEST shall be approved by CEMILAC and the mounting scheme during en-tests shall replicate mounting scheme in flights.

   v. 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.

   vi. If the system has the application software alone (instead of ENTEST 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.

   vii. This software also to be verified & validated before commencement of ENTEST, 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].

   viii. 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.

   ix. All standard equipment used as part of test-jig shall be calibrated.

   x. All test facilities used for qualification of test item shall be calibrated.

k. For systems that have already been qualified for other platforms, SOF requirements shall be accordingly tailored while finalising delta test requirements.

l. 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)

a. LQT is mainly required for conducting developmental flight trial 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.

b. LQT specifies minimum qualification requirements to ensure functional, structural and safety aspects to enable CEMILAC to clear the subsystem for developmental flight trials.

c. The system undergoing limited qualification tests shall be of production standard w.r.t. processes, make, SOP etc.

d. LQT tested subsystem shall be yellow-banded after the test and it is not to be used in the flight trials.

e. The necessary design review should be completed for the subsystem prior to start of LQT.

f. 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 approves the test schedules.

g. SOP, Test rig specification, instrumentation required for the tests including telemetry LQT Plan and Functional Test Procedure should be prepared by the Main Contractor and approved by CEMILAC before commencement of tests.

h. After completion of pre-defined subset of qualification tests (LQT), test results coordinated by QA agency shall be submitted to CEMILAC.

i. The SOP of the subsystem should be placed under configuration control and modifications shall be only with concurrence of CEMILAC.

j. Pre – requisites before commencement of LQT: Refer 21.B3.D1, j. above.

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

a. 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.

b. Provisional Clearance or Type Approval should be available for the subsystem.

c. The Main Contractor and CEMILAC should jointly prepare Airworthiness Certification Plan (ACP) where required, keeping in view the additional certification requirements.

d. 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.

e. The Main Contractor should prepare Incremental QT plan which should be approved by CEMILAC.

f. The Main Contractor should submit Incremental Qualification test results to CEMILAC. The test results should be co-ordinated by QA agency.

g. Software certification should be completed, if required, for all the airborne software components and reports should be generated.

h. The SOP of the system shall be placed under configuration control and modifications shall be only with concurrence of CEMILAC.

i. The system undergoing incremental qualification shall be of production standard w.r.t. processes, make, SOP etc.

j. Pre – requisites before commencement of IQT: Refer 21.B3.D.1, j. above.

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

a. The airborne subsystem shall undergo Full Qualification Tests (QT) before productionisation and service use.

b. The Main Contractor and CEMILAC 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.

c. Preliminary Design Review and Critical Design Review should be conducted by the Main Contractor covering the hardware and software design aspects.

d. The Main Contractor should prepare Test rig specifications. The Functional Test Procedure and QT Plan, if applicable should be prepared in consultation with DGAQA.

e. All the Qualification tests as per the approved QTP should be conducted on the subsystem/LRU.

f. QT tested LRU / subsystem shall be yellow banded after the test and it is not to be used in the flight trials.

g. The Main Contractor should submit Qualification test results to CEMILAC. The test results should be co-ordinated by QA agency.

h. Software certification should be completed for all the airborne software components and reports should be generated.

i. The SOP of the subsystem should be placed under configuration control and modifications shall be only with concurrence of CEMILAC.

j. The system undergoing qualification shall be of production standard w.r.t. processes, make, SOP etc.

k. Pre – requisites before commencement of Full QT: Refer 21.B3.D1, j. above.

21.B3.D.5 INTEGRATED ALM LEVEL TESTING OR ALL ROUND UP TESTING

a. 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.

b. The systems/subsystems should have completed SOF or LQT or IQT or Full QT.

c. 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.

d. 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.

e. The SOP of the cleared subsystem should be approved by CEMILAC.

f. 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 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. Phase-V Checks: These checks are required to be carried out for the canisterised ALMs.

vi. Phase-VI Checks: These checks are carried out after installing the ALM on the airborne platform.

vii. The phase check sequence to be followed.

viii. Phase-I checks are specific to the subsystems and the same are, therefore, not discussed here.

g. 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.

h. 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.

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

j. O-Level Checks: O-Level checks are to be carried out at Air Force Station after loading the ALM on airborne platform.

k. 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. 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.

l. 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.

m. 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.

n. 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)

a. 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.

b. TARB may be constituted by the Main Contractor with the involvement of domain experts. CEMILAC and DGAQA shall be part of the TARB committee.

c. The test plan agreed by TARB shall be reviewed and approved by CEMILAC

d. 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.

e. The subsystem undergoing testing shall be of production standard w.r.t. processes, make, SOP etc.

21.B3.D.7 Test Rigs

a. The airborne subsystem needs to be tested on bench and during environmental tests, for compliance with the technical and functional specification. Test Rig/ATE is used during Design, Development, production and service use.

b. 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.

c. 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.

d. The criticality level applicable to the test software should be the same as that of the system that is certified using the test Software.

e. The Technical specification, software requirements and version description for the Test rig/ Automatic Test Equipment (ATE) shall be approved by CEMILAC.

f. The test rig/ATE shall have identification part number, hardware and software versions, and last calibration date clearly marked on the nameplate.

g. The compliance of the test rig/ ATE to the approved specifications shall be confirmed by QA agency.

h. Only the TAA approved test rig/ATEs shall be used for hardware/ software certification activities of the system.

i. The simulation of airborne platform interfaces and test conditions with the ATE/test rig shall be as close to the actual environment as possible.

j. Environmental tests applicable for test rigs/ATEs should be tailored as per the standards, operating environment and delivery requirement of the test rigs/ATEs.

SUBPART B4
AB-INITIO DEVELOPMENT OF AERO ENGINES

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 intended capability and has met all the Type Design and safety requirements.

Intentionally Left Blank

CONTENTS

21.B4.1	**Applicability**	**B4-5**
21.B4.2	**User Requirements**	**B4-5**
21.B4.3	**Certification of Aero Engines for Indian Military Applications**	**B4-6**
21.B4.4	**Application for Airworthiness Certification of Aero Engine**	**B4-7**
21.B4.5	**Demonstration of Air System Design Organisation (ASDO) Capability**	**B4-8**
21.B4.6	**Airworthiness Certification Criteria/Special Conditions**	**B4-8**
21.B4.7	**Engine Requirement Specifications**	**B4-9**
21.B4.8	**Finalization of Type Certification Basis (TCB)**	**B4-10**
21.B4.9	**Criticality Classification**	**B4-10**
21.B4.10	**Airworthiness Certification Plan (ACP)**	**B4-11**
21.B4.11	**Quality Assurance Plan (QAP)**	**B4-12**
21.B4.12	**Design & Development of Aero Engine**	**B4-12**
21.B4.13	**Configuration Management**	**B4-13**
21.B4.14	**Test Rigs /Test Facilities**	**B4-14**
21.B4.15	**Test and Evaluation**	**B4-14**
21.B4.16	**Deviations**	**B4-16**
21.B4.17	**Flight Tests**	**B4-16**
21.B4.18	**Compliance with Type Certification Basis**	**B4-18**
21.B4.19	**Application for RMTC/MTC Along with Type Records**	**B4-18**
21.B4.20	**Issue of Restricted Military Type Certificate (RMTC)/IOC**	**B4-19**
21.B4.21	**Issue of Military Type Certificate (MTC)/FOC**	**B4-20**
21.B4.22	**Issue of Release to Service Documents (RSD) along with Manuals**	**B4-20**
21.B4.23	**Production**	**B4-21**
21.B4.24	**Changes Requiring SMTC/AMTC/New MTC**	**B4-22**
21.B4.25	**Responsibilities of MTC Holder**	**B4-23**
21.B4.26	**Transferability**	**B4-23**
21.B4.27	**Duration and Continued Validity**	**B4-24**
21.B4.28	**Record Keeping**	**B4-25**
21.B4.29	**Instructions for Sustaining Type Airworthiness (ISTA)**	**B4-25**

Intentionally Left Blank

21.B4.1 APPLICABILITY

REGULATION

The regulations contained in this Subpart are applicable to ab-initio development (including derivative engines) of all classes of aero engines like Turbofan, Turbojet, Turboprop, Turboshaft, Rotary and Reciprocating engines that require MTC for Indian military applications.

ACCEPTABLE MEANS OF COMPLIANCE

The provisions stipulated in this Subpart are to be complied through a Certification programme, on satisfactory culmination of which CEMILAC shall grant MTC for Indian military applications.

GUIDANCE MATERIAL

a. Aero Engines designed and developed as an integral part of the Air Vehicle, which in turn is 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 that require a MTC except for the categories for which exception has been granted by CEMILAC.

c. The Technical Airworthiness Authorities (TAA) responsible for the introduction of new Indian Military Air Systems, except for certain Unmanned Air Systems (UAS) class exemptions detailed in Subpart B2, should ensure that they are certificated in accordance with the 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 GSQR/ASR/NSQR/ISQR/JSQR. In case of acquisition of 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 Main Contractor 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 the User requirements in terms of Performance, Flight envelope, Climatic envelope, Lifing, Safety, Reliability etc.

GUIDANCE MATERIAL

a. User requirements often deal with how a user will interact with a system and what the user expects. The User requirements in terms of GSQR/ASR/NSQR/ISQR/ JSQR, have 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 subsystems are good enough to meet the user requirements and should have concurrence of CEMILAC prior to design implementation.

21.B4.3 CERTIFICATION OF AERO ENGINES FOR INDIAN MILITARY APPLICATIONS

REGULATION

Aero 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 shall flow 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 test criteria, based on considerations for life, safety margins, reliability, intersystem compatibility and maintainability during service operation.

d. For already Type Certified, but where 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 7 phases:

Phase 1 – Identify the requirement for and obtain organisational approvals.

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

Phase 3 – Concurrence of CEMILAC to the Airworthiness Certification Plan (ACP).

Phase 4 – Demonstrate compliance with the TCB as per ACP.

Phase 5 – Agree to Quality Assurance Plan (QAP)

Phase 6 – CEMILAC review of certification evidences and issue of RMTC/MTC.

Phase 7 – Post certification activities.

21.B4.4 Application for Airworthiness Certification of Aero Engine

Regulation

The Main Contractor responsible for engine acquisition shall apply to CEMILAC and DGAQA for the airworthiness certification and quality assurance coverage respectively.

Acceptable Means of Compliance

Main Contractor responsible for engine acquisition shall co-ordinate with TAA and an early intimation of the project plan 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 regarding 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

Main Contractor responsible for aero engine acquisition shall be the organisation with demonstrated capability and is approved by CEMILAC as per the provisions of Subpart G. Firms engaged in design/development/repair of systems, subsystems and components of propulsion system shall have the corresponding approvals from CEMILAC 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 Subpart G for the organisation approvals.

21.B4.6 Airworthiness Certification Criteria/Special Conditions

Regulation

The Main Contractor 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 the Main Contractor in consultation with the User Services and CEMILAC.

b. It is necessary to establish the Type Certification Basis (TCB) for the Type Design of the aero engine or major modifications. Formal approval should be sought from CEMILAC and the User Services 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 Annexure 21.B4.A - Aero Engine development process.

21.B4.7 Engine Requirement Specifications

Regulation

Engine requirements shall be derived from the User requirements that flows down to aircraft level requirements and keeping the current state of the art technology available for manufacturing the components and systems. The Engine Requirement Specification document thus derived shall be approved by CEMILAC.

Acceptable Means of Compliance

a. The requirement specification of engine shall be prepared by the Main Contractor as per the Services requirement in consultation with the User Services and approved by CEMILAC.

b. ASDO shall take concurrence of Service HQ if any significant deviations are there from the User requirements specified.

c. The engine requirement specification shall be confirming to the interface requirements of the associated systems.

Guidance Material

Prior to submitting for CEMILAC concurrence, the engine requirement specification to be reviewed by all other stakeholders concerned.

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

Regulation

The Main Contractor 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 basis shall be based on the provisions specified in Engine requirement specification and acceptance criteria mutually agreed between the Main Contractor 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 Main Contractor.

b. ASDO shall comply with the TCB. If it desires to have an amendment to the airworthiness requirements that are effective after finalisation of TCB, the Main Contractor should approach CEMILAC for any amendment in 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 Criticality Classification

Regulation

Criticality classification of Airborne Stores and sub-systems used in the Aero Engine under development shall be carried out.

Acceptable Means of Compliance

a. System Safety Assessment (SSA) shall be carried out at the Aero Engine level to identify the criticality level of various Airborne Stores and sub-systems used in the Aero Engine under development based upon their functional importance. The criticality level shall be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of the airborne store / subsystem / LRU endangers the safety of the air system or crew.

ii. Mission Critical: The failure of the airborne store / subsystem / LRU results in aborting the air system mission.

iii. Non Critical: The failure of the airborne store / subsystem / LRU does not endanger the safety of the air system and crew and does not result in aborting the mission.

b. A Criticality Classification Document containing the criticality level details of all the airborne stores shall be finalised by the Main Contractor in consultation with User Services and TAA.

c. For Non-Critical Airborne Store, TAA shall enable self-approvals during Test & Evaluation phase so as to minimize stage-gated approvals to enhance process efficiency and accelerate D & D timelines.

d. Provisions related to airworthiness certification and quality assurance of non-critical airborne stores shall be identified during the initial stages itself and included in ACP and QAP respectively.

GUIDANCE MATERIAL

NIL

21.B4.10 AIRWORTHINESS CERTIFICATION PLAN (ACP)

REGULATION

Airworthiness Certification Plan shall be prepared by the Main Contractor in consultation with CEMILAC and shall clearly specify the verification/compliance matrix with means of compliance and TAA engagement plan 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 Main Contractor and agreed with CEMILAC, and will usually form part of the Integrated Test, Evaluation and Acceptance Plan (ITEAP).

21.B4.11 Quality Assurance Plan (QAP)

Regulation

The Main Contractor shall propose a Quality Assurance Plan of the Aero Engines 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) shall include the acceptable limits to demonstrate the quality and shall obtain the concurrence of DGAQA.

Guidance Material

a. The Main Contractor or their contractor firm would 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. Main Contractor or their contractor firm will be responsible for veracity of the information supplied to the representatives of type certifying authority.

c. The responsibility of the ASDO 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.B4.12 Design & Development of Aero Engine

Regulation

The Main Contractor shall have a design & development process that results in Aero Engine and 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 issuance of MTC, is capable of successful design and development of the aero engine/ subsystems.

b. The organisation responsible for the design of the aero engine/subsystems can demonstrate its capability by holding an appropriate Design Organisation Approval or is in the process of applying for such an approval.

c. 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).

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.

e. The design shall be considered to be adequate for prototype realisation as marked by baselining the Master Drawing Index and Equipment Standard of Preparation (ESOP).

f. 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.

g. Fabrication of prototype shall be carried out under a DGAQA approved Quality Assurance Process.

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 Annexure 21.B4. A - Aero Engine development process.

21.B4.13 Configuration Management

Regulation

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 a complex system like aero engine is normally specified by means of a large number of documents, such as performance specifications, drawings, design manuals, testing procedures etc. As the design evolves these documents are subject to change, and configuration management 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 management 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.B4.14 TEST RIGS /TEST FACILITIES

REGULATION

Main Contractor or their partners or contractors shall have test equipment/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, the Main Contractor 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 at Government agencies or NABL accredited facilities can be used under the oversight of TAA.

c. The test equipment/test facilities/engine test beds shall have the approval of appropriate authorities as given in Subpart T and shall have its calibration validity up to date and periodically maintained.

GUIDANCE MATERIAL

Refer Subpart T

21.B4.15 TEST AND EVALUATION

REGULATION

The Main Contractor should agree with the TAA (CEMILAC and DGAQA) on the approved test organisation 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, life and reliability of the aero engines and its subsystems.

b. Test schedules to be approved by CEMILAC.

c. The Main Contractor may constitute the Test Adequacy Review Boards (TARBs) in consultation with CEMILAC, wherever needed for major systems / subsystems, with the involvement of domain experts to review the adequacy of the testing proposed.

d. Self-approvals of test plan and procedures shall be enabled by CEMILAC for Non-Critical airborne stores and associated test rigs and TTGEs subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

e. 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 airworthiness certification plan and quality assurance plan.

f. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne stores and associated test rigs and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

g. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

h. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for vendor / sub-contractors.

i. Test reports shall be prepared by the Main Contractor & duly signed by DGAQA and the same shall be submitted to CEMILAC.

j. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

k. Along with all the test reports, a Certificate of Design (CoD) duly signed by the Chief of Design shall be provided to CEMILAC for issuing clearances for undertaking developmental flight trials of prototype Aero Engines.

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 Annexure 21.B4.B - Aero Engine testing and evaluation

21.B4.16 DEVIATIONS

REGULATION

Main 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. A defined process shall be in place at Main Contractor to handle the deviations arising during design and development of an aircraft.

b. 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 extent possible.

c. The deviations in D&D shall be put by the QA of the Main Contractor to DGAQA through applicable format for disposal.

d. DGAQA may refer to CEMILAC for design aspects. Depending on the impact of the deviation, CEMILAC may refer to NCRB. NCRB shall consists of TAA, domain experts, design representatives and co-opted members. The recommendation of NCRB shall be the basis for deviation disposition by CEMILAC.

e. Deviations resulting in unsafe operation of aero engine shall not be accepted and it must be mitigated through design improvements.

f. The deviations which are not possible to be mitigated through design improvements but not resulting in unsafe conditions shall be listed and indexed as concessions or waivers w.r.t User requirements by Main Contractor with User concurrence.

g. Concessions shall have PDC for their mitigation as design improvements post issuance of RMTC with the concurrence of User.

h. Waivers shall be obtained by Main Contractor from User for those deviations, which are not possible to mitigate as design improvements in the present configuration of aircraft.

GUIDANCE MATERIAL

Nil

21.B4.17 FLIGHT TESTS

REGULATION

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

ACCEPTABLE MEANS OF COMPLIANCE

a. Flight testing for Aero Engine shall be undertaken broadly as per the regulations given in Subpart P with some specific provisions given in this regulation. Prior to flight test, all safety related tests on aero engine and its systems, sub systems and accessories shall be completed.

b. Activities related to flight testing shall be in consultation with the flight testing agency.

GUIDANCE MATERIAL

a. 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.

b. Flight test on intended platform shall be carried out to demonstrate engine operability but not limited to;

   i. Windmill starts

   ii. Cross bleed starts.

   iii. Control transients, primary & secondary

   iv. Supersonic and Super cruise operation, if applicable, based on platform

   v. Inverted manoeuvre

   vi. Max AB performance, if applicable

   vii. Zero g, 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:

      A. Analysis reports for various systems/equipment/LRUs including stress analysis reports

      B. Aircraft/Platform integration procedure and integration test schedules

      C. FMEA/FMECA and reliability estimates

      D. Safety/hazard and risk analysis reports

      E. Investigation/Analysis of all the failures during ground testing and the rectification/improvements to the system

      F. Build Standard of the prototype/Technology Demonstrator or SOP

      G. Quality assurance procedures

      H. Acceptance test procedures

      I. Flight test schedule

21.B4.18 Compliance with Type Certification Basis

Regulation

The Main Contractor shall provide to CEMILAC a compliance matrix prepared in line with the provisions specified in User Requirement, Technical Specification, TCB and Airworthiness Certification Plan.

Acceptable Means of Compliance

Main Contractor shall prepare a compliance matrix along with the supporting evidences for the scrutiny and approval by CEMILAC.

Guidance Material

Nil

21.B4.19 Application for RMTC/MTC Along with Type Records

Regulation

The ASDO/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/Type Record.

b. ASDO/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. Engine Requirement Specifications

   ii. Technical specifications of LRUs/Equipment

   iii. Design documents

   iv. Standard of Preparation (SOP) including Drawings and 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. Compliance statements to the specifications/Test schedule

Guidance Material

Nil

21.B4.20 Issue of Restricted Military Type Certificate (RMTC)/IOC

Regulation

RMTC/IOC for the Aero Engine 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 Aero Engine based on their operational requirements.

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, the Main Contractor shall provide substantiating evidence that there is no impact on air safety.

Guidance Material

Nil

21.B4.21 Issue of Military Type Certificate (MTC)/FOC

Regulation

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

Acceptable Means of Compliance

a. The Main Contractor (ASDO) shall be issued with a MTC when CEMILAC has accepted that the certification requirements have been fully satisfied and the Main Contractor has confirmed that his organisation 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. CEMILAC shall conduct a detailed verification of the compliance status prior to issue of the MTC & TCDS.

d. Review of certification evidence and compliance statement leading to generation of Type Certification Report (TCR)

Guidance Material

a. Type Record document includes description of the aero engine, its functional and performance characteristics, summary of strength and other calculations along with reserve factors, environmental envelope of operation and storage of the aero engine, 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.B4.22 Issue of Release to Service Documents (RSD) along with Manuals

Regulation

Main Contractor shall prepare the Technical publications/Manuals for engine and its subsystems 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 engine manuals is given in Annexure 21.B4.C - List of technical publications/manuals for engine/subsystem

21.B4.23 Production

Regulation

The Main Contractor 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 organisation capable of producing the engines.

Acceptable Means of Compliance

a. Main Contractor shall plan for Issue of Transfer of Technology (TOT) agreement or production planning with the due approvals from the TAA wherever required.

b. Main Contractor 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 Subpart C3.

c. For further details on production approval refer of Subpart F.

d. For further details on the organisation approvals refer Subpart G1 and Subpart G2.

21.B4.24 Changes Requiring SMTC/AMTC/New MTC

Regulation

For Major changes in the type certified engines, it shall require to undergo recertification programme in association with the TAA. Changes proposed to an already type certified Aero Engine shall be analysed and approved in the form of issue of Supplemental Military Type Certificate (SMTC) or Amended Military Type Certificate (AMTC) to the existing MTC.

Acceptable Means of Compliance

a. The designer shall submit details of the change incorporated to CEMILAC along with the criticality assessment.

b. 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.

d. Changes requiring issue of Supplemental 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.

Guidance Material

a. The following changes shall often require a new type certificate or amendment in type certificate;

   i. Outline

   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 D on the modifications approval

21.B4.25 Responsibilities of MTC Holder

Regulation

The Military Type Certificate holder should follow the conditions & limitations mentioned in type certificate to maintain the airworthiness status of the engine and its subsystems.

Acceptable Means of Compliance

a. All the conditions & limitations mentioned in type certificate are to be strictly adhered to.

b. Military Type Certificate 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 or based on the feedback from User Services, the Military Type Certificate earlier issued can be withdrawn.

Guidance Material

a. Generally the type certificate is not transferable.

b. The process frozen during development/qualification stage shall be followed for series production also. Changes, if any shall be implemented only after proper concurrence from CEMILAC.

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.B4.26 Transferability

Regulation

Type certificate issued to the Main Contractor for an aero engine is non-transferable. However, CEMILAC may consider transfer of MTC under very special circumstances.

Acceptable Means of Compliance

a. Generally, MTC Holder cannot transfer the MTC of the item issued to it to any other agency.

b. If a MTC or RMTC is to be transferred, the transfer shall be made only to an ASDO 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 TAA.

GUIDANCE MATERIAL

Following are some special circumstances when CEMILAC may consider transfer of MTC issued to ASDO for an Engine.

i. The MTC holder changing its name

ii. Changes to the Registered Address or Relocating their facility (i.e., Works).

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

iv. The acquired company (MTC Holder) continues to retain possession of the Design documents, Type Records and the responsibilities under the original MTC.

21.B4.27 DURATION AND CONTINUED VALIDITY

REGULATION

RMTC/MTC shall be valid for 5/10 years respectively. The MTC holder shall apply to CEMILAC to renew the MTC prior to its expiry.

ACCEPTABLE MEANS OF COMPLIANCE

a. The validity of the Military Type Certificate is generally 10 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 Military Type Certificate based on the information provided

GUIDANCE MATERIAL

Nil

21.B4.28 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.

Acceptable Means of Compliance

a. The ASDO 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 aero engine from Services.

b. All revisions to be properly updated and traceability to be maintained.

c. The designer/holder of the Military Type Certificate shall follow the documentation requirements to sustain type airworthiness of the aero engines.

Guidance Material

Nil

21.B4.29 Instructions for Sustaining Type Airworthiness (ISTA)

Regulation

Main Contractor shall ensure that complete set of Instructions for Sustaining Type Airworthiness (ISTA) are provided to the User Services.

Acceptable Means of Compliance

a. A programme showing how changes to the ISTA are promulgated should be submitted to CEMILAC by the Main Contractor .

b. Main Contractor should provide all the relevant ISTA to the User Services to keep the aero engine and its sub systems in an airworthy condition.

c. Variations to the ISTA should be made available by the aero engine Main Contractor to the User Services 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 maintenance, may be delayed until after the product has entered into service However, these 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.

ANNEXURE 21.B4.A

GUIDANCE MATERIAL ON AERO ENGINE DEVELOPMENT PROCESS

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.

Mechanical/Structural Design Analysis: The objective of the structural design as well as the factors to be considered are as given under:

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:

a. Fatigue Life [HCF & LCF, Creep]

b. Static Strength Margin

c. Vibration Analysis (No danger of flexural & torsional vibration for rotating components should be present)

d. Establishing critical speeds

e. Safety Margin/Design Margin

Factors to be considered during analysis:

a. Static/Dynamic Mechanical loads (on ground & flight)

b. Vibrating environment (HCF Cycling)

c. Max. temperature/Thermal loads

d. Corrosive environment

e. Manoeuvre loads (g-loads)

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. Addionally, establish by analysis the safety margins in case of undesirable/over speed/ over temperature conditions.

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.

Aero thermodynamic Design Analysis & Verification: The aero thermodynamics design should include the cycle calculations as well as the following analysis using CFD in case of critical components.

a. Cycle calculation & Analysis to establish the cycle parameters

b. Cycle efficiency at design and off-design conditions

c. Pressure, Temperature & Flow distribution

d. Pressure losses if any

Note: Pressure & temperature covering the entire flight envelope including corner points and hot day, cold & standard day conditions.

Aero thermodynamic design of Compressor, Combustion, Turbine, Afterburner and Exhaust Nozzle should be carried out specifying respective efficiencies and losses.

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.

Design Analysis Tools:

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. FMECA

b. Safety & Hazard Analysis

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. Preliminary Design Review (PDR)

b. Detail Design Review (DDR) on requirement basis

c. Critical Design Review (CDR)

Documents for submission:

The designer has to submit the following documents after the design is frozen:

a. Preliminary Design Review (PDR) Report

b. Critical Design Review (CDR) Report

c. Design Document of all the modules/components, systems, sub-systems, LRUs, control systems, etc.

d. Standard of Preparation (Illustrated Part List)

e A set of Engineering Drawings

f. Performance Cycle Deck (PCD) for the engine

ANNEXURE 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:

a. Preliminary Flight Rating (PFR) Tests

b. Initial Flight Release (IFR)

c. Final Flight Release (FFR)

d. Initial Service Release (ISR)

e. 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.

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 TAA.

ii. The designer shall plan and sequence the tests on components/systems/engine in concurrence of CEMILAC 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 CEMILAC.

v. Tests shall be carried out at Test benches/facilities/Rigs under the oversight surveillance of 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
a.	Externally applied forces
b.	Heat Rejection and Cooling test
c.	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.
d.	Engine performance verification
e.	Engine temperature Limits
f.	Vibration Limits
g.	Weight of residual fluids
h.	Reliability Analysis
i.	Engine noise signature at near and far field
j.	Materials and processes used
k.	List of adhesives and sealants used
l.	List of all protective treatments for corrosion protection
m.	EMI control plan and EMI test plan
n.	Inter-changeability: Matched and selected fit parts shall be identified and a proposed listing shall be provided.
o.	Engine Life: i. List of predicted structural lives, without repair or replacement, of all major life limiting engine components by engine module. A. Hot parts life B. Cold parts life C. Critical parts life D. HCF life E. LCF life ii. Demonstrate a safe life in service at which parts should be retired, or iii. Demonstrate that the item has a life significantly longer than the design target life. iv. 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.	Engine pressure balance analysis

q.	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: i. LCF duty cycle for the critical parts individual component tests (spin pit) and any full scale engine LCF testing ii. Cool down time between cycles, and iii. 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 mission hours equivalency shall also be defined.
r.	Vibration and stress analysis
s.	Wear rate analysis
t.	List of all potting compounds
u.	Infrared radiation (IR) signature analysis
v.	Details of Engine Wash System.
w.	Test article configuration
x.	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 Services. 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.

Table B2 - Typical PFR Tests – (For General Guidelines)

Sl. No.	Requirements	Demo	Test
a.	Engine dry weight	X	
b.	Power Lever Torque loads by measurement	X	
c.	Temperature Sensing System Calibration		X
d.	Engine Control System Calibration		X
e.	Engine Calibration. The procedure during the engine calibration shall be such as to establish the performance characteristics of the 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
f.	Customer Bleed Air Analysis		X
g.	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
h.	Engine inspection, maintenance and calibration after endurance test		X
i.	Engine Re-calibration		X
j.	Engine disassembly and inspection	X	
k.	Engine Component Tests shall be conducted on components conforming to the same parts list and configuration used on the PFR endurance test.		X
l.	Explosion proof test of all electrical components, including electrical connectors, not hermetically sealed shall be carried out		X
m.	Fuel pump altitude test		X
n.	Oil reservoir pressure test		X
o.	Fire test of lines, fittings and components, including engine furnished oil tank, which convey flammable fluids		X

p.	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 selected conditions within the flight envelope specified for the engine and at least those specified in the engine requirement 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.		X
q.	Structural tests: i. Engine Pressure Vessel/Case Verification.		X
r.	Rotor Integrity tests i. Over-speed test ii. Over-temperature test iii. Disk burst test		X
s.	Engine static load test		X
t.	Engine attitude test		X
u.	Engine pressure balance verification		X
w.	Heat Rejection and oil Cooling test	X	
x.	Engine electrical power failure tests		X
y.	Engine Vibration Survey	X	
z.	Bleed Air System test		X
aa.	Oil flow interruption Test		X
ab.	Verification of starting torque and speed requirements		X
ac.	Electromagnetic Interference and susceptibility test		X
ad.	Electromagnetic Pulse test		X
ae.	Lightning Test		X
af.	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-B1 and Table-B2 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 is 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 TAA.

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

a. Reports of all analyses specified in Table-B1 shall be submitted to CEMILAC prior to the initiation of PFR tests on engine

b. Reports of all the Tests in Table-B2 duly authenticated by DGAQA shall be submitted to CEMILAC

c. Reports of additional tests/analyses if any

d. Reports of all failures and problems encountered during the test

e. Reports of all inspections carried out prior, during and post-PFR

Guidance Material on Initial Flight Release

This phase of qualification is intended to clear the engine for safety of flight release. Initial Flight Release configuration of the engine shall incorporate changes identified during PFR phase.

Note:

a. 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.

b. Additional analyses, demonstrations and tests required for Initial Flight Release 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.

a. Altitude rating points

b. Transient operation

c. Functional Tests

d. Inlet distortion tests

e. Starts & restarts

f. Altitude windmilling test

Guiding Material on additional tests based on configuration upgradation

a. Accelerated Mission Test (AMT) (as applicable)

b. An AMT (as applicable) will be performed on the Initial Flight Release 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.

c. LCF Test (as applicable)

d. LCF test time must be at least twice the proposed/actual flight test time.

Gearbox Tests (as applicable)

a. Static Torque Test

b. Attitude Test

c. Endurance Test

d. Oil Interruption Test

Flying Test Bed (FTB) trials can also be carried out in Initial Flight Release .

Guidance Material on Full Flight Release (FFR)

FFR clears the engine for initial low rate production. FFR configuration incorporates changes suggested during Initial Flight Release .

Full altitude Qualification Test

Full altitude qualification is conducted during FFR covering

a. Steady state & transient performance

b. Air starts and relights

c. Alternate fuels

d. Compressor stability

e. Secondary flow, thermal mapping etc.

f. Hot and cold day tests

g. 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:

a. 300 hours at high temperature

b. 400 hours at room temperature

c. 300 hours at low temperature

Environmental Component Test (as applicable)

a. Humidity

b. Fungus

c. Explosion-Proof

d. Sand and Dust

e. Sustained Acceleration

f. Impact

g. Vibration

h. Ignition System Fouling

i. Carbon Fouling

j. Water Fouling

Individual Component Testing (as applicable)

a. Oil Reservoir: Cyclic fatigue test, proof pressure test, valve tests

b. Accessory Drive and power Takeoff

c. Generator/Alternator: Over speed, load test, containment test

d. Heat Exchangers

e. Fire Test

f. Hydraulic System

Engine Environmental and Ingestion Tests: (as applicable)

a. Sea Level High and low Temperature Tests

b. Starting and Acceleration Tests

c. Water Saturated Fuel Test

d. Environmental Icing Test

e. Corrosion Susceptibility

f. Bird Ingestion Test

g. Foreign Object Damage Test

h. Ice Ingestion Test

i. Sand and Dust Ingestion

j. Atmospheric Water Ingestion

k. Armament Gas Ingestion

l. Noise Survey

m. Exhaust Gas Emission

n. Exhaust Smoke Emission

o. Invisible Exhaust Mass Emissions

p. 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 Initial Flight Release)

a. Pressure vessels & case

b. Containment Test

c. Rotor Structural Integrity

d. Vibration and stress test

e. Gyroscopic test

f. Engine over-temperature control system test

g. 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 Un-manned Air Vehicles for flight trials. List of engine & system level tests are as given below:

Engine Level Tests:

a. Engine Performance/Ratings & correction
    i. Full & Part Throttle Performance tests
b. Starting Tests
    i. Start/Stop
    ii. Low temperature starting
c. Acceleration/Deceleration Tests
d. Calibration tests
e. Thermal Shock test
f Thermal Cycle tests
g. Over speed
h. Over temperature
i. AMT/Endurance/Mission Cycle Tests/TBO Validation Tests
j. Engine - Propeller System Tests
k. Vibration tests
l. Attitude Tests
m. Altitude Tests
n. Environmental tests
o. Any other tests as deemed necessary by Certification Authority.

System Level Tests:

Turbo Charger (TC) Tests:

a. TC performance on engine - On engine dynamometer
b. Temperature Survey Test - On engine dynamometer
c. Oil supply test - On engine dynamometer
d. Oil sealing capability test -- On engine dynamometer
e. TC : Vibration Tests -- On engine dynamometer
f. Burst test - TC Test Stand
g. Containment test - TC Test Stand
h. High Altitude trials- High altitude test set up
i. Endurance & cyclic durability - On engine dynamometer
j. Any other tests as deemed necessary by Certification Authority.

Propeller & Propeller Functioning Tests:

a. Propeller Functioning
b. Propeller Pitch Control
c. Feather & Un-feather
d. Reverse
e. Engine-Propeller Vibration tests
f. Any other tests as deemed necessary by Certification Authority.

FADEC:

a. Theoretical analysis of Control Law & Algorithm and demonstration by engine tests
b. Software IV & V
c. HILS testing
d. Any other tests as deemed necessary by Certification Authority.

ANNEXURE 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/IMATSOA

Rationale

Airborne Stores include all Parts & Appliances, Propellers, Airborne General Stores (AGS), Aero Materials, Armaments, Flying Clothing, Fuel Oil Lubricants (FOL), standard parts etc, used in an Air System. Process of development of Airborne Stores is normally initiated on specific requirements by the User Services. In addition, Government organisations, Public or Private Sector industries on their own may also initiate development activities considering the applicability of the same for the User Services or for export purpose. All Airborne Stores intended to be used in Air Systems of Indian Military Aviation shall be subjected to a certification and quality assurance process as agreed by the Technical Airworthiness Agencies (TAA), to ensure its Airworthiness.

On completion of design, development and evaluation of Airborne Stores including its associated software, and upon showing compliance with the agreed Type Approval Basis,(TAB) CEMILAC shall issue Type Approval/IMATSOA/LoA for the Airborne Stores, to the Design Organisation.

Standard/AGS Parts, for instance: fasteners, seals, bearings etc., generally have established drawing and established material standards/specifications. These drawing and material standards/specifications are internationally recognised. Hence, the use of these standard/AGS parts are based on the Certificate of Conformance (CoC) and Test Release Certificate (TRC) compliance to the established drawing and/or material standards/ specifications. The User of the standard parts shall mention the standard part number in the SOP and not the vendor specific part number. The user of the standard parts can carry out the supplier selection process to identify the supplier of the standard parts.

APPLICABILITY

a. This Subpart is applicable for the following types of development of Airborne Stores:

i. Ab-initio design and development of Airborne Stores, that can be classified as Line Replaceable Units (LRU) which includes Parts and Appliances, Accessories, Personnel Protective Equipment etc. leading to the issue of Type Approval. The regulations for such stores are covered under Subpart C1.

ii. Ab-initio development of Propellers for Air Systems leading to the issue of Type Approval. The regulations for such stores are covered under Subpart C1.

iii. Ab-initio development of Air Armament Stores and Air Launched Weapons (with the exception of Air Launched Missiles which are covered in Subpart B3) leading to the issue of Type Approval. The regulations for such stores are covered under Subpart C2.

iv. Ab-initio development of Airborne Stores, which includes materials, structural components, finished mechanical parts, electronic modules (may also be termed as SRU - Shop Replaceable Units), fuel, oil, lubricants etc leading to the issue of Letter of Approval (LoA). The regulations for such stores are covered under Subpart C3 & Subpart C4.

v. Ab-initio development of Airborne Stores for which an IMATSO exists. The regulations for such stores are covered under Subpart C5.

vi. Design, Development and Evaluation of Software&Complex Electronic Hardware (CEH) as a part of Airborne Avionic Systems. The regulations are covered under Subpart C6.

vii. Design, Development and Evaluation of re-usable /independent Software components and Complex Electronic Hardware (CEH) components. The regulations are covered under Subpart 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.

CONTENTS

SUBPART C
AB-INITIO DEVELOPMENT OF AIRBORNE STORES
LEADING TO TA/LoA/IMATSOA ---------- C-1

SUBPART C1
AB-INITIO DESIGN & DEVELOPMENT OF AIRBORNE STORES
LEADING TO ISSUE OF TYPE APPROVAL ---------- C1-1

SUBPART C2
AB-INITIO DESIGN & DEVELOPMENT OF AIR ARMAMENT
STORES AND AIR LAUNCHED WEAPONS LEADING TO
ISSUE OF TYPE APPROVAL ---------- C2-1

SUBPART C3
DEVELOPMENT OF AIRBORNE MATERIALS LEADING TO LoA --- C3-1

SUBPART C4
AB-INITIO DEVELOPMENT OF AIRBORNE STORES
LEADING TO LoA ---------- C4-1

SUBPART C5
AIRBORNE STORES, FOR WHICH IMATSO EXISTS,
LEADING TO IMATSO APPROVAL (IMATSOA) ---------- C5-1

SUBPART C6
AIRBORNE/GROUND SYSTEM SOFTWARE AND COMPLEX
ELECTRONIC HARDWARE (CEH) ---------- C6-1

Intentionally Left Blank

SUBPART C1
AB-INITIO DESIGN & DEVELOPMENT OF AIRBORNE STORES LEADING TO ISSUE OF TYPE APPROVAL

RATIONALE

All Line Replaceable Units (LRUs) shall have necessary approvals prior to its installation on the Air System. The airworthiness assessment process shall ensure that the store complies with the airworthiness standards applicable for the intended Air System. The applicant shall show this compliance through analysis, reviews, tests and demonstrations or through similarity with an already approved identical store.

Type Approval (TA) certifies that the store complies with the applicable Airworthiness Certification Criteria finalised for a specific type of Air System. However, the use of the Airborne Store on a particular Air System is based on the inclusion of such store in the build standard of that Air System with the approval of CEMILAC.

Intentionally Left Blank

CONTENTS

21.C1.1	**Applicability**	**C1-5**
21.C1.2	**User Requirements**	**C1-5**
21.C1.3	**Certification of Ab-initio Designed and Developed Airborne Stores**	**C1-6**
21.C1.4	**Application for Airworthiness Assessment Coverage of Airborne Store**	**C1-7**
21.C1.5	**Demonstration of Design Organisation (DO) capability**	**C1-8**
21.C1.6	**Criticality Classification of Airborne Stores**	**C1-9**
21.C1.7	**Airworthiness Certification Criteria**	**C1-9**
21.C1.8	**Type Approval Basis**	**C1-10**
21.C1.9	**Identification**	**C1-11**
21.C1.10	**Technical Specifications**	**C1-11**
21.C1.11	**Airworthiness Certification Plan (ACP)**	**C1-12**
21.C1.12	**Quality Assurance Plan**	**C1-13**
21.C1.13	**Configuration Control**	**C1-14**
21.C1.14	**Design and Development**	**C1-16**
21.C1.15	**Software and CEH Development**	**C1-16**
21.C1.16	**Test Rigs and Test Equipment**	**C1-17**
21.C1.17	**Test and Evaluation**	**C1-18**
21.C1.18	**Deviations**	**C1-19**
21.C1.19	**Defects During Development**	**C1-20**
21.C1.20	**Modification**	**C1-21**
21.C1.21	**Clearance for Integration**	**C1-21**
21.C1.22	**Flight Testing of Airborne Store**	**C1-23**
21.C1.23	**Issue of Provisional Clearance & Clearance for Service Use (CSU) of an Airborne Store**	**C1-24**
21.C1.24	**Compliance to Type Approval Basis**	**C1-25**
21.C1.25	**Application for TA along with Type Record**	**C1-25**
21.C1.26	**Issue of Type Approval**	**C1-26**
21.C1.27	**Transferability**	**C1-27**
21.C1.28	**Production of Airborne Stores**	**C1-27**
21.C1.29	**Duration and Continued Validity**	**C1-28**
21.C1.30	**Record Keeping**	**C1-29**

Intentionally Left Blank

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. The regulations brought in this Subpart may also be applied for the certification of Propellers for Air Systems.

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, for which certification coverage is provided by Indian TAA, shall also be cleared as per this Subpart. However, the clearance shall be issued in the form of BoI Clearance in accordance with Subpart N.

GUIDANCE MATERIAL

The scope of definition of Line Replaceable Units (LRU) includes mechanical, electrical, electronic appliances, equipment, Accessories and Personnel Protective Equipment. A combination of LRUs to realize a higher-level functionality at system level is also covered by this Subpart. For a system, a system level clearance needs to be issued along with the Type Approval of individual LRUs.

21.C1.2 USER REQUIREMENTS

REGULATION

Requirement for the Airborne Store shall either be a direct Service Qualitative Requirement (SQR) or derived from an Air System development process.

ACCEPTABLE MEANS OF COMPLIANCE

a. The requirement for the Airborne Store may be defined in a Service Qualitative Requirement (SQR) from the User Services (Staff).

b. The requirement may also be derived from an Air System design & development (as per Subpart B) or upgradation process (as per Subpart D) or from an indigenous substitution (as per Subpart K) process for Airborne Stores.

c. Store Design Organisations(SDO) on their own may initiate development of Airborne Stores, which has potential applications with Indian Military Services.

d. A Concept of Operation (CONOPS)/Operational Concept for the Airborne Store should be arrived at, based on the CONOPS of the intended Air System. The CONOPS would be the basis for selection of the applicable airworthiness criticality and carry out system safety assessment process to arrive at the Critically Level.

GUIDANCE MATERIAL

a. A feasibility study may be undertaken by the SDO to establish whether it is practicable to meet the requirements and also to identify the technical challenges 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 Air Systems 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 shall be in accordance with the regulations provided in this Subpart.

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 of 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. Phase 7 – Post Certification Activities

b. The Type Record 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 organisation(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.

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 in prescribed format.

b. Main Contractor shall apply to DGAQA for Quality Assurance (QA) coverage in the prescribed format.

GUIDANCE MATERIAL

a. Form 10 of IMTAR Forms.

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

21.C1.5 DEMONSTRATION OF DESIGN ORGANISATION (DO) CAPABILITY

REGULATION

The organisation 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 Organisation Approval (DOA) as per Subpart G1, or should be in the process of obtaining such approval.

b. The Main Contractor, shall apply to CEMILAC for DOA under the Design Organisation Approval Scheme (DOAS) for the scope of design activities in accordance with Subpart G1.

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 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 Organisation Approval Scheme (DOAS) - Subpart G1

c. QMS approval as per DGAQA guidelines

21.C1.6 CRITICALITY CLASSIFICATION OF AIRBORNE STORES

REGULATION

Criticality classification of Airborne Stores under development shall be carried out.

ACCEPTABLE MEANS OF COMPLIANCE

a. System Safety Assessment (SSA) carried out at the Air System level shall identify the criticality level applicable for the Airborne Store under development based upon its functional importance. The criticality level can be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of airborne store endangers the safety of the Air System or crew.

   ii. Mission Critical: The failure of the airborne store results in aborting the Air System mission.

   iii. Non-Critical: The failure of the airborne store does not endanger the safety of the Air System and crew nor does it result in aborting the mission.

b. Provisions of self-approval during the development of the airborne store shall be worked out based on the criticality classification of the airborne store so as to minimize stage-gated approvals to enhance process efficiency and accelerate D&D timelines.

c. For the Non-Critical Airborne Store, TAA shall enable self-approvals during Test & Evaluation phase.

d. Provisions related to airworthiness certification and quality assurance of such airborne store shall be identified during the initial stages itself and included in ACP and QAP respectively.

GUIDANCE MATERIAL

NIL

21.C1.7 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 CEH 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. The Special Conditions may contain such standards that the CEMILAC/DGAQA finds necessary to establish a level of safety, reliability 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 Stores 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.C1.8 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 should also be approved by CEMILAC.

b. TAB shall be effective for a period of 5 years from the date of approval. If Provisional Clearance (PC) /Type Approval (TA) is not achieved within that timeframe, a review

of the changes to the Airworthiness criteria /codes /standards that defined the TAB may be required to assess any shortfall of agreed TAB against contemporary requirements. Requirement for review of TAB shall be decided mutually between the Main Contractor and CEMILAC.

GUIDANCE MATERIAL

a. TAB should be arrived at based on the applicable Airworthiness Certification Criteria (21.C1.7) and Airborne Stores Technical Specification (21.C1.10).

b. TAB may also be derived from internationally available certification criteria documents.

c. 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 shall be provided by the Main Contractor and agreed upon by CEMILAC. The description of the means of compliance should be sufficient to determine that all necessary data will be collected and compliance can be demonstrated.

d. Main Contractor may form committees with stake holders to look in to the adequacy of the proposed TAB.

e. Compliance to TAB forms one of the basis for the issuance of TA and Clearance for Service Use.

21.C1.9 IDENTIFICATION

REGULATION

All Airborne Stores shall be properly and uniquely identified prior to the installation on Air Systems and delivery to the User Services.

ACCEPTABLE MEANS OF COMPLIANCE

Airborne Stores shall have identification as per Subpart Q.

GUIDANCE MATERIAL

Configuration control details of the project

21.C1.10 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 21.C1.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.C1.13).

21.C1.11 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 CEMILAC, the applicant shall prepare an 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 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/CEH considerations wherever applicable

   viii. Test equipment and Rigs

   ix. Route to Flight Testing – Safety of Flight (SOF)/Limited Qualification Tests/ Qualification Tests/Screening requirements

   x. Scope of Flight Test and details of Flight Test Agencies

21.C1.12 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.C1.13 Configuration Control

Regulation

The Store 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. Control of changes 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. The Configuration Control Board should also include the following members:

   i. Representative of Main Contractor responsible for design and development

   ii. Representative of Main Contractor responsible for Quality Assurance

   iii. Representative of Main Contractor responsible for manufacturing

   iv. Representative of CEMILAC

   v. Representative of DGAQA

   vi. Any external experts if required

GUIDANCE MATERIAL

a. Main Contractor to make a Configuration Management Plan(CMP) to fulfill 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 be 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) may 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.

g. If the Main Contractor is a DAO, then the minor changes as per the privileges can be taken up without the involvement of certification agencies.

21.C1.14 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. TAAs 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 (Refer Annexure 21.C1.A). A System Engineering Plan Document shall be prepared and the document shall elaborate the design and development life cycle activities, responsibilities and milestones.

b. Reviews like but not limited to Requirements Review, PDR, CDR shall be conducted for the stores/systems at appropriate stages of design and development.

c. Validated tools should be used if any of the Test & Evaluation activities are automated. 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 and in accordance with a QA process approved by DGAQA.

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, are elaborated in Annexure 21.C1.A to this Subpart.

b. For systems that have already been qualified for other platforms, TAB requirements shall be tailored accordingly while finalising the ACP.

21.C1.15 Software and CEH Development

Regulation

The development life cycle process for 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 which has embedded 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 given in Subpart C6.

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

Development and airworthiness evaluation of Software & CEH components shall follow the guidelines listed at Subpart C6.

21.C1.16 TEST RIGS AND TEST EQUIPMENT

REGULATION

Test Rigs and Test equipment used to demonstrate the compliance to Type Approval Basis (TAB) 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/CEH 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 different categories as per Subpart T.

   i. Used only during design and development

   ii. Used during production

   iii. Delivered to User Services

b. Quality Assurance directives issued by DGAQA may be followed for qualification and acceptance of ground based test systems.

21.C1.17 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 Air System and flight testing.

Acceptable Means of Compliance

a. Test Rig Specification, SOFTP/QTP and Functional Test Procedure (FTP) shall be prepared by the SDO and approved by CEMILAC before commencement of tests.

b. Self-approvals of test plans and procedures shall be enabled by CEMILAC for Non-Critical airborne stores and associated test rigs and TTGEs subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

c. Electrical and Bus ICD, Hardware Design Document and installation drawings shall be provided by the SDO to CEMILAC for reference.

d. Design changes, if necessary during the evaluation process shall be only with the concurrence of CEMILAC.

e. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne stores and associated test rigs and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

f. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

g. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for First Article Inspection for vendor / sub-contractors.

h. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

i. The test results and compliance chart, both endorsed by DGAQA shall be analysed by CEMILAC for issue of clearances.

Guidance Material

a. A detailed description of Test and Evaluation process is provided as Annexure 21.C1.B to this Subpart.

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 Reliability and Performance of the store.

c. When reviewing any test report or activity, the independent function of the Design Organisation should 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.C1.18 Deviations

Regulation

The Main Contractor shall establish a Non-Conformance Review Process to address the deviations observed in the realized system with respect to the baseline configuration during the design and development phase.

Acceptable Means of Compliance

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. 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

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 may be analyzed thoroughly by the Main Contractor and referred to CEMILAC for disposition. Deviations should be referred to CEMILAC in accordance with Form 53A.

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, reliability, 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.C1.19 DEFECTS DURING DEVELOPMENT

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 shall be responsible for convening and co-ordinating DI meeting.

b. DIC may co-opt expert members from external agencies if required.

c. The failed airborne store along with details regarding reported failure/defect shall be forwarded by Main Contractor to Defect Investigation Committee for thorough investigation.

d. Defect Investigation committee shall analyze the failure/defect and identify the reasons thereof and suggest remedial measures. These details should be endorsed in the defect investigation report and signatories to this report are members of the DIC.

e. Main Contractor should forward a modification proposal to CEMILAC based on the remedial measures suggested by the DIC as a Change Note.

f. Main Contractor along with CEMILAC will finalize the required modifications and evolve the evaluation mechanism for improvements to be implemented.

g. If the Defect Investigation results in the incorporation of any new requirements, same shall be referred to Configuration Control Boards (CCBs).

h. The Main Contractor shall compile failures/defects, their analysis and corrective action taken and forward to CEMILAC and DGAQA at regular intervals.

Guidance Material

a. The defects/failures shall be reported by the Main Contractor in appropriate formats.

b. After finalization of modification required and before implementation of modification, the documents configuration is to be managed through Configuration Control Board.

21.C1.20 Modification

Regulation

Modifications to the baseline configuration of the Airborne Stores during the design and development stages are to be properly evaluated and configuration controlled.

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 lead to some modifications in the baseline configuration.

b. Modification may also arise due to incorporation of new requirements, improvement in functionality, reliability, maintainability, testability etc.

c. Modifications cleared by the DIC or CCBs shall be documented by the Main Contractor/design organisation in the form of ECNs & SCNs during development stage.

d. Approved ECNs & SCNs by CEMILAC shall be the basis for incorporating changes in approved configurations.

e. Implementation of modification to be carried out by Main Contractor.

Guidance Material

All the ECNs and SCNs shall be absorbed and a revised baseline configuration document shall be prepared prior to finalising the Type Record document.

21.C1.21 Clearance for Integration

Regulation

Airborne Stores shall hold an Integration Clearance prior to installation on an Air System.

ACCEPTABLE MEANS OF COMPLIANCE

a. The acceptability of Design and Build Standard of the deliverable prototypes for installation & integration on Military Air Systems shall be approved by CEMILAC through an instrument named "Clearance for Aircraft/ Air System Integration".

b. Compliance Statement to mutually agreed requirements for issue of clearance for deliverable prototypes shall be signed by Main Contractor and DGAQA.

c. Airborne Stores shall be issued with a inspection note prior to integration on the Air System. inspection note shall be issued by DGAQA for integration on Air System based on the availability of Clearance for Aircraft/Air System Integration from CEMILAC.

d. On completion of Air System Integration checks, CEMILAC shall issue a Development Flight Clearance (DFC) for the Airborne Store, which shall subsequently form the basis for the Flight Testing of Air System.

GUIDANCE MATERIAL

a. After successful completion of analysis, simulation and testing on qualification prototypes as 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 Air System".

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 deliverable prototypes.

c. Clearance for Integration of the Airborne Store bearing a unique clearance number shall be issued by CEMILAC for the finalised build standard or for every Serial Number during initial phase of development as per the requirement.

d. The scope of clearance for deliverable prototypes shall be limited only to installation & integration of the store on Military Air Systems and not its flight trials. Clearance for flight trials of the store (DFC) shall be issued by CEMILAC on completion of necessary ground integration checks.

e. The Clearance for Aircraft/Air System Integration may contain the following details but not limited to:

f. Reference to the letter of Main Contractor requesting for issue of clearance

   i. Brief Introduction of the store

   ii. Clearance (Scope of the clearance)

   iii. Validity of the Clearance

   iv. Performance Feedback requirement

   v. 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

vi. Limitations of the Clearance, if any

vii. Conditions of Clearance

viii. Significant Technical Parameters

ix. Any other information deemed necessary

g. The inspection tag issued by quality assurance group / QCD of the Main Contractor based on DGAQA clearance for each serial number of the airborne store for development flight trial on receipt of Clearance for Aircraft/Air System Integration from CEMILAC and necessary acceptance criteria, shall be the basis for Aircraft Integration.

21.C1.22 Flight Testing of Airborne Store

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 (TAB).

Acceptable Means of Compliance

a. Flight testing is mandatory wherever the accepted Means of Compliance as a part of TAB necessitates to do so.

b. Flight testing shall be carried out in accordance to Regulations of Subpart P.

c. Airborne Store shall hold a Development Flight Clearance (DFC) from CEMILAC prior to the clearance of the Air System for flight testing.

d. The Flight Test Agencies shall provide a performance report to TAAs on completion of flight trials.

Guidance Material

a. Ground Testing of Airborne Store installed on Aircraft as per Means of Compliance finalised in TAB shall be completed.

b. A Flight Test Specification shall be prepared by Air System Integrator in coordination with the Main Contractor, flight test agencies and CEMILAC. The Specification shall be approved by CEMILAC.

21.C1.23 Issue of Provisional Clearance & Clearance for Service Use (CSU) of an Airborne Store

Regulation

a. The 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 Air System integrator, Main Contractor and CEMILAC.

b. An Airborne Store delivered to User Services for operational use shall have a Clearance for Service Use (CSU) accorded by CEMILAC

Acceptable Means of Compliance

a. The SDO shall be issued with a Provisional Clearance (PC) 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 initially valid for a period of two years. PC may be extended a maximum of two times with each extension having validity of one year, if Type Approval is not issued. Hence, the total period of PC including extensions should not exceed 4 years.

d. In cases of LRUs where hardware is developed by third party suppliers and software by Main Contractor/ design organisation, if any limited/series production requirements of the hardware is envisaged prior to flight trial completion, a Letter of Approval (LoA) as explained in Subpart C4 may be issued for the hardware part on completion of satisfactory performance evaluation.

e. CSU shall be the basis for operation of the Airborne Store by the User Services. Maintenance manuals, Manuals on TTGE, and all other documents/training requirements required for ensuring the Continuing Airworthiness shall be the part of the CSU.

f. The contents of the manuals shall be verified by the appropriate Design Organisations before issue of Clearance for Service Use for Airborne Store.

Guidance Material

a. An application for the issue of provisional clearance along with compliance details to TAB shall be forwarded to CEMILAC.

b. The evaluation as per ACP should be completed. Compliance report along with application for PC should be submitted by SDO.

c. 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.

d. The Main Contractor can approach CEMILAC for PC 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.C1.24 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 Record.

Acceptable Means of Compliance

a. The Main Contractor should prepare Airborne Store Type Record 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 Type Record with proper justification for their temporary/permanent acceptance.

21.C1.25 Application for TA along with Type Record

Regulation

An application for a TA shall be made by the Main Contractor along with supporting documents in the prescribed format.

Acceptable Means of Compliance

The application for TA shall be provided 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 Type Record to CEMILAC.

c. The data required for Type Record 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 Proforma

d. Wherever applicable, the supporting evidences to be approved by authorities responsible for the same.

21.C1.26 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 is 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.C1.27 TRANSFERABILITY

REGULATION

a. If a PC/TA is to be transferred, the transfer shall be made only to a Design Organisation which will be able to fulfil the responsibilities of PC/TA holder as defined.

b. The PC/TA shall not be transferred to a non-Indian entity.

ACCEPTABLE MEANS OF COMPLIANCE

a. Only CEMILAC is authorised to transfer a PC/TA if found appropriate. An application shall be submitted to CEMILAC for transfer of PC/TA.

b. PC/TA transfer should not be made when the same PC/TA is suspended or withdrawn by CEMILAC.

c. The PC/TA issued assumes usage in the Indian Environment only and needs to be redefined in scope for further transferability.

GUIDANCE MATERIAL

Nil

21.C1.28 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 SDO, is given at Annexure 21.C1.C.

c. TA is a design-cum-production certificate. Hence TA holder can take up production of Airborne Store after obtaining production organisation approval.

21.C1.29 DURATION AND CONTINUED VALIDITY

REGULATION

TA shall remain valid for 10 years to the conditions specified, subject to satisfactory Periodic Qualification Test (PQT) and Design Organisation 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 User Services shall be informed on suspension.

b. The SDO should inform the CEMILAC and User Services as soon as practicable when they are no longer able to meet the Type Approval Holder responsibilities.

c. It should be the responsibility of the Main Contractor to obtain feedback from User 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.

e. Main Contractor shall apply for TA renewal 6 months prior to its expiry along with updated Type Record.

f. Periodic Qualification Test (PQT) periodicity shall be as stipulated by DGAQA.

GUIDANCE MATERIAL

a. If the TA Certificate has been suspended, then the suspension should be revoked after ensuring corrective actions have been taken to mitigate the conditions that had resulted in the suspension of TA before the TA Certificate could be considered for renewal.

b. The Main Contractor should update the Type Record with the latest hardware and software modifications/updates which are approved in accordance with Subpart E.

c. The Main Contractor should prepare the updated Type Record 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 with the supporting documents as stipulated. However, renewal is mandatory at the time of revocation of a suspended TA

21.C1.30 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 SDO.

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 Authority Holding Sealed Particulars (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 need 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 the Main Contractor. Any changes to these documents are affected with the approval of CEMILAC after recommendation of DO.

ANNEXURE 21.C1.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:

A. Functional and performance requirements

B. Safety requirements

C. Environmental requirements

D. Applicable specifications and standards followed

E. Interface and Integration requirements

F. Maintainability requirements

G. Reliability Requirements

H. Lifing 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 Technical Specification needs 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 may be reviewed, if deemed necessary by Main Contractor and CEMILAC, by a Requirement Specification Review Committee consisting of members from:

A. Organisation originating requirements

B. User Service Rep

C. CEMILAC Rep

D. DGAQA Rep

E. Contractor responsible for design and development

F. Domain Experts

vi. The committee is to be constituted by Air System Integrator/Main Contractor and shall be chaired by a domain expert not part of organisation responsible for design and development activities.

b. Preliminary Design Review

i. PDR shall be a formal technical review and the objective of PDR is:

A. To have clear understanding of all the parameters of technical specification

B. To evolve the approach for implementation of design architecture to meet the entire technical specification.

C. To ensure complete testability of the accessory.

ii. Followings documents are required before PDR:

A. Approved Technical specification of Airborne Stores

B. Broad approach for implementation of design architecture/details prepared by contractor.

C. 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 working days prior to the date of the PDR meeting.

vi. Preliminary design documents may include following but not restricting to:

A. Preliminary design approach of store

B. Design study reports/results.

C. Functional flow diagram

D. Requirement allocation

E. Safety & security engineering considerations

F. Preliminary list of materials/parts and processes

G. Preliminary reliability/maintainability/availability data

H. Testing limitations and test facility availability

I. Weight & structure analysis

J. 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:

A. Contractor responsible for design and development

B. CEMILAC Rep

C. DGAQA Rep

D. User Services Rep (if applicable)

E. Domain Experts

F. Organisation originating requirements

ii. The committee is to be chaired by domain expert not part of organisation responsible for design and development activities.

d. Critical Design Review (CDR)

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

A. To establish baseline Standard of Preparation for facilitating fabrication of Airborne Stores.

B. Usage of Commercial-Off-The-Shelf (COTS) elements in the design and their impact on airworthiness to be assessed.

iv. Followings documents are required before CDR:

A. Approved Technical specification of Airborne Stores

B. Deatil approach for implementation of design architecture/details prepared by contractor.

C. 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 contractor.

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:

A. Design analysis/study reports/results.

B. Functional flow diagram

C. Design details

D. Safety & security engineering considerations

E. List of materials/parts and processes

F. Reliability/maintainability/availability data

G. Testing limitations and test facility details

H. Test rig and test procedure details

I. Component Build standard

J. Thermal design analysis & results

K. Prototype test results

L. Safety analysis

M. 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:

A. Contractor responsible for design and development

B. CEMILAC Rep

C. DGAQA Rep

D. User Services Rep (if applicable)

E. Domain Experts

F. Organisation originating requirements

ii. The committee is to be chaired by domain expert not part of organisation 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 encompasses information on assembly, subassembly, components, details of engineering drawings, materials, processes which can be applied consistently for manufacturing of Airborne Stores.

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 organisational 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 21.C1.B

TEST AND EVALUATION

a. Testing of Prototype Store

i. The Airborne Store need to be evaluated 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.

ii. 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.

iii. Mathematical modelling techniques are available for determining the cost effectiveness of alternative testing methods - and are essential when dealing with complex systems.

iv. 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.

v. An Airborne Store may be subjected to one of the following evaluation method prior to installation on the Air System

A. Safety of Flight Test

B. Limited Qualification Test

C. Full Qualification tests

vi. The Certification plan shall clearly specify the steps to be followed prior to installation of the store on Air System. Wherever possible Safety of Flight Test approach shall be followed prior to flight trials for development evaluation.

vii. Qualification tests on the unit to be carried out only after achieving adequate level of safety, reliability and performance. However, depending on the criticality of the store, CEMILAC shall decide on the necessary tests and the same shall be included in the Certification Plan.

viii. Functional/Safety of Flight/Qualification Test procedure document shall be prepared by the Designer and approved by CEMILAC.

ix. When more than one unit is necessary for carrying out development flight trials, the additional units shall be subjected to necessary screening and functional checks. The Test procedure document for such evaluation shall be approved by CEMILAC.

x. A Test Adequacy Review Board (TARB) may be constituted by the Main Contractor in consultation with CEMILAC at an appropriate stage to establish the adequacy and completeness of the qualification test requirements of an airborne store when deemed necessary (e.g., for an airborne store involving complex technologies or a store

designed with new technologies which are not developed /certified in the past etc.). Constitution of TARB is not mandatory for all airborne stores under development. Further, TARB is applicable for D&D Phase only

b. Qualification Testing

i. Prototypes built as per the approved Standard of Preparation shall be subjected to detailed qualification testing as per the test document approved by CEMILAC.

ii. The test document for testing of qualification prototypes shall be evolved by the Main Contractor in accordance with the existing Organisational Practices. It may be named as Qualification Test Plan/Qualification Test Procedure/ Type Test Schedule.

iii. 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.

iv. Self-approvals of test plans and procedures shall be enabled by CEMILAC for Non-Critical airborne stores subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

v. 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:-

A. Details of unit to be tested

B. Standard of Preparation of test unit

C. Objective of the tests

D. Applicable guiding standards for conduct of tests

E. Functional and performance tests

F. Environmental tests

G. Strength and life building tests

H. Special tests required for the unit

I. Number of samples to be tested, distribution of test for each sample and sequence of tests if required

J. Test conditions and limitations

K. Procedures for each of the tests

L. Parameters required to be measured during testing

M. Instrumentation required for testing

N. Pass-Fail criteria for each of the tests

O. Schematics of test rigs and special equipment etc

vi. 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.

vii. All the test shall be witnessed by DGAQA. However, DGAQA may delegate certain responsibilities to internal QA depending on their approval status. All the test reports shall be duly coordinated by ORDAQA/DGAQA.

viii. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne stores through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

ix. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for First Article Inspection for vendor / sub-contractors.

x. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

xi. Compliance statement to the approved test document shall be duly signed by Main Contractor and CEMILAC.

xii. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

c. Test Readiness Review

i. 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.

ii. Go-ahead for conduct of testing by the Test Readiness Review Committee after closure of all action points.

iii. 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.

iv. 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.

d. Constitution of Test Readiness Review Committee

i. 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.

ii. 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 also co-opt external experts, if required.

iii. Rep of Design Department of Main Contractor shall convene the meetings of TRRC and chair the meetings.

e. Testing of Prototype Deliverables

i. 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.

ii. Test document for prototype deliverables to validate quality of manufacturing and assembly through functional and performance tests to be approved by CEMILAC.

iii. Test reports for each test to be duly coordinated by ORDAQA/DGAQA.

ANNEXURE 21.C1.C

PROCEDURE FOR TRANSFER OF TECHNOLOGY OF AIRBORNE STORE

a. Airborne Stores after its acceptance by User Services and issue of PC/TA, has to be produced in required numbers. In some cases 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 during the production TOT in such cases. CEMILAC Airworthiness Directive on TOT brings out the procedure for TOT and requirements thereof in greater details.

b. Identification of production agency

DO will identify the production agency by following the process as given below:

i. Assessment of production agency

DO will assess the organisation and infrastructure of the PO in respect of the following by forming a team for the purpose. Suggested team composition is given below:

A. DO (Project officer): Team leader

B. QA representative of design agency

C. CEMILAC

D. DGAQA

E. User Representative

ii. Team should assess the production agency in respect of the following:

A. Commitment of management to acquire technology and know how

B. Well defined organisation and track record

C. Adequacy of specified plant, machinery for production and scope of expansion

D. Adequacy of suitable testing facilities

E. Adequacy of qualified personnel

F. Procedure for document and data control

G. Any other points

c. Business Agreement

Once firm (PO) is assessed and recommended for TOT, a business agreement may be made between the DO & PO.

d. 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. Lifing details
xvii. Packaging, handling and storage instructions

e. 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.

f. Repeat Type Test

To evaluate the technology absorption by PO, repeat type test are essential. Design Organisation will formulate the repeat type test schedule and seek approval from CEMILAC. On completion of the repeat type test CEMILAC may issue necessary clearance. Necessary changes to Type Approval shall be taken up by design agency.

g. 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 repeat type test and issue 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.

Intentionally Left Blank

CONTENTS

21.C2.1	**Applicability**	**C2-5**
21.C2.2	**User Requirements**	**C2-5**
21.C2.3	**Certification of Ab-initio Designed and Developed Air Armament Stores and Air Launched Weapons**	**C2-6**
21.C2.4	**Identification**	**C2-7**
21.C2.5	**Technical Specifications**	**C2-7**
21.C2.6	**Airworthiness Certification Plan (ACP)**	**C2-8**
21.C2.7	**Quality Assurance Plan**	**C2-9**
21.C2.8	**Flight Testing**	**C2-10**
21.C2.9	**Production of Air Armament Stores and Air Launched Weapons**	**C2-11**

Intentionally Left Blank

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 Air Systems.

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.

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 Bought Out Item (BOI) clearance.

GUIDANCE MATERIAL

Nil

21.C2.2 USER REQUIREMENTS

REGULATION

Requirement for the Air Armament Stores and Air Launched Weapons shall be resulting from a Staff Qualitative Requirement (SQR) or from an Air System 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 Staff Qualitative Requirement (SQR) from the User Services.

b. The requirement may also be derived from an Air System 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 Air System. The CONOPS should also be the basis for selection of the Applicable Airworthiness Certification Criteria 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 Air Systems 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 Activities shall be in accordance with the regulations provided at Subpart C1 unless specifically elaborated here.

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 seven 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 Record 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 Subpart 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 organisation(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.

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.

c. The document to specify the systems and details of architecture and top level specifications and interfaces that shall meet the user requirements.

d. Detailed technical specification by the design agency is the starting point for progression of the activities in regard 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

e. 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 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

vi. Artefacts/documents generated at each stage

vii. Software/CEH 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

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

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 Certification Basis.

ACCEPTABLE MEANS OF COMPLIANCE

a. Flight testing should be done in accordance with 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 Airborne Stores.

ACCEPTABLE MEANS OF COMPLIANCE

a. Design organisation shall apply for PC/TA to CEMILAC in accordance with regulations provided at 21.C1.23 & 21.C1.25.

b. Production of Airborne Store shall be as per provisions given in Subpart F.

c. In case the Production agency and Design Organisation are different, the Procedure to be followed for Production Transfer of Technology is detailed at Annexure 21.C1.C to Subpart C1.

GUIDANCE MATERIAL

a. Production organisation Approval Process.

b. Often design & development agency and production agency are not same. Hence production needs to be established at new production agency.

Intentionally Left Blank

SUBPART C3
DEVELOPMENT OF AIRBORNE MATERIALS LEADING TO LoA

RATIONALE

Airborne Stores such as materials that are developed independently and form the parts of other Line Replaceable Units (LRUs) may be issued with a Letter of Approval (LoA).

APPLICABILITY

This Subpart is applicable for the materials for Ab-initio Development and Indigenous Substitution, License Production and Bought-out categories.

CONTENTS

21.C3.1 Certification of Ab-initio Developed and Indigenous Substituted Military Airborne Materials---------- C3-4

21.C3.2 Certification of Military Airborne Materials for Licensed Projects---------- C3-27

21.C3.3 Clearance of Bought-out Military Airborne Materials ---------- C3-28

INTRODUCTION

Materials are the backbone for Airframe, Landing gear, Aero engines components, Airborne missile and Stealth applications. Materials are broadly defined as Metallic alloys, Polymers (Plastics, Elastomers, Resins and Fibres), Ceramics, Composites and Airborne consumables. Composites are further classified based on the Matrix: Metal Matrix (MMC), Polymer Matrix (PMC) and Ceramic Matrix (CMC), and also 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 and consists of following

   i. Mill forms such as Ingots, Rolled bars, Forged bars used as feed stock for semi-finished products

   ii. Semi-finished / Un-finished products such as Forgings, Castings Rolled rings, etc,

   iii. Mill forms/ Bar stock MMC based brake pads

b. Polymers, 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. FOL (Fuel, Oil, Lubricants), Paints, Coatings, Adhesives, FOL additives and so on are grouped as Airborne consumables.

The reason for including Airborne consumables under the material category is to make a simple, concise and unified regulatory approach for the entire gamut of materials.

Since Materials are used to manufacture components for LRUs, subsystems and systems and cleared as part of system and sub-system levels, Type Approval (TA) is not issued for the Materials. Therefore, military airborne materials that are intended to be used on military air systems shall be issued with a Letter of Approval (LoA)/ Provisional Clearance before their Release To Service (RTS) by the Main contractor/Designer/User.

The traceability for Materials starts from Alloy making (casting ingots) for castings, final melt of ingots for Forging Stock, Compound preparation for elastomers, Sintered material for powder metallurgy parts and in case of additive manufacturing it shall be powder manufacturing.

Bill of Materials (BOM) for Ingredients / master alloys / base metals/ chemicals etc. is to be part of the Process Control Document (PCD).

CONTENTS

21.C3.1.1 Applicability ---------- C3-7
21.C3.1.2 Eligibility ---------- C3-7
21.C3.1.3 Certification of Ab-initio Designed and Developed and Indigenous Substituted Airborne Materials - C3-8
21.C3.1.4 Application for Airworthiness Assessment of Airborne Materials ---------- C3-9
21.C3.1.5 Airworthiness Certification Criteria ---------- C3-9
21.C3.1.6 Certification Basis ---------- C3-10
21.C3.1.7 Identification ---------- C3-11
21.C3.1.8 Test Schedule/Technical Specifications ---------- C3-11
21.C3.1.9 Airworthiness Certification Plan (ACP) and Certification Procedure ---------- C3-11
21.C3.1.10 Quality Assurance Plan (QAP) ---------- C3-15
21.C3.1.11 Design and Development (Part/Process) ---------- C3-16
21.C3.1.12 Test and Evaluation ---------- C3-17
21.C3.1.13 Deviations ---------- C3-18
21.C3.1.14 Configuration Control ---------- C3-19
21.C3.1.15 Provisional Clearance ---------- C3-19
21.C3.1.16 Compliance with the Certification Basis ---------- C3-20
21.C3.1.17 Issue of LoA ---------- C3-21
21.C3.1.18 Production of Airborne Stores ---------- C3-21
21.C3.1.19 Production Permit ---------- C3-22
21.C3.1.20 Defects in Service ---------- C3-22
21.C3.1.21 Amendment to a LoA ---------- C3-23
21.C3.1.22 Responsibility of the LoA Holder ---------- C3-23
21.C3.1.23 Transferability ---------- C3-24
21.C3.1.24 Duration and Continued Validity ---------- C3-24
21.C3.1.25 Record Keeping and Audit ---------- C3-25
21.C3.1.26 Manuals ---------- C3-25
21.C3.1.27 Instructions for Sustaining Airworthiness ---------- C3-26

Intentionally Left Blank

21.C3.1 Certification of Ab-initio Developed and Indigenous Substituted Military Airborne Materials

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 Schedule 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 to DGAQA / concerned QA authorities for the development of materials 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. This agency will be called the Design and Development Organisation or Main Contractor.

Guidance Material

Nil

21.C3.1.3 Certification of Ab-initio Designed and Developed and Indigenous Substituted Airborne Materials

Regulation

a. Ab-initio designed and developed & Indigenously Substituted materials that are intended to be used in Indian Military Air Systems shall be Airworthiness Certified by CEMILAC.

b. Such Airborne materials shall hold a valid LoA/ Provisional Clearance.

Acceptable Means of Compliance

a. The approach to Certification and 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/Competent QA Authority shall be responsible for the Quality Assurance during design & development as well as production.

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 to the Airworthiness Certification Plan (ACP)

   iii. Phase 3 - Agree to the Quality Assurance Plan

   iv. Phase 4 - Demonstrate compliance with the CB

   v. Phase 5 - Review of Certification Evidence

   vi. Phase6- Issue of Provisional Clearance (PC) / LoA for critical materials and LTCC clearance for non-critical materials.

b. Successful completion of the certification phases for a new Airborne Material will result in CEMILAC issuing a PC / LoA to the Design and Development Organisation.

c. A Provisional Clearance / LoA will certify that the critical Airborne Material:

   i. Has been designed and developed by the organisation(s).

   ii. Meets the approved test schedule/technical specification.

   iii. Is supported by appropriate test reports and technical information such as process sheet /process control document, part and process design details etc., whichever is applicable to the class of the material.

21.C3.1.4 Application for Airworthiness Assessment of Airborne Materials

Regulation

An application for Certification and QA coverage respectively to CEMILAC & DGAQA/ Competent QA Authority shall be made by the Main Contractor in appropriate IMTAR 21 form.

Acceptable Means of Compliance

a. Main Contractor shall apply to CEMILAC for Airworthiness certification coverage.

b. Main Contractor shall apply to DGAQA/Competent QA Authority 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 (if applicable)
   iv. Timelines for the development
   v. Scope of the development
   vi. Any special conditions

21.C3.1.5 Airworthiness Certification Criteria

Regulation

DGAQA/Competent QA Authority shall ensure that the airborne materials are as per CEMILAC approved test schedule, & applicable specification / standard and drawing (if applicable).

Acceptable Means of Compliance

Airborne Materials should be developed to the test schedule/applicable specification, Process control Document and drawing (if applicable) approved by CEMILAC.

Guidance Material

a. Material is generally developed to the National and International aeronautical standards and specifications and/or the qualification criteria specified by the TAA in association with the Main contractor/designer/user and Customer.

b. Cases where the aeronautical specifications or standards are not available or incomplete in ensuring the airworthiness, Test schedule 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 TAA.

d. Case where the acceptance criteria for the particular test is not available from the standards/specifications or relaxation foreseen, may be finalized in LTCC. However, in order to continue the development and use of the material, Provisional Clearance 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 schedule.

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 PC/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).

b. Main Contractor shall also specify the way of compliance to every requirement listed in the CB. The description shall include 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. CEMILAC should 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 to the extent applicable 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 SCHEDULE/TECHNICAL SPECIFICATIONS

REGULATION

The Main Contractor shall bring out the detailed technical specification / test schedule that meets the User requirements.

ACCEPTABLE MEANS OF COMPLIANCE

a. Test schedule 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 an Airworthiness Certification Plan (ACP) that shall include the means to demonstrate compliance with applicable Airworthiness standards/specification depending on the criticality classification.

CRITICALITY CLASSIFICATION

The criticality level can be Safety Critical, Mission Critical or Non-Critical depending on the end use. For the Non-Critical Airborne Store, TAA shall enable self-approvals

during Test & Evaluation phase so as to minimise stage-gated approvals to enhance process efficiency and accelerate D&D (Design & Development) agency timelines. Provisions related to airworthiness certification and quality assurance of such airborne materials shall be identified during the initial stages itself and included in ACP and QAP respectively.

Acceptable Means of Compliance

a. The applicant shall provide a certification plan for material development.

b. The airworthiness 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) meeting should be conducted to finalize the Airworthiness Certification Plan.

d. The ACP should be approved by the CEMILAC after discussing in LTCC Meeting before compliance demonstration commences and updated as necessary during the Certification process.

Guidance Material

a. ACP contains, in general, the following:

   i. Description of intended use of the material

   ii. Applicable aerospace material standards

   iii. Process Control Document and relevant documents

   iv. Applicable international material/Process standards/specifications

   v. Metallic material (if applicable) /Semi finished metallic component design criteria form

   vi. The input data sheet / forms for C/C composite brake pads, Composites / Ceramic Components, Metal Matrix /Polymer Matrix Composite Brake Pads, Nonmetallic materials and components, Paints and Coatings, FOL (if applicable).

   vii. Classification of Aeronautical Materials as per Table 1 (if applicable)

   viii. Test schedule

   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 (safety and mission)	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

a. The mill forms, Un/Semi-finished or directly machined components from feed stocks or mill forms, non-metallic materials and Airborne consumables are considered as critical or non critical based on its function as per Table 1.

b. Mill forms/non-metallic materials/Airborne consumables developed to National/ International specification (where user EOI is not there) are considered as critical since they are not specific to project / platform and the relevant IMTAR Form is not required.

c. Non-metallic materials or airborne consumables (where user EOI is there) developed to test schedule are classified as critical / non critical based on its function as per Table 1 and the relevant IMTAR form is required.

d. Important documents to conduct LTCC for the certification of non-metallic materials/ airborne consumables are type test schedule / specification and process control document.

e. The classification should be finalized by the main contractor in consultation with the user/ user services and duly approved by the CEMILAC.

f. Once the criticality is finalized, the Main Contractor proposes the raw material/ ingredient list, drawing, draft/type test schedule, draft 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).

g. The constitution of LTCC is given in Configuration Control Subpart 21.K.4

h. The LTCC committee discusses the airworthiness qualification test requirements for the materials.

i. The first step in the certification process is the raw material/ingredients 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/ airborne consumables along with the certificate of conformance (CoC) and/or test release certificate (TRC) from OEM to the appropriate raw material/Ingredient standards/ specifications if procured from abroad or India. CoC and/or TRC are referred as documents, which contains statement of conformance to relevant specifications in the condition of supply of the material. The content of such documents shall be a statement of conformance to specification and results of tests carried out to demonstrate the conformance to the specification. The document can be a combination of conformance statement and compilation of test results or independent documents.

Documents can be in the form of Certificate of Conformance/QA certificate/ Test certificate/Certificate of analysis/Result of analysis/Declaration of conformance/ Approved certificate/Conformance certificate/Mill test certificate. But in the case of un/semi-finished/directly machined metallic components, the mill form is the raw material to produce them and LoA should be produced, if procured from India. CoC and/or TRC from OEM as stated above should normally be considered adequate for usage to produce semi-finished components and / or directly machined parts from material procured from abroad / and cases where the CoC and/or TRC as stated above are not adequately covering the applicable national / international material specifications, test schedule shall be prepared by Main Contractor in consultation with TAA, in order to adequately cover the shortcomings in the CoC and/or TRC as stated above, as decided by TAA. For Airborne consumables / non-metallic materials where standards/specifications for ingredients are not available; the acceptance criteria to be defined in the Process Control Document.

j. If any of these documents (CoC and/or TRC as stated earlier, LoA) is not available for raw materials at the time of LTCC meeting, the Main Contractor should at least submit the documents (as mentioned above) to the TAA before beginning the processing of the mill form/un/semi-finished/directly machined components/non-metallic materials and components, airborne consumables.

k. After the essential process and testing criteria to ensure airworthiness is evolved, the sampling basis 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 of any dispute in the sampling basis, the decision given by TAA is final. Small pilot test batches can be prepared for development /certification purpose for freezing of process parameters. Actual production batches can thereafter be scaled up based on approved process & certification. Further, for non-critical materials, single batch/heat/melt may suffice for certification purpose provided the freezing of process parameters is achieved using single batch/heat/melt. In case the same is not achieved, the Main Contractor shall be prepared for usage of more than one (up to maximum three) batch/heat/melt.

l. In the event of non-availability of acceptance criteria, following reference documents may be referred to analyze property data in order to derive statistically design allowable for military airborne structures.

   i. MMPDS (Metallic Materials Properties Development and Standardization) Handbook (www.mmpds.org)

   ii. MIL-HDBK-17 (5 Vols) for Composite Materials

m. The process documents, drawing, and test schedule for the development stage prepared by the Main Contractor will be approved by CEMILAC. DGAQA/ Competent QA Authority shall concurrently approve the ATP (Acceptance Test Plan) for the production stage in a time-bound manner within one month after the receipt of all the details. ATP can be either the test schedule approved by the CEMILAC as it is or sub-set of it as decided by DGAQA/Competent QA Authority.

n. In general, TAA is expected to participate and coordinate the process and test conducted by the Main Contractor during certification/concurrent development and certification activity. TAA may delegate the witnessing role to the Main Contractor. But the process compliance report and test compliance report should be coordinated by the DGAQA/Competent QA Authority.

o. Airborne materials for critical components are to be issued with LoA. Non-critical airborne materials are cleared in LTCC for production.

p. The Main Contractor has to submit the documents and the application form for LoA for the critical airborne materials to the CEMILAC for the LoA clearance.

q. The list of documents in the case of semi-finished components, in general include CoC and/or TRC from OEM as stated above 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.

r. In cases where long cycle testing is pending or machining feedback, fitment/ functional feedback for metallic and nonmetallic materials or flight performance for airborne consumables (whichever is applicable for the particular class of material) is not available, the Main Contractor can apply for Provisional Clearance for the critical airborne materials. This allows the use of material for the fabrication of subsystems/ systems/assemblies/LRUs or prototype trials or further evaluation on the platform. The Provisional Clearance must stipulate the limitation and safety issues, if any.

s. CEMILAC will study and verify all documents compliance to the approved drawing, approved process document, approved test schedule/National/International standard material specification and accord clearance for provisional clearance or LoA for the critical airborne materials depending on the request from the Main Contractor.

t. The validity of the Provisional Clearance and LoA for the critical airborne materials is given in respective Subpart sections. Based on the LoA issued for the critical airborne materials, DGAQA/Competent QA Authority can clear the critical airborne materials for bulk production. Figure C3.1 presents the certification flow chart for the materials.

21.C3.1.10 Quality Assurance Plan (QAP)

Regulation

The Main Contractor shall propose to the DGAQA/Competent QA Authority Quality Assurance Plan that shall include the QA milestones and activities.

Acceptable Means of Compliance

a. The QAP should be approved by the DGAQA / Competent QA Authority before the production commences and can be updated as necessary during the Design, Development and Acceptance process.

b. Any changes in the QAP should be intimated by the Main Contractor to the DGAQA Competent QA Authority 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, QA measuring, and test equipment control, Nonconforming material control, Corrective and preventive actions, handling and storage, In-service feedback, quality escapes, if applicable and Issuing authorized release documents.

b. QAP shall normally be prepared based on mutually agreed national and international quality assurance standards/specifications, CEMILAC approved test schedule, Process control Documents.

21.C3.1.11 DESIGN AND DEVELOPMENT (PART/PROCESS)

REGULATION

a. The Main Contractor shall have a design and development process document 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 (for semi-finished components) 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, Subpart 21.C3.

c. Part design of metallic or non-metallic based semi-finished components 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 ṬAA.

e. Process document should contain a Process Flowchart indicating the sequence of all manufacturing/processing steps from raw material/ingredients to final dispatch of the metallic/non-metallic material/airborne 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, 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.

Acceptable Means of Compliance

a. The Main Contractor to 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 would be the approving authority for the test schedule of the material being developed.

c. The laboratory in which testing carried out should possess accreditation from National Aerospace and Defence Contractors Accreditation Program (NADCAP) / National Accreditation Board for Testing and Calibration Laboratories (NABL) or approval of DGAQA.

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 QA, or review any report necessary to determine compliance with the test schedule, drawing and process documents.

f. The Main Contractor should provide access for the TAA to make QA 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.

g. The test plans and procedure documents that includes QTP, and other tests deemed necessary as planned in the ACP shall be reviewed and approved by CEMILAC in a time-bound manner within 2-3 months after the receipt of all the details. CEMILAC may seek review from subject matter experts for ensuring adequacy of the test coverage towards meeting the airworthiness requirements. Self-approvals of test plan and procedures shall be enabled by CEMILAC for Non-Critical airborne materials and associated test rigs and TTGEs subject to test adequacy being ensured. The

right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the certification requirements.

h. The Main Contractor shall involve DGAQA for participation during the testing as planned in the ACP and D&D QAP document. The test reports shall be approved by DGAQA. Self-approvals in quality assurance requirements shall be enabled by DGAQA for Non-Critical airborne materials and associated test rigs and TTGEs through AFQMS. The right to self-approvals can be revoked for a certain duration if the Main Contractor repeatedly fails to meet the quality assurance requirements.

i. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

j. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 (First Article Inspection) for vendor / sub-contractors.

k. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals. Main contractor has to provide the Infrastructure for digitization of all documents during D&D and production.

GUIDANCE MATERIAL

a. NADCAP accreditaton and AS 9100 certification are preferable for the organization involved in the chemical processing, coatings, nonconventional machining, heat treating, non- destructive testing activities to produce the metallic or non-metallic materials and components and consumables.

b. The TAA has the right of access to any report or 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 schedule and process documents before the issue of Provisional Clearance 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 production permit as given 21.C3.1.19, failing which, the material is rejected on the ground of major deviation which may lead to endangering the safe operation of the Air System.

b. Suppose, the deviation is observed after the issue of Provisional Clearance 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 with the approval of CEMILAC and corresponding documents should be amended accordingly. Also, Provisional Clearance 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 TAA.

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/indigenisation should be discussed in the LTCC

b. The LTCC constitution should be as per Subpart 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 Subpart 21.C3.1.

21.C3.1.15 PROVISIONAL CLEARANCE

REGULATION

a. The cases when the long term properties (long cycle time tests such as fatigue, creep, stress corrosion cracking etc in case of metallic/non metallic materials and long term storage tests, operational life assessment tests in case of Airborne consumables) as per the test schedule/specification/applicable document is under progress but the project PDC demands the material for further processing or functional testing, Provisional Clearance along with clearly defined limitations shall be given based on meeting short term properties (Short time taking tests such as Microstructure, Chemistry,

Tensile, Impact, etc.) as per the specification/test schedule and other requirements to the test schedule, drawing and process control document.

b. Operational life assessment of Oils and Lubes will be decided and mutually agreed by TAA, Design & Development agency/Main contractor along with user services during the development phase. The life assessment tests will be stipulated in the Provisional clearance by CEMILAC.

c. This clearance shall be applicable for the fabrication of finished components and/ or for allowing assembly and functional tests or evaluation on the platform.

ACCEPTABLE MEANS OF COMPLIANCE

a. CEMILAC should issue Provisional Clearance to the Main Contractor when all submitted reports except long term test requirements have satisfied the requirements of the test schedule, drawing and process sheet. Provisional Clearance shall allow the metallic materials for the production provided all the testing complied to qualification test schedule/test specification, drawing requirements and ACP.

b. Provisional Clearance for the critical airborne materials should be the basis for DGAQA/Competent QA Authority to clear the material for further processing/ functional testing.

c. Provisional Clearance should normally be issued for 2 years and if requested by the Main Contractor, a subsequent extension for 2 years is given prior to the issue of LoA. In other words, the total period of Provisional Clearance including extension should not exceed 4 years.

d. Failure to convert to LoA within 4 years from the date of issue of provisional clearance would result in revoking the Provisional Clearance 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 schedule 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 ACP followed during the design and development should also be submitted to the CEMILAC.

c. Non-compliances to CB and ACP 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/Competent QA Authority (involved during processing/testing) should comply to the approved test schedule and drawing (if applicable).

c. All dimensions should meet the approved drawing.

d. Machining and fitment test feedback for the un or semi-finished metallic or non-metallic materials (if applicable) should be satisfactory. Report of No adverse feedback on the metallic, non-metallic materials and Airborne consumables shall also be treated as a positive feedback to issue LoA.

e. LoA should be given for 10 years with periodic submission of compliance report by the firm every five years.

f. The Main Contractor should normally apply for the renewal before 6months of the expiry.

g. 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 schedule, approved drawing, approved process documents (whichever applicable), functional and user requirements.

21.C3.1.18 PRODUCTION OF AIRBORNE STORES

REGULATION

Bulk production of the Airborne Materials may be taken up by a Production Organisation on Receipt of LoA for the respective airborne materials.

ACCEPTABLE MEANS OF COMPLIANCE

a. LoA holder should take up production of the Airborne Store in consulation with Main contractor.

b. If the LoA holder and Production Organization are different, necessary Transfer of Technology should be carried out.

c. Airborne materials produced post certification shall be accepted, by all the organisations using these materials, either based on the CoC & TRC issued by the Main Contractors producing these materials or by utilising Third Party Inspectors (TPIs) as per approved BOM.

GUIDANCE MATERIAL

Nil

21.C3.1.19 PRODUCTION PERMIT

REGULATION

DGAQA/Competent QA Authority shall issue the production permit, on the basis of a request from the Main Contractor, incases of process related defects/ inconsistencies or dimensional issues in the materials.

ACCEPTABLE MEANS OF COMPLIANCE

a. The application in the prescribed form for the Production Permit should be submitted to DGAQA/Competent QA Authority.

b. DGAQA/Competent QA Authority can grant production permit 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 observed during service usage in the material shall be reported to the Main Contractor, production agency, CEMILAC and DGAQA/Competent QA Authority.

ACCEPTABLE MEANS OF COMPLIANCE

a. User Service should raise a defect report and circulate to Designers, Production agency, CEMILAC and DGAQA/Competent QA Authority.

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 amendment to a LoA, if requested by the Main Contractor

ACCEPTABLE MEANS OF COMPLIANCE

a. Any change in the component drawing / process sheet/ test schedule after the LoA issue shall call for the change/updates in the LoA.

b. Based on the severity/criticality of changes, CEMILAC may seek partial/ full type testing as per the test schedule / specification 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 present the documents whenever TAA asks.

b. LoA holder should normally apply for the renewal before 6 months of the expiry.

c. LoA holder should intimate to TAA on the compliance of raw material and process quality to the test schedule and process documents as also the process and testing equipment calibration status periodically every five years.

d. CEMILAC may revoke the LoA for the subject materials if any major non-adherence or change is 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 DGAQA/Competent QA Authority after LoA issuance.

GUIDANCE MATERIAL

Nil

21.C3.1.23 TRANSFERABILITY

REGULATION

a. LoA shall, in general, not be transferable to any other organization.

b. In the case where a transfer of LoA from a development agency to a production agency which is different from development agency is required, the material shall be subjected to full LoA tests during Transfer of Technology (ToT) 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. In cases where the LoA holder prefers to transfer the Intellectual property right or make it available to other organisation/ company by licensing agreements under the aegis of CEMILAC, such materials shall be subjected to full LoA tests at the licensee's location for ensuring compliance with the laid down specifications. After successful completion of the LoA tests, 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 legal 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, CEMILAC may ask mini or full type testing on 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 would no longer be valid if any change in process documents, drawing, test schedule 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 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 proprietary / company confidential should be sealed in the presence of the TAA 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 are 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) Airborne 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 stake holders.

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 may be withdrawn. The DGAQA/Competent QA Authority and user agencies like IAF/IN/IA should be informed about such withdrawals.

Guidance Material

Nil

21.C3.2 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 schedule, 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 these para test schedule, 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. Provisional Clearance for the critical airborne materials shall not be needed.

c. Machining / fitment test feedback for the un or semi-finished metallic or non- metallic materials (whichever applicable), or atleast no adverse feedback on the metallic and nonmetallic materials and Flight feedback for the Airborne consumables or atleast no adverse feedback on the consumables from the User are required to issue LoA for the critical airborne materials to absorb the source change of developer/ manufacturer of the material.

21.C3.3 Clearance 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 shall have a CoC and/or TRC as stated earlier from OEM complying to aeronautical material standard/ specification and/or approved test schedule. LoA clearance is not required from the CEMILAC. TAA shall accept the imported materials based on the CoC and/or TRC as stated earlier to the relevant aeronautical material standard/specification/test schedule

b. Cases where the CoC and/or TRC as stated earlier are incomplete with reference to the material specifications, test schedule with additional testing shall be prepared by the Main Contractor in consultation with TAA to issue LoA. Feedback is not required to issue LoA.

c. Imported materials which do not have CoC and/or TRC as stated earlier or have incomplete CoC and/or TRC as stated earlier shall be given LoA by CEMILAC:

   i. The Main Contractor shall prepare test schedule and drawing (if applicable) in consultation with the TAA with the testing matrix based on the relevant material standards /specifications available information from the user / past experience of the Main Contractor and get approval from the TAA.

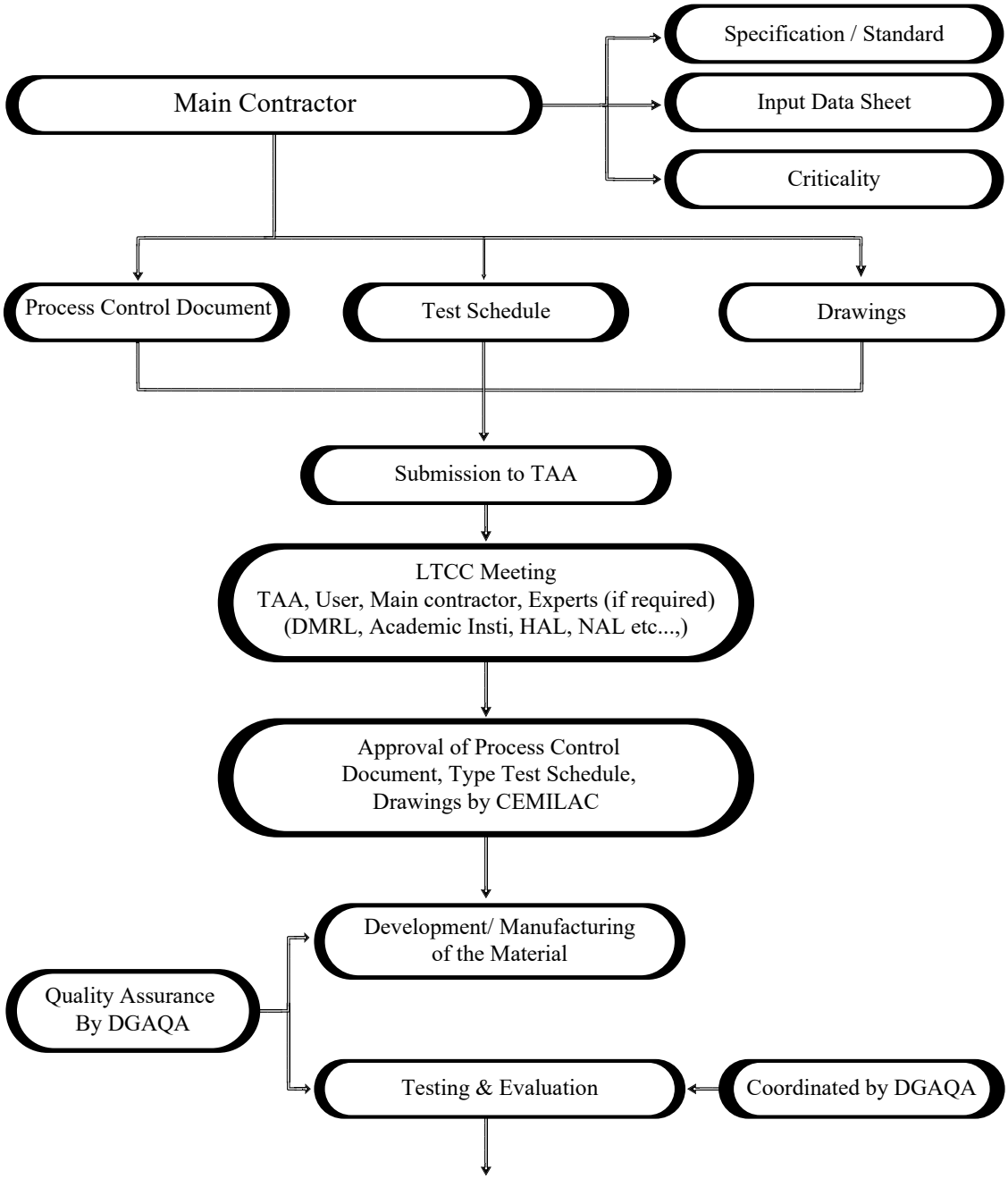
   ii. Other certification procedure to issue LoA for the critical airborne materials shall follow the Subpart 21.C3.1.1 certification of ab-initio and indigenous substitution of military airborne materials. Non-critical airborne materials shall be cleared in LTCC.

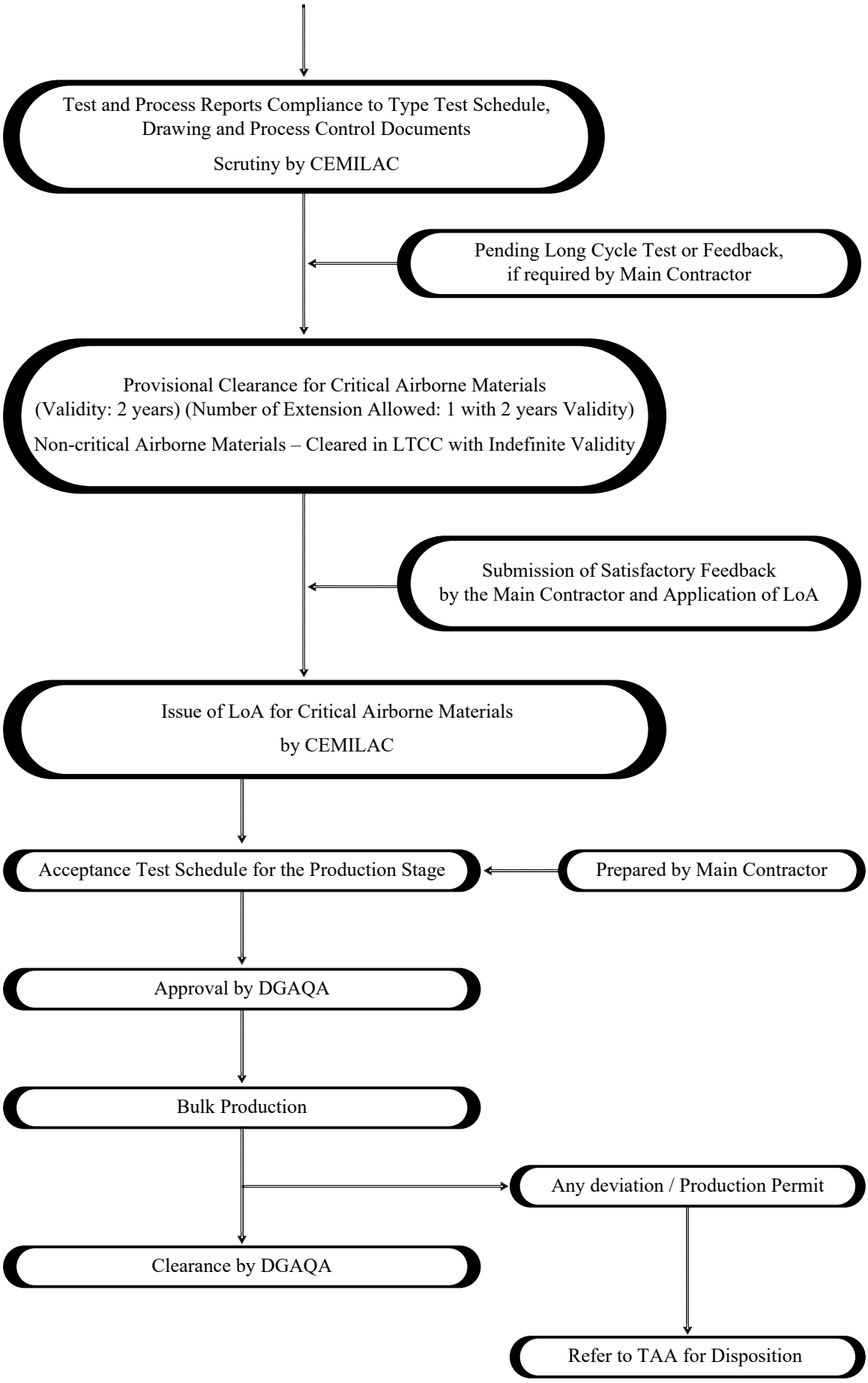
   iii. Provisional Clearance shall not be needed for the critical airborne materials.

   iv. Machining / fitment test feedback for the un or semi-finished components and/ or flight feedback for the airborne consumables are not required to issue LoA for the airborne bought out materials.

   v. The applicability of the LoA for the imported airborne materials issued as above for cases at 21.C3.3(c) is restricted to the material source and a particular batch supply imported.

Figure C3.1 The Certification flow chart for the materials for section 21.C3.1 is given below for easy reference.




Test and Process Reports Compliance to Type Test Schedule, Drawing and Process Control Documents
Scrutiny by CEMILAC
Pending Long Cycle Test or Feedback, if required by Main Contractor
Provisional Clearance for Critical Airborne Materials
(Validity: 2 years) (Number of Extension Allowed: 1 with 2 years Validity)
Non-critical Airborne Materials – Cleared in LTCC with Indefinite Validity
Submission of Satisfactory Feedback by the Main Contractor and Application of LoA
Issue of LoA for Critical Airborne Materials
by CEMILAC
Acceptance Test Schedule for the Production Stage
Prepared by Main Contractor
Approval by DGAQA
Bulk Production
Any deviation / Production Permit
Clearance by DGAQA
Refer to TAA for Disposition

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 Air Systems. Mostly these stores are cleared as a part of Airborne Stores where they are integrated with. These stores are also supplied as spares to user/ maintenance organisations to carry out D-Level/O-Level maintenance of Airborne Stores. Certain stores may be developed as a part of indigenous substitution efforts. Apart from this, 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.

Intentionally Left Blank

CONTENTS

21.C4.1	**Applicability**	**C4-5**
21.C4.2	**Application for Airworthiness Assessment**	**C4-5**
21.C4.3	**Criticality Classification of Airborne Stores**	**C4-6**
21.C4.4	**Airworthiness Certification Plan (ACP)**	**C4-7**
21.C4.5	**Quality Assurance Plan**	**C4-8**
21.C4.6	**Identification**	**C4-9**
21.C4.7	**Design and Development**	**C4-9**
21.C4.8	**Software & Firmware Development**	**C4-10**
21.C4.9	**Test Rigs and Test Equipment**	**C4-10**
21.C4.10	**Test and Evaluation**	**C4-11**
21.C4.11	**Deviations**	**C4-12**
21.C4.12	**Defects During Development**	**C4-13**
21.C4.13	**Configuration Control**	**C4-14**
21.C4.14	**Issue of LoA**	**C4-15**
21.C4.15	**Production**	**C4-15**
21.C4.16	**Transferability**	**C4-16**
21.C4.17	**Duration and Continued validity**	**C4-16**

Intentionally Left Blank

21.C4.1 APPLICABILITY

REGULATION

Electronic/Electrical Modules/SRUs which are generic in nature/functionalities Sub-assemblies 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, Sub-assemblies and finished parts for which a Technical Specification is approved by CEMILAC and are not considered as Line Replaceable Units (LRUs).

b. This Subpart may also be applied in cases where modules are independently developed as a part of certain LRU development and are separately evaluated for airworthiness with an intention to use in multiple systems or to supply as shop replaceable spares at user bases.

c. Letter of Approval (LoA) may be issued for the airborne stores that are not covered under either Type Approval or IMATSOA.

d. Generic software and generic CEH may also be issued with LoA. However, development and certification process should be in accordance with Subpart C6.

GUIDANCE MATERIAL

Nil

21.C4.2 APPLICATION FOR AIRWORTHINESS ASSESSMENT

REGULATION

An application for certification and QA coverage shall be made by the Main Contractor/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. An application for Airworthiness assessment and QA Coverage shall be made to TAA in the prescribed format. 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 (if available)

   iv. Timelines of the program

v. Scope of the program

vi. Any special conditions

GUIDANCE MATERIAL

Nil

21.C4.3 CRITICALITY CLASSIFICATION OF AIRBORNE STORES

REGULATION

Criticality classification of Airborne Stores under development shall be carried out.

ACCEPTABLE MEANS OF COMPLIANCE

a. System Safety Assessment (SSA) carried out at the Air System level shall identify the criticality level applicable for the Airborne Store under development based upon its functional importance. The criticality level can be Safety Critical, Mission Critical or Non-Critical.

   i. Safety Critical: The failure of components, systems or items endangers the safety of the air system or crew.

   ii. Mission Critical: The failure of the components, systems or items result in aborting the air system mission.

   iii. Non Critical: The failure of components does not endanger the safety of the air system and crew nor does it result in aborting the mission

b. Provisions of self-approval during the development of airborne stores shall be worked out based on the criticality classification of the airborne stores so as to minimize stage-gated approvals to enhance process efficiency and accelerate D&D timelines.

c. For the Non-Critical Airborne Store, TAA shall enable self-approvals during Test & Evaluation phase.

d. Provisions related to airworthiness certification and quality assurance of such airborne store shall be identified during the initial stages itself and included in ACP and QAP respectively.

GUIDANCE MATERIAL

NIL.

21.C4.4 AIRWORTHINESS CERTIFICATION PLAN (ACP)

REGULATION

The Design agency shall propose to the CEMILAC an Airworthiness Certification Plan (ACP) 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 an Airworthiness Certification Plan (ACP) containing the following information:

   i. Description of the store and the kind of operations envisaged

   ii. Applicable Airworthiness codes/standards

   iii. Special conditions, equivalent safety findings and environmental protection requirements (wherever applicable).

   iv. Identification of relevant personnel making decisions affecting airworthiness and interfacing with the Authority.

   v. Major Project milestones and review stages

   vi. Artefacts/documents generated at each stage

   vii. Software/CEH considerations wherever applicable

   viii. Test equipment and Rigs

   ix. Screening Requirements

GUIDANCE MATERIAL

a. A description on how compliance will be demonstrated, with proposed means of compliance and any selected guidance material shall be provided in the ACP. 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 applicable airworthiness code and environmental protection requirements applicable to the project, with reference to the means of compliance and to the related compliance documents shall be prepared.

c. If the store is already operationalized/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 DO 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.C4.5 QUALITY ASSURANCE PLAN

REGULATION

The Design Organisation 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 shall contain 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 (wherever 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. A description on how compliance will be demonstrated, with proposed means of compliance, and any selected guidance material shall be provided in QAP. 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.C4.6 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

Configuration Control Procedure

21.C4.7 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 store as envisaged in airworthiness 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, SOP/Build Standard, 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 DO 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 made with the concurrence of CEMILAC.

f. Software certification shall be carried out for all the software components in the system in accordance with Sub Part C6.

g. The test results endorsed by DGAQA and compliance matrix shall be analyzed 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 21.C1.A of Subpart 21.C1

21.C4.8 SOFTWARE & FIRMWARE DEVELOPMENT

REGULATION

Software/CEH used in Airborne Stores shall comply with the applicable airworthiness regulations for the software/CEH aspects of airborne systems and equipment certification.

ACCEPTABLE MEANS OF COMPLIANCE

a. Software/CEH development and certification process shall be as per Subpart C6.

b. Developers of Airborne Stores containing Software/CEH should demonstrate the means of compliance for the Software /CEH aspects.

c. Software/CEH should be developed and tested in accordance with an established Software Development Life Cycle Process.

d. The criticality level of the software should be defined. Criticality level should be derived through a System Safety Assessment Process carried out at appropriate level depending on the end usage.

e. The objectives of each stage of the SDLC should be identified and Means of Compliance shall be arrived at.

f. 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.C4.9 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.

b. Certification of Test Rigs, Simulators, Test equipment etc should be in accordance with Subpart T.

c. Test Rig Software/CEH 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.C4.10 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 Airworthiness Certification Plan (ACP) and technical specifications prior to release to User Services.

ACCEPTABLE MEANS OF COMPLIANCE

a. The steps to be followed for Test and Evaluation are explained at Annexure 21.C1.B of Subpart 21.C1.

b. For the Non-Critical Airborne Stores, TAA shall enable self-approvals during Test & Evaluation phase.

c. DGAQA shall enable acceptance of industry standard quality assurance requirement such as AS9102 for First Article Inspection for vendors / sub-contractors.

GUIDANCE MATERIAL

When reviewing any test report or activity, the design organisation is independently checked to ensure:

a. That materials and processes adequately conform to the specifications for the proposed Design.

b. Those parts of the Airborne Store adequately conform to the drawings in the proposed Design.

c. That the manufacturing processes, construction and assembly adequately conform to those specified in the proposed Design.

d. That the test equipment and all measuring equipment used for tests are adequate for the test and are appropriately calibrated.

21.C4.11 DEVIATIONS

REGULATION

The Main Contractor shall establish a Non-Conformance Review Process to address the deviations observed in the realized system with respect to the baseline configuration during the design and development phase.

ACCEPTABLE MEANS OF COMPLIANCE

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. 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

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 may be analyzed thoroughly by the Main Contractor and referred to CEMILAC for disposition. Deviations should be referred to CEMILAC in accordance with Form 53A.

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, reliability, 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.C4.12 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

a. A Defect Investigation committee shall be constituted for each development project with members from DO, Design QA, CEMILAC, DGAQA and User Services (wherever applicable). The QA shall be responsible for convening and coordinating DI meeting.

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 of the Defect Investigation Committee.

d. Main Contractor shall forward a modification proposal to 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 and evolve the testing required for verifying.

f. The Main Contractor shall 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 requirements, same shall be referred to Configuration Control Boards (CCBs)

GUIDANCE MATERIAL

a. After finalization of modification required and before implementation of modification, the documents configuration is to be managed through Configuration Control Board.

b. The committee may co-opt domain experts if found appropriate.

21.C4.13 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. 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 leads 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.C1.17)

c. Modifications cleared by the DIC or CCBs (21.C1.16 & 21.C1.17) shall be submitted by Main Contractor to CEMILAC in the form of ECNs & SCNs.

d. Approved ECNs & SCNs by CEMILAC 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.C4.14 Issue of LoA

Regulation

The DO shall be issued with a Letter of Approval (LoA) when CEMILAC has accepted that the requirements of Certification Basis have been fully met

Acceptable Means of Compliance

a. On completion of the evaluation process as per ACP, the Design Oragnisation shall apply for issue of LoA to CEMILAC.

b. Compliance report should also be submitted by DO along with application for LoA.

Guidance Material

Nil.

21.C4.15 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 valid release note from DGAQA.

Guidance Material

a. Production organisation Approval Process, Subpart G2

21.C4.16 Transferability

Regulation

If a LoA is to be transferred, the transfer shall be made only to a Design Organisation registered within 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.

Guidance Material

In case of change in ownership of the firm/acquisition, LoA may be transferred to the new owner as per provisions.

21.C4.17 Duration and Continued validity

Regulation

LoA subject to any constraints shall remain valid for life subject to the Design Organisation 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 keep updated all the LoA documents with the latest hardware and software modifications/Updates, as applicalbe.

c. The Vendors should ensure that all design changes/corrections in drawings are incorporated in the LoA documents.

Guidance Material

a. If the suspension of LoA is carried out due to an Airworthiness/operational non-compliance, necessary action shall be taken to inform the User Services to implement the corrective actions.

SUBPART C5
AIRBORNE STORES, FOR WHICH IMATSO EXISTS, LEADING TO IMATSO APPROVAL (IMATSOA)

RATIONALE

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 Aviation Technical Standard Order (IMATSO) are the TSOs released by CEMILAC considering Indian Military requirements. Although CEMILAC has not released any IMATSO, TSOs issued by other certification authorities are also considered provided they have potential application with Indian Military Services. Any organisation that produces or is preparing to produce an IMATSO store, shall be eligible as an applicant for an IMATSO Approval (IMATSOA) on demonstrating that the article complies with the technical conditions of the applicable IMATSO, and submitting the corresponding statement of compliance. When a DO is authorized to manufacture a material, part, or appliances to a IMATSO standard, this is referred to as IMATSO Approval. Receiving a IMATSO Approval include both design and production approval.

Intentionally Left Blank

CONTENTS

21.C5.1	**IMATSOA**	**C5-5**
21.C5.2	**Applicability**	**C5-5**
21.C5.3	**Demonstration of Design Organisation (DO) Capability**	**C5-6**
21.C5.4	**Identification**	**C5-7**
21.C5.5	**Airworthiness Certification Plan (ACP)**	**C5-7**
21.C5.6	**Quality Assurance Plan**	**C5-8**
21.C5.7	**Design Development and Evaluation**	**C5-9**
21.C5.8	**Application for IMATSOA**	**C5-9**
21.C5.9	**Declaration of Design and Performance (DoDP)**	**C5-10**
21.C5.10	**Design Changes to Airborne Stores having IMATSOA**	**C5-11**
21.C5.11	**Record Keeping**	**C5-11**
21.C5.12	**Obligations of the IMATSOA holder**	**C5-12**
21.C5.13	**Production of IMATSOA Stores**	**C5-12**
21.C5.14	**Duration and Continued Validity**	**C5-13**
21.C5.15	**Transferability**	**C5-13**
21.C5.16	**Failures, Malfunctions and Defects**	**C5-14**

Intentionally Left Blank

21.C5.1 IMATSOA

REGULATION

Indian Military Aviation Technical Standard Order (IMATSO) is a detailed airworthiness specification issued by CEMILAC describing minimum performance standard for a specified Airborne Store, 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 IMATSO standard, this is referred to as IMATSO Approval.

b. Receiving an IMATSO Approval include both design and production approval.

c. Receiving an IMATSO Approval is approval to design & 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 an IMATSO Approval means that an article meets a minimum performance requirement independent of the article's intended installation on an aircraft.

d. Receiving an IMATSO Approval is not an approval to install and use the article in the aircraft. It means that the article meets the specific IMATSO and the applicant is authorized to manufacture it.

e. The applicant has to ensure and demonstrate TAA that the IMATSO 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 IMATSOA article on an aircraft for carrying out the evaluation.

GUIDANCE MATERIAL

Nil

21.C5.2 APPLICABILITY

The regulations contained in this Subpart are applicable to the development and certification of Airborne Stores for which an IMATSO released by CEMILAC exists.

ACCEPTABLE MEANS OF COMPLIANCE

a. CEMILAC may release IMATSO 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 IMATSO 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 IMATSO. Any shortfall in the comparison may require analysis and/or qualification and/or testing to meet requirement of the IMATSO.

21.C5.3 DEMONSTRATION OF DESIGN ORGANISATION (DO) CAPABILITY

REGULATION

The organisation responsible for the design and development of the IMATSOA 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 Organisation 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 Organisation Approval Scheme (DOAS) - Subpart G1

21.C5.4 IDENTIFICATION

REGULATION

Any IMATSOA Store, considered for issue of an IMATSOA shall be properly identified.

ACCEPTABLE MEANS OF COMPLIANCE

IMATSOA Store shall be identified as per Subpart Q

GUIDANCE MATERIAL

Nil

21.C5.5 AIRWORTHINESS CERTIFICATION PLAN (ACP)

REGULATION

The DO shall propose an Airworthiness Certification Plan (ACP) to CEMILAC that shall include the means to demonstrate compliance with the applicable IMATSO.

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 IMATSO 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/CEH 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 IMATSOA 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.C1.13 through 21.C1.20.

b. DO, who requests for approval to deviate from any performance standard of an IMATSO 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. Main Contractor's QA (Approved by DGAQA) may be authorised for Inspection activities for design, development and evaluation for Airborne Stores.

d. 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 IMATSOA

Regulation

An application for an IMATSOA shall be made to CEMILAC by the DO on completion of design evaluation activities.

Acceptable Means of Compliance

a. The data required is:

i. A statement of compliance certifying that the applicant has met the requirements of this regulation.

ii. A declaration of Design and Performance (DoDP).

iii. One copy of the technical data required in the applicable IMATSO.

GUIDANCE MATERIAL

a. The holder of an IMATSOA is entitled to produce and to mark the article with the appropriate IMATSO marking, ensuring compliance in accordance with the provisions of this regulation.

b. Upon satisfaction of compliance to this regulation CEMILAC shall issue IMATSOA for Airborne Stores.

21.C5.9 DECLARATION OF DESIGN AND PERFORMANCE (DODP)

REGULATION

A DoDP shall be submitted to the TAA by DO for issuance of IMATSOA.

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 IMATSO.

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 IMATSO.

GUIDANCE MATERIAL

Nil

21.C5.10 Design Changes to Airborne Stores having Imatsoa

Regulation

The holder of the IMATSOA may make minor design changes without further approval 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.

b. Any design change by the holder of the IMATSOA that is extensive enough to require a substantially complete investigation to determine compliance with the IMATSO 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 or fresh IMATSOA.

Guidance Material

Nil

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

Contractor shall prepare the compliance of IMATSO of Airborne Stores and submit all the artefacts to TAA.

Guidance Material

Nil

21.C5.12 Obligations of the IMATSOA holder

Regulation

The holder of an IMATSOA shall fulfil certain obligations to upkeep the Airworthiness of IMATSOA Store

Acceptable Means of Compliance

The holder of an IMATSOA 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 IMATSO approval 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 IMATSOA 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 IMATSOA Stores

Regulation

Limited Series or Series Production of the IMATSOA may be taken up by a Production Organisation on Receipt of IMATSOA.

ACCEPTABLE MEANS OF COMPLIANCE

a. IMATSOA holder may take up limited/series production of the Store.

b. If the IMATSOA holder and Production Organisation are different, necessary Transfer of Technology shall be carried out.

c. Provisions in Subpart F shall be followed.

GUIDANCE MATERIAL

Production of Stores shall be carried out as per provisions provided in Subpart F.

21.C5.14 DURATION AND CONTINUED VALIDITY

REGULATION

An IMATSO approval shall be issued for an unlimited duration.

ACCEPTABLE MEANS OF COMPLIANCE

It shall remain valid unless:

a. The conditions required when IMATSO approval was granted are no longer being observed or

b. The obligations of the holder specified in Subpart.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 approval 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 IMATSO approval issued by TAA is not transferable.

Acceptable Means of Compliance

a. Each change to the design assurance system or quality system in the production organisation that can significantly affect the compliance of the article to the IMATSO, 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 IMATSOA shall have a system for collecting, investigating and analysing reports of and information related to failures, malfunctions, defects and other occurrences in the operation or storage of the article covered by the IMATSOA 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 IMATSOA shall report to TAA any failure, malfunction, defect and other occurrence related to the article covered by the IMATSOA, 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 IMATSOA 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 IMATSOA shall submit the relevant data to the TAA.

SUBPART C6
AIRBORNE/GROUND SYSTEM SOFTWARE AND COMPLEX ELECTRONIC HARDWARE (CEH)

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 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 before integration on platform and flight testing. Complex Electronic Hardware (CEH) consists of custom micro-coded components like ASICs/FPGAs/PLDs etc. Akin to qualification of Hardware, Software and CEH also need qualification/certification.

Ground System Software is the supporting software for Testing and validation of Air Systems/Airborne Systems and Ground preparation software. They include test jig software, ground preparation software, mission planning software, ground exploitation software and ground analysis software. Test jigs and test rigs are created at various levels and stages of software design and development. Ground Control System (GCS) Software of the Unmanned Air Systems which are part of the control loop, affecting the safety and performance of the Air System are to be treated at par with Airborne Software. Criticality level of Ground System and Ground Control Software are required to be in accordance with its airborne counterparts.

APPLICABILITY

The regulations contained in this Subpart are applicable to Airborne Software, Ground System Software, Ground Control Software, Complex Electronic Hardware (CEH) and Intellectual Property (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 Control Software of Unmanned Air Systems (UAS).

d. This Subpart shall be applied for Ground System Software which are a part of Ground equipment.

e. In addition to applicability on indigenous development, 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 also follow this Subpart.

CONTENTS

21.C6.1 Ab-Initio Design & Developed Airborne Software ---- C6-5
21.C6.2 Ab-initio Design and Developed Airborne CEH and IP cores ---------- C6-25
21.C6.3 Ab-initio Design and Developed Ground System Software ---------- C6-33

Intentionally Left Blank

21.C6.1 Ab-Initio Design & Developed Airborne Software

Rationale

Many safety and mission critical aircraft functions are software-enabled. Military Airborne software must be verified, validated and approved by the certification authorities prior to deployment on target systems. To ensure that the engineering of airborne and associated ground system software is systematically designed and is verifiable and auditable, it is mandated that compliance with software engineering practices and safety standards that detail industrial best practices are ensured. 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.

CONTENTS

21.C6.1.1 Applicability ---------- C6-7
21.C6.1.2 Certification of Ab-initio Design and Developed Air borne Software ---------- C6-7
21.C6.1.3 Application for Airborne Software Certification Coverage ---------- C6-8
21.C6.1.4 System Requirements and Criticality Level ------ C6-8
21.C6.1.5 Identification ---------- C6-9
21.C6.1.6 Constitution of Software IV&V team ---------- C6-10
21.C6.1.7 Software Certification Plan (SCP) ---------- C6-11
21.C6.1.8 Software Planning ---------- C6-12
21.C6.1.9 Software Requirements Analysis ---------- C6-12
21.C6.1.10 Software Preliminary and Detailed Design Reviews ---------- C6-14
21.C6.1.11 Software Code Analysis ---------- C6-14
21.C6.1.12 Module Level Testing ---------- C6-15
21.C6.1.13 Integration Testing ---------- C6-16
21.C6.1.14 Software Verification and Validation ---------- C6-17
21.C6.1.15 Software Quality Assurance ---------- C6-19
21.C6.1.16 Software Configuration Management ---------- C6-19
21.C6.1.17 Clearance for Airborne Software ---------- C6-21
21.C6.1.18 Clearance of Software Modifications after Initial Airworthiness Approvals ---------- C6-21
21.C6.1.19 Software Designed and Developed by Foreign Vendor (CFE Software)/ Bought Out Software and Their Software Changes ---------- C6-22
21.C6.1.20 Certification of UAS Airborne Software --------- C6-23

21.C6.1.1 APPLICABILITY

REGULATION

This regulation is applicable for the clearance of the software component of Military Air Systems, classified as Airborne Software.

ACCEPTABLE MEANS OF COMPLIANCE

a. All kinds of Software which are residing in an Airborne System/LRU/SRU which forms a part of the Air System shall be treated as Airborne Software.

b. Maintenance mode software, which are residing inside Airborne System/LRU/SRU, but inactive during operational phase shall be treated as Airborne Software.

c. Hardware Acceptance Software used during the Qualification/Acceptance of Airborne Hardware shall be treated on par with Airborne Software.

d. Ground Control Software (GCS) of Unmanned Aerial Systems (UAS), which directly control the operation and mission of a UAS shall be treated at par with Airborne Software.

GUIDANCE MATERIAL

GCS software components which are not directly affecting the flight safety or operational mission may be treated as Ground System Software.

21.C6.1.2 CERTIFICATION OF AB-INITIO DESIGN AND DEVELOPED AIR BORNE SOFTWARE

REGULATION

Ab-initio design and developed Airborne software for indigenously designed Airborne Stores/Air System shall be issued with a clearance by RCMA/CEMILAC prior to the clearance of the corresponding Airborne Store/Air System for flight trials and subsequent service use.

ACCEPTABLE MEANS OF COMPLIANCE

The approach to clearance shall be in accordance with the regulations provided in this Subpart in the subsequent sections.

GUIDANCE MATERIAL

a. The clearance 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 Software Certification Plan (SCP)and other plans

iv. Verification of Software Requirements

v. Verification of Software Design and implementation

vi. Conduct of Software Evaluation

vii. Demonstration of compliance with SCP and review of Certification evidences

viii. Issuance of Software Clearance

b. Successful completion of certification process for an Airborne Software will result in CEMILAC issuing a Software Clearance, based on the application/request for software clearance from the Main Contractor.

21.C6.1.3 Application for Airborne Software Certification Coverage

Regulation

Main Contractor shall apply to RCMA/CEMILAC for software certification coverage of airborne software in prescribed format.

Acceptable Means of Compliance

The application shall include:

a. A description of the firm

b. A description of the software being developed/Functional Requirement Specification

c. Scope of the program

d. Time-lines of the program

e. Criticality classification of the software

f. Standard compliance mandated by the user, if any

g. Intended end use platform (if available)

h. Any special conditions

Guidance Material

Application Form in prescribed format

21.C6.1.4 System Requirements and Criticality Level

Regulation

Criticality level for Software shall be assigned based on the System Safety Assessment (SSA) and the functionalities allocated to software.

ACCEPTABLE MEANS OF COMPLIANCE

a. System Requirements allocated to software shall be identified and allotted to each of the planned Software components. This shall be documented and approved by the Main Contractor as System Architecture & Requirements Allocation Document (SARAD). SARAD is a single document for the system and it shall contain other allocations like CEH, IP core requirements also.

b. Safety requirements that define the fault detection, fault tolerance and fault avoidance characteristics of the system are to be identified from the allocated software requirements, apart from functional and performance requirements. Failure modes shall be identified.

c. Criticality Level shall be determined for each of the software and CEH component. Software Criticality classes recommended are: Safety Critical, Mission Critical, Non-Critical.

d. SSA reports duly signed by all stakeholders and SARAD duly approved by the Main Contractor shall be released.

e. System Interface requirements wrt software shall be documented.

GUIDANCE MATERIAL

a. User Requirement document may be used for identifying System Requirements.

b. System design shall allocate the functionalities to be done by Software.

c. System Safety Assessment guidelines and details.

d. The Parameter Data Item(PDI) files shall be allotted with the same software criticality level as the software component that uses the parameter data.

21.C6.1.5 IDENTIFICATION

REGULATION

Airborne Software which is uniquely identified through a configuration control process only shall be cleared for integration on Air Systems and subsequently delivered to User Services. Software Life cycle artefacts shall also be uniquely identified.

ACCEPTABLE MEANS OF COMPLIANCE

a. Airborne Software shall be identified as CSCIs (Computer Software Configurable Item).

b. Each CSCI shall be uniquely identified by name, part number and version number and checksum.

c. Parameter Data Item(PDI) files (configuration files) shall be uniquely identified by name and version number.

d. Each artefact created during the Software Development Life Cycle (SDLC) process shall be uniquely identified by document name, number and issue number.

GUIDANCE MATERIAL

SCM Plan approved by RCMA/CEMILAC.

21.C6.1.6 CONSTITUTION OF SOFTWARE V & V/IV & V TEAM

REGULATION

Main Contractor shall constitute V&V team for non-critical software and IV&V team for critical software for the verification and validation of the software.

ACCEPTABLE MEANS OF COMPLIANCE

a. Each DO shall constitute In-house V&V team for critical and non-critical software.

b. IV&V team shall be constituted only for safety critical and mission critical software.

c. IV&V team shall consist of system experts, domain experts, testing experts from relevant stake holder organisations, CEMILAC and DGAQA representatives.

d. The members in V&V team and IV&V team shall be independent from the software design and development team.

e. V&V team and IV&V team shall carry out reviews, analysis, testing, reporting activities and participate in software review meetings during the various phases of software life cycle as per IV&V plan document

f. Software documents shall be approved after closure of all observations received after review carried out and accepted by each member of IV&V team.

g. The recommendation from V&V/IV&V team is a required input for RCMA/ CEMILAC for Software clearance.

h. RCMA/CEMILAC has got the prerogative to create an evaluation team to augment the efforts of certification.

GUIDANCE MATERIAL

a. A software Certification plan, detailing the role of stakeholders and plan for verification and validation, shall be prepared by the Main Contractor.

b. Software V&V/IV&V team may be involved from planning stage of the project.

c. If the Main Contractor has already its software IV&V group, then the members from the same may be selected to constitute IV&V team to for new project.

21.C6.1.7 Software Certification Plan (SCP)

Regulation

The Main Contractor shall propose to CEMILAC a Software Certification Plan (SCP) 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. For software design, development & verification, a standard process is to be followed such as DO 178, IEEE 12207, DSSD or any other process acceptable to RCMA/ CEMILAC.

c. The SCP shall be approved by RCMA/CEMILAC before the compliance demonstration commences and updated as necessary during the Certification process.

d. SCP shall bring out any similarity information like criticality, operational requirements, development environment, verification environment, target environment with supporting evidence, based on which the certification credits can be claimed for the already developed portion. This baseline configuration shall separately identified and any further changes shall be under configuration control.

e. 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.

f. Usage of Off the Shelf Software components like Operating System (OS) Software, device drivers, Board Support Packages (BSPs), standard libraries etc. and its certification plan, shall be clearly brought out.

g. In addition to SCP, software documents like SVP, SRS/SRD, SVCP, and compliance report of SCM shall be approved by RCMA/CEMILAC.

h. Software certification activities shall be carried out concurrently with the software development.

i. Means of compliance shall be provided.

Guidance Material

a. SCP forms the basis of agreement between the Main Contractor and certification authority on the activities to be carried out and objectives to be met during the software development life cycle.

b. SSA Report of Airborne Store/ Air System

21.C6.1.8 Software Planning

Regulation

The Main Contractor shall propose to the CEMILAC, the plan documents on Development, Configuration Management, Verification & Validation, and Quality Assurance.

Acceptable Means of Compliance

a. Availability of Development plan, Configuration management plan, Verification & Validation 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.

d. Requirements, Design and coding standard shall be prepared and made available.

Guidance Material

A generic list of artefacts, which form the basis of clearance depending on the criticality level shall be planned as part of certification planning. Industry / Organisation specific standards may also be used. Necessary tailoring, if required, may be made for this process on discussion with CEMILAC.

21.C6.1.9 Software Requirements Analysis

Regulation

Software Requirements and Interface Requirements shall be prepared by the Main Contractor.

Acceptable Means of Compliance

a. Software Requirements Specification (SRS) or Software Requirements Data (SRD) shall be consistent with and bi-directionally traceable to System requirements allocated to software as defined in SARAD.

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 Software 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 by the Main Contractor with participation of relevant stake holders, specifically V&V/IV&V and CEMILAC, to evaluate the completeness, consistency, testability and correctness of the requirements.

d. SRS shall adhere to Software Requirements Standard. V&V/IV&V shall review the Software Requirements and provide a review report before design.

GUIDANCE MATERIAL

a. SRS (Software Requirement Specifications) shall identify all requirements such as:

   i. Functional, performance requirements covering all modes of software

   ii. All external and internal interface requirements

   iii. Feasibility and compatibility with target computer

   iv. Engineering constraints

   v. Initial determination and allocation of resources

   vi. Growth potential in terms of memory and processing time

   vii. Safety and security requirements and fault tolerance, fault detection, fault reporting and avoidance capabilities

   viii. Other non-functional requirements

   ix. Operation, priority and sequence of function

   x. Database requirements

b. 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 (periodicity)

   iv. Number of retries

   v. Format in the case of digital data

   vi. Parity details

   vii. Range and sign conventions

   viii. Precision and accuracy requirements

   ix. Engineering units and valid range

c. Any other information or special conditions applicable

d. Review recommendations to be documented and tracked for closure.

e. IRS may be included in SRS itself in the case of non-critical software.

21.C6.1.10 Software Preliminary and Detailed Design Reviews

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 consistent with and bi-directionally 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 thereafter release revised SSA report.

c. Agreed upon design standards shall be adhered.

d. Preliminary and detailed design reviews have to be conducted by the Main Contractor as per (c) and (e) of Annexure 21.C1.A including members of V&V or IV&V team and CEMILAC.

e. Libraries and reusable modules shall be listed. Its failure modes and method of validation shall be explained.

f. Approach towards usage and validation of off the shelf software components like OS, Device Drivers, Library Functions etc to be elaborated.

g. 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 V&V/IV&V team for validation of algorithms.

Guidance Material

a. Parameter Data Item (PDI) to be identified and incorporated in design.

b. Detailed design shall include software architecture to unit level.

c. Fault identification, fault tolerance mechanisms and defensive approaches to be built into the design.

21.C6.1.11 Software Code Analysis

Regulation

Software code walk through review and code analysis (static/dynamic) shall be carried out by V&V/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 shall be adhered to for Software Coding.

c. Code walkthrough review is held by the Main Contractor to present the control and data flow of the software to the V&V/IV&V team.

d. Static analysis to check for coding standard and conventions used while programming shall be carried out.

e. Dynamic code analysis shall be carried out to confirm correct runtime behaviour.

GUIDANCE MATERIAL

a. Peer review of the code may be conducted by developer to minimize bugs.

b. Compiler validation if defined in software Certification plan based on Criticality Level, has to be done.

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.

21.C6.1.12 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 and structural coverage.

b. For component level, different interrelated units are tested together for correctness of interfaces and their combined functionality.

c. Software Test plans, Software Test Description, test drivers and test reports along with compliance matrix shall be produced. These are also part of configuration control and shall be submitted to V&V/ IV&V team.

d. Software Test Plan and Test Documents shall be approved by RCMA/CEMILAC.

GUIDANCE MATERIAL

a. For safety critical software, analysis to be done to ensure that the compiler does not generate extraneous code. Traceability between source and object code to be established. Linker map files to be verified for any unresolved entities. Loader output to be verified.

b. Appropriate testing methodology to be used to measure the structural coverage as per plan and in the embedded environment.

c. 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. If RBT is followed then, traceability shall be established between LLR and unit level test cases and the test cases shall be based on LLRs and not code. If structural coverage is not achieved, then analysis to justify the presence of code not traceable to LLR may be carried out.

21.C6.1.13 Integration Testing

Regulation

Software-software integration, hardware-software integration and system integration testing shall be performed by the Main Contractor with participation of the V&V/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. Bi-directional Traceability shall be established from system requirements to test cases.

e. Test plans, test cases, test procedures shall be produced and kept under configuration control.

f. Test plans, test cases, test procedures and other test data along with test reports shall be submitted to the V&V/IV&V team.

g. The test plan and procedures shall be reviewed by V&V/IV&V team for completeness and approved by CEMILAC.

i. Test Adequacy Review Board (TARB) may be constituted by the Main Contractor in consultation with CEMILAC to establish the test adequacy. TARB has members from CEMILAC, System experts, domain experts, Software design & development team members, V&V/IV&V member.

j. TARB may be conducted before integration testing. If there are major observations, then only again it has to be referred. It is applicable only for Safety Critical and Mission Critical Software.

GUIDANCE MATERIAL

a. 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.

b. The tests to be automated as far as practicable for ease of execution and to ensure repeatability.

c. Memory utilization and execution timing to be measured for all modules.

21.C6.1.14 SOFTWARE VERIFICATION AND VALIDATION

REGULATION

Verification & Validation (V&V) of software shall be carried out in two phases: Designer V&V (in-house) and Independent V&V (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. Designer verification reports shall be provided to IV&V.

b. Software Verification Plan shall be made specific to the project after identifying the criticality of the software

c. Modified and incremental versions of the software shall also be reviewed based on Change Impact Analysis.

d. 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 to review the verification and validation results.

GUIDANCE MATERIAL

a. Verification and Validation activities for Parameter Data Item (PDI) files shall be conducted in line with the corresponding software component. The parameter

data item files are to be verified separately for its correctness, completeness and consistency.

b. A generic procedure for IV&V is given below:

i. Safety Critical Software

A. IV&V process at various stages of Software Development Life Cycle (SDLC) shall be carried out by the two-tier configuration - first by in-house V&V team and then by IV&V team.

B. The IV&V team shall also carry out the following major activities in addition to regular IV&V activities:

1. Ensure that Tool Verification/Qualification, Compiler Validation, Object Code Verification (OCV) and identification of test cases are done.

2. Complete dynamic real time testing on a certified test rig to be ensured.

3. Verification of verification results shall be carried out by IV&V.

C. IV&V recommendations will form an essential input to CEMILAC for clearance of software.

D. Continued airworthiness support will be provided by CEMILAC with the support of IV&V team.

ii. Mission Critical Software

A. 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.

B. IV&V recommendations will form an essential input to CEMILAC for clearance of software.

C. Continued airworthiness support will be provided by CEMILAC with the support of IV&V team.

iii. Non-Critical Software

A. V&V process at various stages of SDLC will be carried out by an in-house V&V team.

B. Software clearance and continued airworthiness support by CEMILAC shall be as per the agreed plans.

21.C6.1.15 Software Quality Assurance

Regulation

Software Quality Assurance (SQA) shall be carried out based on agreed upon Software Quality Assurance Plan (SQAP) and approved by QA group of the Main Contractor.

Acceptable Means of Compliance

Software Quality Assurance activity shall ensure:

a. SQA plan and Software Development Plan are compatible. Agreed upon SQAP is adhered to.

b. Main Contractor uses applicable standards and follow established processes.

c. Development reviews and audits are conducted by Main Contractor.

d. The transition criteria for the software life cycle processes are satisfied.

e. Deviations from software development process are exposed as early as possible, evaluated, tracked and resolved and permitted deviations are recorded.

f. Data regarding Problem Reports, defects discovered, open and closed issues, waivers shall be maintained in a database and tracked to closure by QA.

g. SQAR of each software product shall be submitted for certification review by CEMILAC.

Guidance Material

Nil

21.C6.1.16 Software Configuration Management

Regulation

Every Software CSCI being certified and associated artefacts 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. Baseline shall be established at each major milestone during design and development of those items to be kept under configuration control.

c. A configuration item should be bi-directionally traceable to the configuration item from which it was derived.

d. Planned and defined methods shall be followed for archiving, storage, handling, retrieval and delivery of software products.

e. Artefacts shall have version/revision numbering scheme along with unique identification number and date. Whereas, source code shall have unique version numbering scheme.

f. Version management and Configuration Status Accounting shall be followed for software and artefacts.

g. Not only the embedded software but the test software and tools used in test rigs also shall be brought under configuration control.

h. Problems encountered during SDLC, flight trials or service use are to be reported through Software Problem Report (SPR).

i. Software Change Control Boards (SCCBs) at various levels shall be established to address software changes during design and development.

j. Any changes for baseline configuration shall be controlled through Software Change Requests (SCRs) and Software Change Notes (SCNs). During design & development phases, approval of SCNs by the RCMA/CEMILAC shall be treated as the approval for the changes and shall form the new baseline configuration.

k. Configuration Control process shall track and record the problem reports and change requests raised against those configuration items during the development phase.

l. 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.

m. Compatibility of software versions wrt corresponding versions of parameter data item is to be ensured.

GUIDANCE MATERIAL

a. Any change in the contents of parameter data item file to reflect in VDD with new revision number for VDD though this change does not affect the software version numbering.

b. 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.C6.1.17 CLEARANCE FOR AIRBORNE SOFTWARE

REGULATION

CEMILAC shall issue clearance for the Airborne System including associated Airborne Software.

ACCEPTABLE MEANS OF COMPLIANCE

a. CEMILAC shall conduct audits at every stage of software development life cycle like planning, requirements, design & development, verification and validation.

b. IV&V shall provide recommendation to CEMILAC on successful completion of the agreed upon verification activities and system integration testing. Closure of all observations shall be ensured.

c. RCMA/CEMILAC shall issue software version clearance based on V&V or IV&V (as applicable) recommendation and compliance of SCP.

d. In case of minor changes during development, approval of SCN by CEMILAC shall be treated as the clearance for the software.

e. All Software clearances shall refer the applicable version of the hardware of the respective system on which the software is integrated.

GUIDANCE MATERIAL

a. On completion of necessary functional checks at respective Rigs with applicable software version, CEMILAC shall issue an Integration clearance for the Airborne System/LRU on Aircraft.

b. On Completion of Ground Integration Checks of the Airborne System on Aircraft, CEMILAC shall issue necessary flight Clearance for the Air System.

21.C6.1.18 CLEARANCE OF SOFTWARE MODIFICATIONS AFTER INITIAL AIRWORTHINESS APPROVALS

REGULATION

All software changes after the issue of Initial Airworthiness Approval (IAW) like PC/TA/LoA/IMATSOA clearance for service use for the respective System/Store shall be authenticated by CEMILAC prior to its operational use.

ACCEPTABLE MEANS OF COMPLIANCE

a. During operational use, software modifications may become necessary due to identification of software defects, need for improvements, hardware changes, requirement changes etc.

b. For changes in software post service use clearance, the process elaborated at Subpart E shall be followed.

c. A Local Technical Committee to evaluate the software mod, as defined in Subpart E with inclusion of IV&V reps shall be formed.

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 IV&V team and test procedure and results shall be coordinated by LTC. Flight trials, if necessary shall be carried out and feedback shall be obtained.

f. For introduction of the software mod into the production/operational Aircraft, Local Modification Committee (LMC) shall be conducted by Main Contractor. Provision for identification of such Mods shall be provided on the respective hardware.

g. Minor software corrections that do not have operational implications and which shall come within the scope of Alteration/Amendment shall be cleared in accordance with Subpart E.

Guidance Material

Subpart D & Subpart E

21.C6.1.19 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 Military Airborne applications 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 if the software is designed and developed based on the contract placed by Indian agencies.

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 documents as described in para (e) given by the foreign vendor through Main Contractor/ User Services. Main Contractor/User Services shall be responsible for obtaining the certificate from the foreign airworthiness certification agency and necessary documents from the foreign vendor.

c. 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 Bought-out software, the minimum documents e.g. SRS, Interface Control Document (ICD), test documents, test reports, IV&V reports and version description document 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/upgrade 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/Bought Out 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 to obtain CEMILAC clearance for the change/ upgrade.

Guidance Material

NIL

21.C6.1.20 Certification of UAS Airborne Software

Regulation

Unmanned Aerial System/Vehicle Software for the airborne avionics shall be certified by CEMILAC.

Acceptable Means of Compliance

a. The SSA and SDLC process shall follow the software development life cycle activities as done for the system of manned aircraft and described in sections 21.C6.1.1 to 21.C6.1.18 of this document.

b. The certification of test rigs for testing the software shall be as described in Subpart 21.C6.3 section of this document.

GUIDANCE MATERIAL

Subpart 21.B2 may be referred for more guidance.

21.C6.2 Ab-initio Design and Developed Airborne CEH and IP cores

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, many of the processor based applications are getting replaced with CEH. This necessitates a formal certification procedure for CEH. This procedure is for programmable aspect of CEH design and not for CEH device as such.

CONTENTS

21.C6.2.1 System Requirements and CEH Criticality Level---------- C6-27
21.C6.2.2 Constitution of CEH IV&V team ---------- C6-28
21.C6.2.3 CEH Certification Plan (CEH CP) ---------- C6-28
21.C6.2.4 CEH Design and Development (D&D)---------- C6-29
21.C6.2.5 CEH Evaluation and Tests---------- C6-29
21.C6.2.6 CEH Configuration Control and Process Assurance ---------- C6-30
21.C6.2.7 CEH Clearance and Flight Trials ---------- C6-31
21.C6.2.8 Custom made Intellectual Property Cores (IP Cores) ---------- C6-31

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 (SSA).

Acceptable Means of Compliance

a. CEH Component shall be identified in line with regulation 21.C6.1.5.

b. System Requirements allocated to CEH shall be identified and allotted to each of the planned CEH components. This shall be documented and approved by the Main Contractor as SARAD which is a single document for the system and in addition, it shall contain other allocations like software requirements.

b. Safety requirements that define the fault detection, fault tolerance and fault avoidance characteristics of the system are to be identified from the allocated CEH requirements, apart from functional and performance requirements. Failure modes shall be identified.

c. 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.

d. 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.

e. SSA reports duly signed by all stakeholders and SARAD duly approved by the Main Contractor shall be released.

f. System Interface requirements w.r.t. CEH shall be documented.

Guidance Material

a. ARP4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment.

b. 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.

c. SSA (and PSSA) may be carried out by a team constituted by Main Contractor including System experts, Domain experts, IV&V, CEMILAC and any other relevant stake holders.

21.C6.2.2 Constitution of CEH IV&V team

Regulation

For every Airborne Store with an embedded system, IV&V team shall be constituted by Main Contractor with relevant stakeholders.

Acceptable Means of Compliance

a. IV&V team shall consist of system experts, domain experts, testing experts from relevant stake holder organisations and CEMILAC and DGAQA representatives.

b. IV&V team shall to be independent from the CEH design and development team.

c. IV&V team shall carry out IV&V planning, independent reviews and participate in CEH review meetings, analysis, verification and reporting activities during the CEH development life cycle.

d. IV&V recommendation is a required input for CEMILAC CEH certification.

e. CEMILAC has got the prerogative to create a CEH evaluation team apart from the IV & V team.

Guidance Material

Nil

21.C6.2.3 CEH Certification Plan (CEH CP)

Regulation

Main Contractor shall propose to CEMILAC, a CEH Certification Plan (CEH CP) that shall include acceptable means to demonstrate compliance.

Acceptable Means of Compliance

a. CEH CP shall address

   i. Milestones, involved agencies, artefacts, audits

   ii. Means of compliance 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

b. Comprising of advanced analysis method, product service experience and architectural mitigation.

c. Main Contractor shall prepare CEH CP and it shall be approved by CEMILAC before compliance demonstration commences and updated as necessary during the Certification process.

d. CEH certification shall be carried out concurrently with the CEH development.

e. Identification of CEH - HwCI and other CEH artefacts shall follow Regulation no. 21.C6.1.5 “Identification”.

GUIDANCE MATERIAL

Nil

21.C6.2.4 CEH DESIGN AND DEVELOPMENT (D&D)

REGULATION

Main Contractor shall have a D&D process for CEH which shall meet the CEH Certification Plan.

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.

GUIDANCE MATERIAL

a. CEH Plans shall be prepared and approved by CEMILAC as per the CEMILAC Level of Involvement mentioned in the CEH CP.

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 reviews, analysis, verification and testing shall be audited by 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) may be constituted by the Main Contractor in consultation with CEMILAC to establish the test adequacy. TARB has members from CEMILAC, System experts, domain experts, Software design & development team members, V&V/IV&V team member.

d. Test Adequacy Review Board (TARB) may review the test plan and test methodologies at system integration level for adequacy. 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 behavior testing.

b. In-Hardware run time dynamic testing method and means may be detailed. On target, at speed testing to be carried out for critical CEH applications.

c. RTL model simulation reports to be prepared by the Main Contractor. 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. Configuration Management and Process Assurance shall be done based on respective plans.

b. At every phase of CEH life cycle, base-lining, archiving, version control shall be done.

c. HwCI (Hardware Configuration Items) shall be uniquely identified.

GUIDANCE MATERIAL

a. Problem Report generation and Change control procedures to be adhered.

b. Ensure configuration of all identified CIs at System/Store 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 Trials

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 Technical Acceptance along with conditions and limitations will be brought out.

d. Certification life cycle data for CEH shall be handled in similar lines with software.

Guidance Material

Nil

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 Approval (LoA).

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 plans shall be defined and documented.

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 apply for Letter of Approval (LoA) for IP core through an application/ request. During which time Main Contractor shall submit an endorsed

Certification of Design (CoD). He shall also submit an IP core data sheet during application/request for Letter of Approval (LoA).

g. IP developer shall inform CEMILAC whenever an IP user is using his IP core.

h. 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.

GUIDANCE MATERIAL

a. All Regulations on CEH to be referred wherever applicable.

b. IP developer shall release user manual.

21.C6.3 AB-INITIO DESIGN AND DEVELOPED GROUND SYSTEM SOFTWARE

RATIONALE

Ground System Software covers a wide variety of Software like Test Rig Software, TTGE Software, Ground Control Station software, Ground Exploitation Software, Mission Planning and Analysis Software, Training System Software etc. 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 bench level, rig level, platform level simulation and testing. It becomes imperative to certify these software.

The Ground Control Software of UAS are considered on par with Airborne Software and are cleared as per Subpart C6.1.

CONTENTS

21.C6.3.1 Applicability ---------- C6-35
21.C6.3.2 Design, Development and Certification of Test Rig and TTGE Software ---------- C6-36
21.C6.3.3 Design, Development and Certification of Mission Planning and Analysis Software -------- C6-37
21.C6.3.4 Design, Development and Certification of Ground Data Loading Software ---------- C6-38
21.C6.3.5 Design, Development and Certification of Calibration and Instrumentation Software ------ C6-39
21.C6.3.6 Design, Development and Certification of Air System Maintenance and Pilot/Crew Training Software ---------- C6-39

21.C6.3.1 APPLICABILITY

REGULATION

This regulation shall be applied for the clearance of the software components which are identified as Ground System Software and reside inside non- Airborne Systems.

ACCEPTABLE MEANS OF COMPLIANCE

a. The following Types of Software shall be considered as Ground System Software:

i. Test Rig & TTGE Software:

A. Test Rigs and TTGE are required during design/development, Production Operation and Maintenance of Air Systems and Airborne Stores. Refer Subpart 21.T for categorization of Test Rigs and TTGE. Software developed for the Test Rigs & TTGE shall be certified by respective agencies in accordance with Subpart T.

B. Test Rig Software include Software that resides in the ground Test Equipment/Test Rigs/ Automated Test Equipment (ATE) which are used to test and analyse the hardware and/or software of the Airborne Systems (UUT).

C. Simulation Software include Software that closely mimics the behavior of external systems or environment in the absence of actual systems/ environment. (Eg: Power system behavior simulation, Radar signal processing simulation etc.,). This software shall be considered as Test Rig Software.

D. TTGE covers a wide spectrum of equipment like simple mechanical tools and support equipment to complex Mission planning and analysis systems. However, considering the complexity of certain Ground Equipment, the system software is further classified into different categories as applicable for airborne software. Clearance of such software shall be issued by CEMILAC or DGAQA as elaborated in the subsequent sections of this Subpart.

ii. Mission Planning and Analysis software:

A. Mission Planning Software is the software to support mission & flight preparation and mission execution activities. They also include Pre-Flight Message Generation Software and Flight Plan Generation Software.

B. Flight Data Analysis (FDA) or Flight Data Monitoring (FDM) software is used to analyse and interpret on board stored data of Air Systems. The data include flight data as well as mission storage data.

iii. Ground data loading and data retrieval software:

A. Data loader software: (Eg: ARINC 615/603 based software data loaders, Fill gun software, threat libraries)

B. Data Retrieval software (Eg: Milking data from FDR)

C. Software used for In-situ programming & verification of the Airborne Store also shall be categorised under Ground System Software

iv. Calibration and Instrumentation software:

A. Calibration software is used for calibrating Airborne Systems (Eg: Radar calibration, EW calibration, INS calibration)

B. Ground based custom made Instrumentation software used to monitor, collect and analyse Air System/Mission System performance during flight. (Eg: Vibration recorder, Data Converter, Vibration analysis). This excludes standard FTI and telemetry software.

v. Air System and Pilot/crew training/maintenance software:

A. Maintenance Software of the Air System

B. Pilot/crew training software

b. Any software component apart from the application software which resides inside an Airborne System during its qualification, acceptance, operation and maintenance shall be considered as Airborne Software and shall be cleared in accordance with Subpart C6.1.

GUIDANCE MATERIAL

NIL

21.C6.3.2 DESIGN, DEVELOPMENT AND CERTIFICATION OF TEST RIG AND TTGE SOFTWARE

REGULATION

Test Rig & TTGE Software shall follow a systematic design development and certification process based on its criticality, role and functionality prior to its intended usage.

ACCEPTABLE MEANS OF COMPLIANCE

a. Test Rig & TTGE software Design, Development and Certification shall follow established Software Development Life Cycle process and industry best practices. Towards this, the development and certification process elaborated in Subpart C6.1 shall be followed in general. However, System specific SDLC and certification process shall be elaborated in a Software Certification Plan document.

b. The responsibility for the clearance of Test Rig and TTGE software shall be in line with the clearance of such systems as elaborated in Subpart T.

c. Software Certification Plan for Test Rig and its software shall be prepared by the Main Contractor in consultation with CEMILAC/DGAQA and other relevant stake holders. The plan shall detail the review processes and stages of involvement of certification agencies.

d. CEMILAC/DGAQA may delegate the responsibility of Verification and validation of Test Rig and TTGE software to the IV&V /SQA group of the Main Contractor depending on its criticality and as a privilege under organisation approval.

e. Obtaining the software clearance for test software required during development will be the responsibility of Main Contractor of those equipment.

f. 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 and approved as per Subpart T.

g. Software Requirements of the ground/test equipment and test rig shall be approved by CEMILAC.

h. IV&V, Configuration management and SQA activities, review process to be covered for full life cycle of ground/test equipment and test rig software design, development and certification.

Guidance Material

NIL

21.C6.3.3 Design, Development and Certification of Mission Planning and Analysis Software

Regulation

Mission Planning and analysis Software shall follow a systematic design development and certification process based on its criticality, role and functionality prior to its intended usage.

Acceptable Means of Compliance

a. All flight/mission planning, mission preparation, data analysis and pre-flight messaging software shall be certified by CEMILAC.

b. Software Certification Plan for Mission Planning and analysis Software shall be prepared by the Main Contractor in consultation with the CEMILAC and other relevant stake holders. The same shall be approved by CEMILAC.

c. Software development shall follow an established SDLC process.

d. Software requirements, software design/development, preparation of test plans and reports of Ground Planning and Analysis Software shall be done by the Main Contractor.

e. Verification and validation of all Mission Planning and Analysis software shall be the responsibility of the Main Contractor.

f. Based on the software verification reports and in compliance with the approved software certification plan, CEMILAC shall issue the clearance.

GUIDANCE MATERIAL

Nil

21.C6.3.4 DESIGN, DEVELOPMENT AND CERTIFICATION OF GROUND DATA LOADING AND ANALYSIS SOFTWARE

REGULATION

Ground Data Loading and Analysis Software shall follow a systematic design development and certification process prior to its intended usage.

ACCEPTABLE MEANS OF COMPLIANCE

a. Software development shall follow an established SDLC process in line with Subpart C6.1. however, necessary tailoring of the process shall be made based on its criticality level and intended usage.

b. System requirements and Software requirements shall be approved by RCMA/ CEMILAC.

c. Software requirements, software design/development, preparation of test plans and reports of Ground Data Loading Software shall be done by the Main Contractor.

d. Verification and validation of all Data Loading and Analysis software shall be the responsibility of the Main Contractor.

e. RCMA/CEMILAC shall issue the software clearance certificate based on submitted artefacts and IV&V report

GUIDANCE MATERIAL

NIL

21.C6.3.5 Design, Development and Certification of Calibration and Instrumentation Software

Regulation

Calibration and Instrumentation Software shall follow a systematic design development and certification process prior to its intended usage.

Acceptable Means of Compliance

a. Software development shall follow an established SDLC process in line with Subpart C6.1. however, necessary tailoring of the process shall be made based on its criticality level and intended usage.

b. Software requirements, software design/development, preparation of test plans and reports of Calibration and Instrumentation Software shall be done by the Main Contractor.

c. Verification and validation of all Calibration and Instrumentation Software shall be the responsibility of the Main Contractor.

d. DGAQA shall issue software clearance certificate for on board instrumentation software after ensuring the compliance and also based on the reports forwarded by Verification and validation team. This excludes standard FTI and telemetry software.

e. DGAQA may delegate the Verification & Validation responsibility of such software to IV&V/SQA group of the Main Contractor depending on the criticality and if such privilege is available under organisation approval.

Guidance Material

NIL

21.C6.3.6 Design, Development and Certification of Air System Maintenance and Pilot/Crew Training Software

Regulation

Air System maintenance and pilot/crew training software shall follow a systematic design development and certification process prior to its intended usage.

Acceptable Means of Compliance

a. Software development shall follow an established SDLC process in line with Subpart C6.1. however, necessary tailoring of the process shall be made based on its criticality level and intended usage.

b. Software requirements, software design/development, preparation of test plans and reports of Calibration and Instrumentation Software shall be done by the Main Contractor.

c. Verification and validation of all Air System maintenance and pilot/crew training Software shall be the responsibility of the Main Contractor.

d. DGAQA shall issue software clearance certificate after ensuring the compliance and also based on the reports forwarded by Verification and validation team.

e. DGAQA may delegate the Verification & Validation responsibility of such software to IV&V/SQA group of the Main Contractor depending on the criticality and if such privilege is available under organisation approval.

GUIDANCE MATERIAL

NIL

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 the 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.

Intentionally Left Blank

CONTENTS

21.D.1	**Eligibility for taking up Modification & Alteration / Amendment of an Air System**	**D-5**
21.D.2	**Application for AMTC & SMTC**	**D-5**
21.D.3	**Changes in type design**	**D-6**
21.D.4	**Approval of Alteration/amendment to an Air System**	**D-7**
21.D.5	**Airworthiness Certification Plan for Modifications**	**D-8**
21.D.6	**Process of approval of Modifications**	**D-8**
21.D.7	**Designation of applicable Airworthiness Codes/Standards for Modification**	**D-9**
21.D.8	**Constitution of Local Technical Committee (LTC)**	**D-11**
21.D.9	**Constitution of LMC**	**D-12**
21.D.10	**Classification of modifications**	**D-14**
21.D.11	**Issue of Amended Military Type Certificate (AMTC) or Supplemental Military Type Certificate (SMTC)**	**D-16**
21.D.12	**Duration and continued validity**	**D-17**
21.D.13	**Record keeping**	**D-18**
21.D.14	**Instructions for Sustaining Type Airworthiness**	**D-18**
21.D.15	**Constitution of Local Concession Committee (LCC)**	**D-19**

Intentionally Left Blank

21.D.1 Eligibility for taking up Modification & Alteration / Amendment of an Air System

Regulation

Modification & Alterations/Amendments of an Air System leading to issuance of an Amended Military Type Certificate (AMTC) or Supplemental Military Type-Certificate (SMTC) shall be carried out by such organisations which complies with the eligibility criteria for such capability.

Acceptable Means of Compliance

a. Any organisation that has demonstrated, or is in the process of demonstrating its capability as a design organisation for carrying out such modifications as per Subpart G1 shall be eligible as an applicant for an AMTC or SMTC under the conditions laid down in this Subpart.

b. User Services may also undertake modifications & alteration/amendment for Air Systems including bought out and license produced Air Systems by undertaking such tasks themselves or assigning such jobs to the OEM/ Licensee or any third party design organisation.

Guidance Material

Refer to Subpart G1.

21.D.2 Application for AMTC & SMTC

Regulation

Any organisation applying for an AMTC or a SMTC shall demonstrate its capability by holding a Design Organisation Approval (DOA), issued by CEMILAC.

Acceptable Means of Compliance

a. The organisation shall hold a DOA issued by CEMILAC as per Subpart G1.

b. Alternatively, 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.

c. If the design organisation is the OEM of the Air System, an AMTC shall be issued. However, if the modification is limited to a few numbers as a variant of the original configuration, and if the modification is not applicable for the regular production series, such modification may be issued with SMTC.

d. If the organisation is not the original design organisation of the Air System, SMTC may be issued. In this case the organisation should enter into an agreement with a design organisation which holds Type Design data to ensure that such specific actions shall be within the prescribed safety limits. 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.

Guidance Material

Nil

21.D.3 Changes in type design

Regulation

Any change in Type Design shall be identified either as an 'alteration/amendment' or as a 'modification'. Identification shall be approved by CEMILAC or by the Air System Design Organisation (ASDO) as a privilege under DOA.

Acceptable Means of Compliance

a. A change that has negligible 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 effect on Function, Interchangeability, Life, Maintenance, Safety and Strength (FILMSS) shall also be classified as alteration/amendment.

b. All other changes including upgrades shall be considered as a modification. All modifications shall be ratified through a Local Modification Committee (LMC).

c. The criteria for classification (alteration/amendment or modification) for the changes to the Type design carried out shall be recorded by ASDO and approved by CEMILAC during the DOA process. This information shall be produced to CEMILAC on a mutually agreed periodicity.

d. CEMILAC reserves the authority to re-classify if deemed appropriate to do so.

Guidance Material

a. Changes shall be identified as either alteration/amendment or modification, using the criteria of the regulation and the complementary guidance issued by CEMILAC.

b. 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.

21.D.4 Approval of Alteration/amendment to an Air System - Form 32

Regulation

Alteration/Amendment in a type design shall be classified and approved either by CEMILAC or by the Air System Design Organisation (ASDO) as a privilege under DOA.

Acceptable Means of Compliance

a. Main Contractor shall propose the changes classified as alteration/amendment with unique amendment number and submit to the concerned CEMILAC/ authorised signatory of ASDO for coordination.

b. Documents like Drawings, MDI, Drawing Applicability List (DAL), SOP and ACBS shall be updated.

c. The classification and approval of changes in Type Design carried out by the approved ASDO as alteration/amendment shall be subjected to audit by CEMILAC during the renewal of organisation approval or as required by the authority at any time.

Guidance Material

When the approved ASDO is introducing an alteration/amendment into the Air System under a procedure agreed with CEMILAC, the role of the approved compliance verification engineer shall be in agreement with CEMILAC.

21.D.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 stakeholders and same shall be submitted along with the application. This ACP shall be approved by CEMILAC.

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 organisations.

c. ACP shall discuss about the formation of committees 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.

21.D.6 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. Modification of an Air System during production or in-service phase is approved through 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 Subpart 21.D.9. A 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 constitution of LCC provided in Subpart 21.D.15

b. A Local Technical Committee (LTC) is formed at contractor place to evaluate the modifications proposed by the Main Contractor, for which technical data/information is not readily available, and those modifications that have been recommended by the LTC need to be considered by the LMC for ratification. Refer constitution of LTC provided in Subpart 21.D.8.

c. Classification of modification shall be carried out as given in Subpart 21.D.10.

d. The availability of amended publications shall be ensured before introduction of modified aircraft/engine/equipment into service use as given in Subpart 21.D.14.

Guidance Material

a. Different committees are formed to handle those design changes categorized as "Modification" and to provide recommendations to CEMILAC to enable them to issue an AMTC or a SMTC.

b. Modifications shall be classified to indicate the urgency and application of each modification.

c. Main Contractor is responsible to supply the customer, amendments to all related publications consequent to introduction of the modification.

21.D.7 Designation of applicable Airworthiness Codes/ Standards for Modification

Regulation

The 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. Acceptability of airworthiness code/standard shall be approved by the Local Technical Committee (LTC), as per Subpart 21.D.9

b. If the Main Contractor chooses to use an earlier amendment of the airworthiness code/ standard, then the Main Contractor should show that the changed product complies with the earlier amendment of the airworthiness code, and of any other requirement the LTC finds is directly related. However, the earlier amended airworthiness code/ standard should not precede the corresponding airworthiness code of the Type Design.

c. If the Main Contractor 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, then the Main Contractor shall also comply with any other airworthiness requirements that the LTC finds is directly related.

d. If LTC finds that the airworthiness codes referenced in the TCB do not provide adequate standards with respect to the proposed change, the Main Contractor 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. A change in Type Design should 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.

b. The Main Contractor can comply with an earlier amendment of the airworthiness code consistent with the requirements of Subpart D, 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.

c. Note that earlier amendments shall not precede the corresponding amendment of the airworthiness code incorporated by reference in the MTC.

d. 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.

e. 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.

f. 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.

g. 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 CEMILAC.

21.D.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, when sufficient technical data/information is not readily available.

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 (Form 31) 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 be given 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 Chairman LMC shall have representatives from Design/Liaison, Quality Assurance/ Quality Control, Manufacturing & Methods/Technology departments of the Main Contractor, CEMILAC and DGAQA. LTC shall be chaired by CEMILAC representative or a domain expert as decided by Chairman LMC.

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 there of shall rest with Main Contractor.

e. Every modification shall be put up for consideration by the LTC. An Advance Modification Information must be issued by the design agency to CEMILAC, DGAQA and CSDO (Dett)/NASDO/MAG (Avn). This has to be technically cleared by concerned division of CEMILAC before the modification can be considered by the LTC.

21.D.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 OF COMPLIANCE

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 field unit of 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 shall ensure that such items have been approved by Air /Naval/Army HQ 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 HQ. A draft proposal proforma indicating the timelines, Air Systems on which this mod can be

introduced during production, retro embodiment, redundancy etc., along with LMC's recommendation shall be sent to Directorate of Engineering at Air/Naval/Army/CG HQ and Maintenance rep of User Services (Eg. CSDO/AFLE/IAF PMT/BRD/NASDO/MAG(Avn)/Eqvt), 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 field unit of CEMILAC to all members, DGAQA, Service HQ, Directorate of Engineering HQ, Director of Projects, Flight testing agency, Director of Ground Electronics and Systems (where necessary), Coast Guard HQ and CDA.

h. An Index of Modifications shall be prepared by the Main Contractor and circulated to Service HQ, operating units, Flight test agency, 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 Maintenance rep of User Services (Eg. CSDO/AFLE/IAFPMT/BRD/NASDO/MAG(Avn)/Eqvt), User Services (Air/Naval/Army/CG Head Quarters), DGAQA, CDA, Contractor's representatives in Design, Production Engineering, Methods Engineering and Quality Control.

b. An Advanced Modification Information (AMI) (Form 33) 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 AMI shall be duly coordinated by CEMILAC. AMIs are to be prepared even in respect of modifications introduced by the Services. The AMI is the document which would give exact details of work to be done, effect on publication, status prior to introduction of Mod, effect on spares etc.

c. On ratification of AMI by LMC, it shall be converted to a Mod leaflet (Form 35) duly approved by Chairman LMC and distributed to all stakeholders and agencies earmarked to receive minutes of LMC.

d. The index of modifications (Form 34) shall be made available. 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 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.D.10 Classification of Modifications

Regulation

Modifications of Air Systems shall be classified either Alphabetically or Numerically depending on the initiator/implementation agency of such modifications.

Acceptable Means of Compliance

a. Alphabetical Classification shall be applied to the Air Systems modified by the Main Contractor.

b. Numerical Classification shall be applied to the modifications initiated by the User Services.

Guidance Material

a. Indian Air Force Order 18/2019 shall be considered while carrying out the classification.

b. The following Alphabetical Classification apply to Air Systems being produced, reconditioned or repaired at contractor's place.

i. **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.

ii. **Class A:** Modifications those are essential. Non-embodiment will affect safety, non-availability or impose severe operational limitations. They shall be embodied irrespective of any delay in delivery or scrap involved.

iii. **Class B:** Modifications that are of 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 LMC.

iv **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 LMC.

v. **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 overhaul/repair when unmodified spares are exhausted.

c. 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.

d. Numerical Classification

The following classifications shall apply to Air System 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.

i. **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.

ii. **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 LMC.

iii. **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 committee to outweigh the cost and effort of retrospective embodiment.

iv. **Class 4:** Modifications that are non-retrospective and do not affect the interchangeability of spares. When LMC decides it is necessary to withdraw and modify or scrap existing spares. If required, they shall be embodied during repairs or reconditioning.

e. 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:

A. To be embodied in the nth production aircraft/missile/ equipment or,

B. Provision of "X" complete modification sets to be delivered for specified aircrafts missiles/equipment, and

C. 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.D.11 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 Air System for the modification carried out by any organisation, who is not a Military Type Certificate Holder (MTCH).

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 CEMILAC.

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 custodian of the 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. The following types of modifications may 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 to 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 result in CEMILAC issuing the AMTC or SMTC.

21.D.12 DURATION AND CONTINUED VALIDITY

REGULATION

An AMTC or SMTC shall be issued for a period of seven 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 does 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.D.13 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 for at least 5 years after the removal of the last Type certified Air System from Service.

Guidance Material

Nil

21.D.14 Instructions for Sustaining Type Airworthiness

Regulation

The approved ASDO responsible for the change, shall provide to CEMILAC the variations to Instructions for Sustaining Type Airworthiness (ISTA) for the product, on which the change is to be installed, prepared in accordance with the applicable TCB.

Acceptable Means of Compliance

a. Variations to the ISTA should be made available by the ASDO to 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 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

21.D.15 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 non-compliance 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 Head Quarters.

viii. The final acceptance of concessions for non-compliance of modifications of Class B/2 nature can only be decided by Service Head Quarters 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 CEMILAC 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).

b. Concessions on non-compliance of modifications, SI/STI on manufacturing projects shall be referred to through DGAQA for concurrence. Concurrence on operational aspects should be in consultation with User.

SUBPART E
MODIFICATIONS OF AIRBORNE STORES

RATIONALE

This Subpart provides the regulation for any alteration/amendment or modification to the Type Design of Airborne Stores after the issue of initial airworthiness clearances like IMATSOA (For Minor Changes in IMATSOA: IMATSOA holder is authorized to do the modification as per this subpart and For Major Changes in IMATSOA : IMATSOA holder has to apply for new IMATSOA), LoA and TA. Any change in design, material and process is treated as either alteration/amendment or modification. The regulations of this Subpart also cover modification of bought-out Airborne Stores and license manufactured Airborne Stores

Intentionally Left Blank

CONTENTS

21.E.1	**Design Changes During Production & Service Use**	**E-5**
21.E.2	**Constitution of Local Modification Committee (LMC)**	**E-6**
21.E.3	**Constitution of Local Technical Committee (LTC)**	**E-7**
21.E.4	**Design Changes during Production – Alteration/Amendment**	**E-8**
21.E.5	**Design Changes During Production – Modifications**	**E-9**
21.E.6	**Publications and Promulgation of Modification**	**E-13**
21.E.7	**Compliance of Modification**	**E-13**
21.E.8	**Modification of Airborne Stores where LMC is not Constituted**	**E-14**
21.E.9	**Modification of Airborne Stores by Agency other than Certificate Holder**	**E-14**
21.E.10	**Constitution of Local Concession Committee (LCC)**	**E-15**

Intentionally Left Blank

21.E.1 Design Changes During Production & Service Use

Regulation

Any changes to the baseline configuration of an Airborne Store (for which initial airworthiness approval has been issued), necessitated during production or regular service use, shall follow a formal approach for clearance.

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 Subpart 21.E.3

b. Modifications – Acceptance of the modification by Local Technical Committee (LTC) and approval thereafter by Local Modification Committee (LMC) as described in Subpart 21.E.2

c. Design changes/modifications carried out on items issued with LoA shall also be classified as alterations/amendments or modifications.

Guidance Material

a. Production of Airborne Store commences after the issue of initial airworthiness clearances like PC/TA/LoA/IMATSOA. Changes to the baseline configuration of an Airborne Store may be necessitated during its production or service use subsequent to its delivery.

b. Such changes may result from 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 a defect investigation committee or the 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: Does not affect FLIMS) and “Modification” (major changes: Affect FLIMS) by Main Contractor. In cases where the categorisation of a particular design change as “Alteration/Amendment” or “Modification” is difficult to be decided, these shall be discussed through LTC.

e. There may arise a need to introduce certain design changes to the stores being manufactured under license. These design changes may be proposed by the Licensor

(OEM of the store) 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 Modification Committee (LMC)

Regulation

Local Modification Committee (LMC) comprising of representatives from all the stakeholders is formed by the Government to approve the configuration changes categorized as "Modification". An LMC may be formed at the Contractor's premise which has the design responsibility for the modifications.

Acceptable Means of Compliance

a. The terms of reference of the LMC are as below:

i. Members – Representatives from the Design/Liaison, Quality Assurance/ Quality Control, Production & Methods/Technology Departments of the Contractor, CEMILAC, DGAQA, Maintenance rep of User Services (Eg. CSDO/AFLE/IAF PMT/BRD/NASDO/MAG(Avn)/Eqvt), IAF/ Army/Navy/ CG Head Quarters and DAD/CDA

ii. Chairman – Chief Resident Engineer/Regional Director of the concerned unit of CEMILAC.

iii. Chairman shall nominate an officer of CEMILAC to work as member secretary to LMC.

iv. The name of the members of the LMC to be notified by chairman at the start of each production year.

v. To form a Local Technical Committee (LTC) to assess the technical aspects of the modifications or alterations/amendments.

vi. To determine the feasibility and assess justification or other implications of introducing a modification while considering the recommendation from LTC.

vii. To decide on classification, applicability and the point of embodiment of the modification, to recommend manner of retro-compliance and effect on spares.

viii. To accord technical and financial approval to a modification proposal if found to be acceptable, subject to the financial limits of the LMC.

ix. To accord technical approval and to recommend financial approval by the concerned service HQ in respect of modifications whose cost is beyond the financial powers of LMC.

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. Main Contractor shall forward the agenda points along with requisite technical documents well in advance and request to CEMILAC for initiation of LMC.

c. CEMILAC shall initiate LMC and forward 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.

d. The LMC is not required for those design issues not involving production or issues of purely manufacturing in nature not involving any design changes. Such issues shall be dealt directly with CEMILAC and DGAQA respectively.

e. Responsibility for convening meetings of LMC and release of minutes thereof shall rest with CEMILAC. Minutes of LMC meetings shall be circulated by CEMILAC to all the member agencies of LMC, external agencies not participating in the meeting but affected by the decisions taken in the LMC.

21.E.3 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), where sufficient data/information on the proposal is not readily available.

ACCEPTABLE MEANS OF COMPLIANCE

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. The members & terms of reference of the LTC are as below:

   i. Members – Representatives of Main Contractor/ Licensor, CEMILAC and DGAQA.

   ii. Chairman – Representative of CEMILAC

iii. Categorization of a design change proposed by the Main Contractor as alteration/amendment or modification.

iv. Scrutiny/Study of design changes to the accessory proposed by the Main Contractor/Licensor and the justifications thereof.

v. To decide on classification and applicability of those design changes categorized as "Modification".

vi. Finalization of test requirements including environmental tests if any required for validation of the efficacy of proposed design changes and to establish their airworthiness.

vii. Analysis of results of tests decided at Para vi above.

viii. Acceptance of the design changes categorized as "Alterations/Amendments" for implementation.

ix. Recommending approval of "Modifications" to Local Modification Committee (LMC).

Guidance Material

LTC shall function in accordance with the listed terms of reference for handling design changes in respect of the stores 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 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 to be submitted by the Main Contractor along with necessary justification.

b. Minutes of LTC meeting on scrutiny, evaluation and acceptance of "Alterations/ Amendments" for their implementation.

GUIDANCE MATERIAL

a. An Alteration/Amendment is a design change which does not

   i. Affect the safety, operational use, life, reliability or other specification or design requirements of a store.

   ii. Involve significant changes in production or changes which affect stores already produced.

   iii. Affect the cost, the delivery program of the store or standard of spare parts.

   iv. Affect the interchangeability of the store.

b. The following design changes only will meet the above criteria and can be covered under Alteration/Amendment:

   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.

   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 which do not seriously affect the cost and the material procurement etc.

c. 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 in 21.E.3.

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 in 21.E.2.

c. All modifications proposed by Main Contractor shall be implemented only after approval of the same by LMC and approval of modification leaflet by CEMILAC. 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 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 CEMILAC.

e. Index of Modifications prepared by the Main Contractor, updated once in a year and duly coordinated by 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 Head Quarters. 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 Head Quarters 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:

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". The Mod Proposal shall be technically evaluated and accepted by the LTC as per the applicable terms of reference before recommending the same for consideration by the LMC.

c. Advanced Modification Information (AMI)

An Advanced Modification Information (AMI) shall also be issued by the design agency to CEMILAC, DGAQA and CSDO/NASDO/MAG (Avn). Post evaluation of the Mod Proposal by LTC, the AMI shall be technically cleared by CEMILAC before the modification can be considered by LMC.

d. Modification Leaflet:

A Modification Leaflet 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 CEMILAC. 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:

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 CEMILAC. The index of modifications shall be made. The index of modifications is the only document which would

give applicability as well as compliance status of modifications on various aircraft. Updated index of Modifications are to be prepared by Main Contractor and to be co-ordinated by CEMILAC and are to be shared to all stakeholders at the start of the year by the Main Contractor. 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 CEMILAC, approved by Air /Naval/Army HQrs for the particular application and also the Airborne Store is duly Certified (TA/IMATSOA/LoA).

iii. 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 Maintenance rep of User Services (Eg. CSDO/AFLE/IAF PMT/BRD/NASDO/MAG(Avn)/Eqvt), 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 Head Quarters 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 HQrs 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. 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.

21.E.6 Publications and Promulgation of Modification

Regulation

The details of modification shall be published and promulgated to all the stakeholders like ASDO, Service Head Quarters, operating units, flight test departments and TAAs.

Acceptable Means of Compliance

a. The modification leaflet, service bulletin shall be forwarded to all the stakeholders within 30 days of 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 Head Quarters 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, CE(A), CEMILAC shall form a Local Technical Committee (LTC). The LTC shall technically ratify the modification without financial implications.

ACCEPTABLE MEANS OF COMPLIANCE

a. All necessary technical details to be provided to the LTC.

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 CEMILAC.

   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 the Airborne Store, has to be obtained for non-collaboration of Type Approval Holder in supporting continued airworthiness.

GUIDANCE MATERIAL

Nil

21.E.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 & C 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 Class C and D nature or equivalent Service instructions.

vi. To recommend acceptance or reject concessions for noncompliance of Class B modifications nature or equivalent instructions.

vii. The LCC is not authorized to grant concessions of Class B modifications but can only recommend acceptance to Service Head Quarters.

viii. The final acceptance of concessions for non-compliance of modifications of Class B nature can only be decided by Service Head Quarters based on the recommendations of LCC.

ix. The LCC can accept concessions of Class C & D modifications.

b. The LCC shall be chaired by the CEMILAC 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).

b. Concessions on non-compliance of modifications, SI/STI on manufacturing projects shall be referred to DGAQA for concurrence. Concurrence on operational aspects should be in consultation with the User Services.

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/Airborne Store and failure to understand its configuration will make continuing airworthiness very difficult. 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 Signal out certificate for an Air System or Release Note for an Airborne Store.

Intentionally Left Blank

CONTENTS

21.F.1	**Applicability**	**F-5**
21.F.2	**Eligibility**	**F-5**
21.F.3	**Application for Production Evaluation Coverage**	**F-7**
21.F.4	**Quality Management System**	**F-7**
21.F.5	**Transition to Production**	**F-9**
21.F.6	**Production without RMTC/MTC**	**F-10**
21.F.7	**Production of Air Systems under Restricted MTC**	**F-11**
21.F.8	**Production of Air Systems under MTC /AMTC/SMTC**	**F-12**
21.F.9	**Production of Air Systems under License Agreement**	**F-13**
21.F.10	**Production of Airborne Stores under Provisional Clearances**	**F-15**
21.F.11	**Production of Airborne Stores under TA/LoA/IMATSOA**	**F-16**
21.F.12	**Production of Airborne Stores under License Agreement**	**F-18**
21.F.13	**Documentation and Language**	**F-19**
21.F.14	**Identification**	**F-20**
21.F.15	**Packaging**	**F-20**
21.F.16	**Application for CoA/Release Note**	**F-21**
21.F.17	**Issue of CoA/Release Note**	**F-21**
21.F.18	**Spares**	**F-22**
21.F.19	**Test during Production & Periodic Qualification Tests**	**F-23**
21.F.20	**Amendment or Modification**	**F-24**
21.F.21	**Deviations during Production**	**F-25**
21.F.22	**Concessions**	**F-26**
21.F.23	**Defects during Service Usage & Production**	**F-26**
21.F.24	**Lifing aspects**	**F-27**

Intentionally Left Blank

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 MTC/AMTC/SMTC/PC/TA/IMATSOA/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/PC/TA/IMATSOA/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 Subpart. The licensor of the Air Systems/Airborne Stores shall hold a valid Approval/ Certification from a recognised airworthiness authority.

GUIDANCE MATERIAL

If the licensor is a foreign OEM, it is desirable that the certification agency of the country of origin may have a mutual recognition with Indian TAA.

21.F.2 ELIGIBILITY

REGULATION

Organisations involved in the production of Air Systems and Airborne Stores shall have a structure with responsibilities, procedures, processes, and resources well organised, so that the products conform to the certified configurations and are in a condition for safe flight.

ACCEPTABLE MEANS OF COMPLIANCE

a. Only that organisation 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 (PO) intending to produce an Air System 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 Air System developer.

c. A Production Organisation intending to produce an Airborne Store shall hold a valid PC/TA/ LoA/ IMATSOA 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 or holder of a POA 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. 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 Air System and its major components, from the country of origin to CEMILAC shall be included in the terms and conditions of the license projects.

c. The licensed production of Air Systems /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 produced after establishing compliance with approved configurations and performance requirements.

e. The holder of a POA may obtain a Release Note from DGAQA or equivalent for each serial number of the Airborne Store produced after establishing compliance with approved configurations and performance requirements.

f. 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.1).

   ii. Details of MTC/AMTC/SMTC/PC/TA/IMATSOA/LoA/Equivalent (if applicable).

   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. 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 Subpart G2.

b. AFQMS released by DGAQA or AS 9100 can be the baseline for establishing the QMS.

GUIDANCE MATERIAL

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,

A. Ensure that each supplier provided product, article, or service conforms to the production organisation approval holder's requirements; and

B. 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 organisation 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:

A. An Acceptance Test Plan for each of the item produced.

B. 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 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. Non conforming product and article control:

A. 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.

B. Procedures to ensure that discarded articles are rendered unusable.

C. Corrective and preventive actions. Procedures for implementing corrective and preventive actions to eliminate the causes of an actual or potential non-conformity to the approved design or non-ompliance 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,

A. Address any in-service problem involving design changes; and

B. 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 for Air Systems 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/fixtures/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 Air System or Airborne Store meets the TCB/TAB to a satisfactory level and is approved by CEMILAC.

c. The method of sealing of drawings shall be agreed by contractor with CEMILAC.

d. In case of production under license agreements, the Transfer of Technology and the First Article Inspection/Evaluation & RTT, if required shall be completed prior to the sealing of drawings.

GUIDANCE MATERIAL

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 Air System may be commenced prior to the issue of RMTC/MTC whenever a satisfactory compliance to TCB is achieved.

ACCEPTABLE MEANS OF COMPLIANCE

a. Except for the availability of RMTC/MTC, the provisions detailed at 21.F.7 are applicable.

b. The number of units shall be restricted as agreed upon between the stakeholders.

GUIDANCE MATERIAL

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 G2. 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 mitigate 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 Air Systems shall be in accordance with the TCDS.

f. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones. PO shall conduct Acceptance Testing for Air Systems in accordance with the approved Schedules.

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 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 G2.

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 Air System, 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 Air System to User bases.

k. On completion of aceptance tests, each Air System shall be issued with a Certificate of Airworthiness (CoA) in the form of Signal out Certificate (SOC) as per Subpart H.

GUIDANCE MATERIAL

a. Production Organisation Exposition (POE) shall be prepared in accordance with Subpart G2

b. Type record 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 Type record 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 Supplemental 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.

c. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones. PO shall conduct Acceptance Testing for Air Systems in accordance with the approved Schedules.

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. Type Record for FOC 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 organisation 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 Air System/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 Head Quarters 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. PO shall conduct Acceptance Testing for Air Systems in accordance with the approved Schedules.

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. Type Record 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 provision 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.F.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 trial performance evaluation of the Airborne Store, where an acceptable baseline configuration concurred by the User Services is arrived at.

d. PO shall demonstrate the capability to produce such Airborne Store to DGAQA and CEMILAC as per provisions provided in Subpart G2. 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 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 as per Subpart T.

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 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.

j. The PC 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 released 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. Functional test plan documents and/or Qualification Test Schedule/Plan shall be the basis for finalising the ATP and FTP documents.

d. Maintain at the place of manufacture all information and data specified in Provisional Clearance.

21.F.11 PRODUCTION OF AIRBORNE STORES UNDER TA/LOA/ IMATSOA

REGULATION

A production organisation may take up series production of Airborne Stores after obtaining Type Approval (TA)/LoA/IMATSOA 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/IMATSOA 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/IMATSOA from CEMILAC for the baseline configuration of the Airborne Store under consideration in accordance with Subpart C.

e. PO shall prepare a QA Plan indicating the inspection and test/demonstration milestones. PO shall conduct Acceptance Testing for Airborne Store in accordance with the approved Schedules.

f. PO shall obtain approval for the specifications of the test rigs and jigs used in the production of such Airborne Stores from CEMILAC as per Subpart T.

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/IMATSOA 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 qualification tests may be repeated to validate the production under new facilities and processes.

j. Each manufacturer of a product being manufactured under TA/IMATSOA/LoA 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 DGAQA or its authorised representative.

   iii. Maintain records of the completion of all inspections and tests required 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 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.

GUIDANCE MATERIAL

a. AFQMS document released by DGAQA shall be followed for finalizing the QA aspects of the System.

b. Production Organization Exposition (POE) shall be prepared in accordance with AFQMS.

c. Functional test plan documents and/or Qualification Test Schedule/Plan shall be the basis for finalizing the ATP and FTP documents.

d. Maintain at the place of manufacture all information and data specified in Type Record.

21.F.12 Production of Airborne Stores under License Agreement

Regulation

a. The Production Organisation (PO) may take up the production of Airborne Store with an intention to deliver those Airborne Store 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 Airborne Store

Acceptable Means of Compliance

a. The PO should have a formal agreement in place with the appropriate design organisation 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 Air Systems/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 Airborne Stores to DGAQA and CEMILAC as per provisions provided in Subpart G2. 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. PO shall conduct Acceptance Testing for Airborne Store in accordance with the approved Schedules.

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 Head Quarters 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 Airborne Store from CEMILAC as per Subpart T.

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 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.

GUIDANCE MATERIAL

a. AFQMS document released 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/Qualification Test Plan shall be the basis for finalising the ATP and Functional Test Plan documents.

21.F.13 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.14 IDENTIFICATION

REGULATION

Each Air Systems and Airborne Stores shall be identified with its Type, Serial Number and Modification Status if any in a manner legible and acceptable to all stakeholders.

ACCEPTABLE MEANS OF COMPLIANCE

a. Each Air Systems and Airborne Stores shall be identified as per Subpart Q, identification.

b. PO 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.15 PACKAGING

REGULATION

Each Airborne Store produced shall be packaged in a manner such that the store can be safely transported to its intended destinations or it can be stored in its defined condition.

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.

c. Applicable tests of the Airborne Store where packaging properties are evaluated need to be conducted.

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.16 Application for CoA/Release Note

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 for Air System and Release Note for Airborne Store.

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 to DGAQA.

b. Application for CoA of an Air System shall be in accordance with provisions given in Subpart H.

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 activities are carried out by the organisation in accordance with approved baseline configuration & procedures and the Airborne Store is in an acceptable state of Airworthiness.

Guidance Material

a. For a newly manufactured Air borne Stores following documents shall be submitted.

   i. A copy of TA/LoA/IMATSOA/PC, License agreements for production if any and Organisation Approval Certificates from TAA.

   ii. Statement of conformity to approved baseline configuration.

   iii. 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.

b. Refer to Subpart H for application for CoA of newly manufactured Air System.

21.F.17 Issue of CoA/Release Note

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) for an Air System in the form of a Signal out Certificate (SOC) or a Release Note for an Airborne Store by DGAQA.

Acceptable Means of Compliance

a. Statement of conformity for an Air System to approved baseline configuration shall be produced by PO to DGAQA.

b. 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.

GUIDANCE MATERIAL

a. Release Note shall be endorsed by appropriately authorized certifying staff on behalf of the organisation when it has been verified that all maintenance has been properly carried out by the organisation 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. Details of Certificate of Airworthiness for an Air System is provided at Subpart H

21.F.18 SPARES

REGULATION

Every Airborne Store supplied as spares to the User Services shall also have a release note/equivalent issued by DGAQA.

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 DGAQA shall finalise an acceptance mechanism for the spares.

b. DGAQA shall conduct necessary inspection and acceptance tests, at the appropriate level.

c. DGAQA shall issue a release note for the spare in a manner finalised with User Services.

21.F.19 Test during Production & Periodic Qualification Tests (PQT)

Regulation

a. Every Air System produced shall undergo identical standards of ground and flight tests before acceptance.

b. Production Acceptance Tests (PAT) shall be carried out on each Airborne Stores produced as per the approved SOP to ensure product quality and performance compliance.

c. Periodic Qualification Tests (PQT) shall be carried out on Airborne Stores at a defined periodicity to ensure consistency in quality of production.

Acceptable Means of Compliance

a. The ground & flight tests shall be detailed in a schedule of tests, prepared by the Main Contractor, in coordination with CEMILAC and DGAQA. Inputs from User Services may be obtained in Finalisation of Production Flight Test Schedule if necessary.

b. The ground test in accordance with the schedules, shall be demonstrated to the satisfaction of DGAQA. If any production Air System does not meet the requirement of tests, the subject matter should be referred as a concession to DGAQA and CEMILAC, for acceptance.

c. If certain flight tests are omitted because of weather, non-availability of equipment etc it shall be clearly stated in the aircraft documents that such tests have not been carried out.

d. Production Acceptance Test (PAT) Schedule shall be finalized jointly by the Design Organization, Production Organization and DGAQA

e. Periodic Qualification 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 Periodic Qualification Tests could be evolved jointly between the Design, Production and QA agencies.

f. Periodicity/frequency for conduct of PQT shall be determined jointly by the Design Organization, Production Organization and DGAQA based on the production batch size and criticality of the store.

g. The unit subjected to Periodic Qualification Tests (PQT) may be delivered to User Services with less / reduced life assigned based on quantum of PQT and type of LRU.

GUIDANCE MATERIAL

a. If the number of units (Air System sets) 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 (Air System set) or one unit in every 10 years, whichever is earlier, shall be subjected to PQT.

c. If there is a break in production for more than five years, PQT shall be carried out.

d. PAT Schedule shall be finalized based on the qualification test schedule of the unit. Test required to establish the functioning and performance of the unit and validate the quality of manufacturing shall be included in the PAT Schedule. However, the final list of tests shall be finalized in consultation with DGAQA

e. 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.

f. Any failure during PQT which calls for a design modification shall be referred to CEMILAC.

21.F.20 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 Subpart D

b. Any amendment to approved configuration of the Airborne Stores after the commencement of production shall be carried out as per 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.21 DEVIATIONS DURING PRODUCTION

REGULATION

The main contractor shall establish a non-conformance process for systematic handling of deviations during Limited Series Production (LSP) and Series Production (SP) phases.

ACCEPTABLE MEANS OF COMPLIANCE

a. The quality assurance department of Main Contractor shall ensure that the product is in accordance with the approved drawings and processes.

b. Any deviations from the approved drawing / process shall be identified and documented.

c. The deviations shall be put up to DGAQA for disposition. If felt necessary, DGAQA may refer to CEMILAC / NCRB for further analysis of the impact of the deviation on design. Based on the recommendation by CEMILAC / NCRB, DGQAQ may provide the disposition for the deviation.

d. The NCRB have members from CEMILAC, DGAQA, domain experts, design representatives and co-opted members.

e. The Main Contractor shall have a mechanism for segregation and disposal of rejected components.

f. The Main Contractor shall maintain a register of deviations for traceability and continual improvements.

GUIDANCE MATERIAL

a. The Main Contractor may maintain a Minor Deviation Register (MDR) register listing components with minor deviations. Deviations occurring on non-serial numbered items can be disposed off by DGAQA through MDR. These components with minor deviations can be used on the Air System/ Air borne store only with prior approval of DGAQA. Salvaging is allowed only for non-serially numbered items.

b. Deviations on serially numbered items shall be referred to DGAQA by Quality Control/Quality Assurance Department of Main Contractor through Form 53B. Minor deviations on such items may be disposed off by DGAQA themselves in consultation with QA and Design Departments of Main Contractor.

21.F.22 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 released for service use.

ACCEPTABLE MEANS OF COMPLIANCE

a. Granting of concessions depends upon the classification and criticality of the modification and service instructions.

b. Concessions on non-compliance of modifications, SI/STI on manufacturing projects shall be referred to CEMILAC through DGAQA for concurrence.

c. 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

a. 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.

b. Refer Subpart D & Subpart E for details on LCC for Air Systems & Airborne Stores.

21.F.23 DEFECTS DURING SERVICE USAGE & PRODUCTION

REGULATION

There shall be a mechanism to carry out the investigation of defects of Air Systems/ Airborne Stores after initial airworthiness approval is issued by CEMILAC.

ACCEPTABLE MEANS OF COMPLIANCE

a. User Services shall raise a defect report and shall be circulated to designers, production agency, CEMILAC and DGAQA.

b. A defect investigation mechanism shall be set up at manufacturer's/designer's premises to establish the reason for the defects reported through prescribed format and remedial measures to address the issue. Proceedings of the Defect Investigation shall be documented in the form of a Defect Investigation Report in the format prescribed in AFO 11/11 of IAF/equivalent by the respective User Service.

c. The field defect report shall be considered in establishing the reliability parameters of the Air Systems/Airborne Stores.

d. To ensure that defect investigation committee actions are properly carried out, a review of the defect investigations carried out at the contractor's firm is necessary. The constitution of defect investigation review committee shall be with Quality Chief of the Main Contractor as Chairman and CEMILAC, DGAQA, User Services, representatives of Quality Department, Production Department and Design Department of the contractor firm as members. The committee shall meet periodically for analyzing all defect investigations and review of the necessary remedial measures

e. A Reliability & Maintainability Cell shall be formed at the Production Organization to handle High Failure Rate Aggregates (HFRAs). The R&M Cell shall follow-up for instituting and implementing suitable remedial measures to address the causes of failures of those LRUs/systems/ accessories identified as HFRAs.

GUIDANCE MATERIAL

a. Refer Subpart L
b. Form 1023 (PWR)/Form prescribed by respective User Service
c. Form 1022 for the Defect Report/ Form prescribed by respective User Service
d. Format for Defect Investigation Report as prescribed by the respective User Service
e. IAF Directive on Formation and Functioning of R&M Cell

21.F.24 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 Air Systems and Airborne Stores shall be considered in accordance with Subpart L & Subpart N.

Intentionally Left Blank

SUBPART G
ORGANISATION APPROVALS

RATIONALE

To ensure that, the organisations taking up design, development, production and maintenance of Air Systems/Airborne Stores, possess the requisite capability to undertake such activities, different types of organisation 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 organisation approval schemes are proposed. An organisation involved in or intended to take up design and development activities of Military Air Systems and Airborne Stores shall be assessed through a Design Organisation Approval Scheme (DOAS). Organisations involved in production of Air Systems and Airborne Stores shall be assessed through a Production Organisation Approval Scheme (POAS). Organisations involved in maintenance and repair of Air Systems and Airborne Stores shall be assessed through a Maintenance Organisation Approval Scheme (MOAS). It is necessary that the organisations possess the applicable approvals for taking up the defined activities.

APPLICABILITY

This Subpart is applicable for the following types of organisations involved in the design & development, production and maintenance of Air System/Airborne Stores in Indian Military aviation:

a. Organisations taking up design, development, repair and modification of Air Systems/Airborne Stores. The regulations for approval of such organisations are covered under Subpart G1.

b. Organisations taking up production and/or repair of Air Systems/Airborne Stores. The regulations for approval of such organisations are covered under Subpart G2.

c. Organisations involved in maintenance, repair and overhaul of Air Systems/ Airborne Stores. The regulations for approval of such organisations are covered under Subpart G3.

CONTENTS

SUBPART G
ORGANISATION APPROVALS ----------G-1

SUBPART G1
DESIGN ORGANISATION APPROVAL SCHEME (DOAS) ---------- G1-1

SUBPART G2
PRODUCTION ORGANISATION APPROVAL SCHEME (POAS) ------- G2-1

SUBPART G3
MAINTENANCE ORGANISATION APPROVAL SCHEME (MOAS)--- G3-1

Intentionally Left Blank

SUBPART G1
DESIGN ORGANISATION APPROVAL SCHEME (DOAS)

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 Organization Approval Scheme (DOAS) is one such means, which ensures that the design organization has all processes/procedures, human resources and infrastructure for the responsibilities the Design Organization has to take towards Design, Development, Airworthiness Certification and Continued Airworthiness of Air System/Airborne Stores in the identified scope. Design Organization Approval Scheme (DOAS) also enables effective engagement between CEMILAC and Design Organization (DO). Inclusion in DOAS also empowers the DOs to operate the privileges granted by CEMILAC towards certification activities. Two categories of organizations are proposed under Design Organization Approval Scheme, namely Air System Design Organizations (ASDO) and Store Design Organizations (SDO). ASDO is an organization involved in Design, Development, Airworthiness Certification and Continued Airworthiness of Air System in the identified scope. SDO is an organization involved in Design, Development, Airworthiness Certification and Continued Airworthiness of Airborne Stores used in an Air System in the identified scope.

Intentionally Left Blank

CONTENTS

21.G1.1 Responsibilities of a Design Organisation---------- G1-5
21.G1.2 Scheme Inclusion and Approval Award ---------- G1-6
21.G1.3 Establishing and Maintaining Design Assurance System ---------- G1-8
21.G1.4 Changes in Design Assurance System---------- G1-9
21.G1.5 Provisions for Audit and Investigations ----------G1-10
21.G1.6 Reporting of Findings ----------G1-10
21.G1.7 Mitigation of Findings---------- G1-11
21.G1.8 Privileges ----------G1-12
21.G1.9 Validity of Approval ----------G1-12
21.G1.10 Record Keeping ----------G1-13
21.G1.11 Suspension or Cancellation of Approvals ----------G1-14

Intentionally Left Blank

21.G1.1 RESPONSIBILITIES OF A DESIGN ORGANISATION

REGULATION

The Design Organization (DO) shall fulfill the obligations towards Design, Development, Airworthiness Certification and Continued Airworthiness of the Air System / Airborne Store within the scope of approval.

ACCEPTABLE MEANS OF COMPLIANCE

a. The Design Organization shall carry out all the activities required in IMTAR-21 towards: -

   i. Design, Development and Airworthiness Certification of the Air Systems / Airborne Stores.

   ii. Continued Airworthiness activities for the Air Systems / Airborne Stores designed and developed by the Organization. For example, modification of product through LMC, Preparation of Urgent Operating Notice (UON), Servicing Instruction (SI), Special Technical Instruction (STI) and Service Bulletin (SB), Repair manual and Overhaul manual etc.

b. The Design Organization shall 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.

c. The Design Organization shall 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.

d. The Design Organization shall provide to CEMILAC the statements and associated documentation confirming compliance to the stipulated requirements for getting the requisite approvals from CEMILAC for Air Systems / Airborne Stores.

e. The Design Organization shall make appropriate provisions to report to CEMILAC in a timely manner any failure, malfunction, defect or other occurrences related to an Air System / Airborne Store which has resulted in or may result in an unsafe condition/operation.

f. The Design Organization shall ensure that any notified design related failures / defects/snags are investigated with advice from CEMILAC in a timely manner detailing appropriate recovery action (e.g. modifications, repair schemes, technical instructions) to restore and maintenance of type airworthiness.

g. The Design Organization shall provide appropriate subsystem and interface data in the form of specifications and drawings for those aspects of the system or equipment that are designed by another DOs.

h. The Design Organization shall maintain its Design Organization Exposition (DOE) in conformity with the Design Assurance System (DAS).

i. The Design Organization shall ensure that the DOE references the basic working documents within the organization.

j. ASDO shall be responsible for the overall design, through-life configuration management and life cycle support of the design of the Air System, and for coordinating the design and integration of the Airborne Stores designed by other DOs

k. SDO is responsible for the overall design, through-life configuration management and life cycle support of the design of the Airborne Stores.

GUIDANCE MATERIAL

a. For Design Assurance System refer Annexure 21.G1.A

b. CEMILAC will release the information required in Design Organization Exposition DOE through CEMILAC Airworthiness Directive.

21.G1.2 SCHEME INCLUSION AND APPROVAL AWARD

REGULATION

An organization shall be included in the DOAS and awarded approval for a defined scope of Airborne Stores and Air Systems only when the organization meeting the eligibility criteria, has been assessed and accepted by CEMILAC.

ACCEPTABLE MEANS OF COMPLIANCE

a. This regulation applies to organizations carrying out design & development activities according to the IMTAR-21.

b. CEMILAC will release eligibility criteria for an organization to apply for Design Organization Approval through CEMILAC Airworthiness Directive.

c. An organization seeking inclusion in the scheme shall apply to CEMILAC as per the prescribed application form, along with requisite supporting documents.

d. The organization shall be accorded Design Organization Approval (DOA) in the scope only after organization is assessed and accepted through an audit process by CEMILAC. CEMILAC shall issue Design Organization Approval Certificate as per the prescribed format.

e. CEMILAC shall release the modalities of audit process through CEMILAC Airworthiness Directive. During the audit process, the organization has to present evidence (Documents, Drawings, Records, Reports and Certificates etc.) to demonstrate that it satisfies the applicable requirements.

f. Inclusion in DOAS is not an essential pre-requisite for the award of design and development contracts for Air Systems / Airborne Stores. CEMILAC will release, through CEMILAC Airworthiness Directive, the stage by which DOA to be mandatorily taken by the design and development organization.

g. If a DO wants some change in its DO approval, the organization should apply to CEMILAC as per the application form as per the prescribed format. Change in DO approval shall be confirmed by an appropriate amendment of Design Organization Approval Certificate.

GUIDANCE MATERIAL

a. Inclusion in DOAS means that the DO possess the requisite technical capability, infrastructure and human resources to undertake activities towards ensuring compliance to airworthiness certification of Air Systems/Airborne Stores.

b. Inclusion in Design Organization Approval Scheme (DOAS) enables effective engagement between CEMILAC and the Design Organization.

c. Inclusion in DOAS empowers the DOs to operate the privileges granted by CEMILAC towards airworthiness certification activities.

d. Inclusion in DOAS does not guarantee airworthiness certification of an Air System/ Airborne Store designed & developed by the DO. The Air System/Airborne Store has to undergo all the certification processes as per the applicable requirements of IMTAR-21 for certification.

e. A list of organizations that have been granted approvals under DOAS shall be published by CEMILAC on its website.

f. Scope of the DOA shall include Class and the Activity.

i. Inclusion of a DO in DOAS shall be as per identified Class and Activity. Class is based on the type of Air Systems/Airborne Stores for which DO intends to be holder of MTC/ AMTC/SMTC/TA as per applicable Subpart of IMTAR-21. Activity is based on the nature of work to be undertaken by the DO as per applicable Subpart of IMTAR-21.

ii. The identified classes are as follows:

	Class	**Applicable Subpart**
ASDO	Fixed Wing Aircraft	Subpart B1
	Rotary Wing Aircraft	Subpart B1
	UAS	Subpart B2
	ALM	Subpart B3
	Aero Engines	Subpart B4
SDO	Electrical & Avionics	Subpart C1 & C5
	Mechanical Systems	Subpart C1 & C5
	ALWs	Subpart C2

iii. For the classes above identified activities are:

	Activity	Applicable Subpart
ASDO	Ab-initio Design & Development	Subpart B
	Modification	Subpart D
SDO	Ab-initio Design & Development	Subpart C
	Modification	Subpart E

21.G1.3 Establishing And Maintaining Design Assurance System

Regulation

The Design Organization shall demonstrate that it has established and is able to maintain a Design Assurance System to ensure design and development of Air Systems / Airborne Stores is carried out as per the requirements of IMTAR-21 in the identified scope of approval.

Acceptable Means of Compliance

a. The Design Organization (DO) shall establish Design Assurance System as per Annexure 21.G1.A.

b. The Design Organization (DO) shall independently monitor the adequacy and compliance to design assurance system as required in IMTAR-21 and Annexure 21.G1.A for carrying out design and development of Air Systems and Airborne Stores as covered in scope of DOAS Application.

c. Independent monitoring of Design Assurance System shall be carried out by:--

   i. Independent design assurance system monitoring group within the design Organization. Design Organization shall, therefore, form one group in the organization to independently monitor the design assurance system.

   ii. Committee appointed by CEMILAC during audits.

d. Procedure for Independent Design Assurance System monitoring shall be part of the Design Organization Exposition (DOE).

e. CEMILAC shall independently monitor the Design Assurance System as per:

   i. Relevant IMTAR-21 Sub Part

   ii. DOE of the Design Organization

iii. Evaluation criteria, which CEMILAC shall release through CEMILAC Airworthiness Directive.

f. CEMILAC shall independently monitor the DAS through audits. During the audit process, the design organization shall present evidences (Documents, Data, Drawings, Records, Reports and Certificates etc.) to demonstrate that it satisfies the requirements.

g. The Independent monitoring procedure shall include a feedback mechanism to ensure corrective actions are introduced.

h. The DO shall ensure satisfactory integration of the partner/sub-contractor within the design assurance system including selection of sub-contractors and control of design carried out by sub-contractors etc.

GUIDANCE MATERIAL

a. Design Assurance System shall be established and maintained by the Design Organization in accordance with the requirements stipulated in Annexure 21.G1.A.

b. The design assurance system monitoring function may be undertaken by the Airworthiness Group of the Design Organization.

c. A well-defined, and properly implemented design assurance system in a design organization provides confidence that: --

i. Design organization has the understanding of roles of various stake holders as per IMTAR-21

ii. The DO has the capability to take up design, development, airworthiness certification and through-life management of Air System and/or Airborne Stores as per the IMTAR-21 requirements.

21.G1.4 CHANGES IN DESIGN ASSURANCE SYSTEM

REGULATION

After the issue of a Design Organization Approval, any change to the Design Organization, mandating a change to the DAS, DOE and authorized signatories shall be reported to CEMILAC for approval.

ACCEPTABLE MEANS OF COMPLIANCE

a. An application for approval of a change to the Design Organization mandating change to the DAS, DOE and authorized signatories shall be submitted in writing to CEMILAC in the prescribed format (Refer Form 82) in CEMILAC Airworthiness Directive along with the changes to the DAS, DOE, authorized signatories and other relevant supporting documents.

b. Towards approval of the proposed change, CEMILAC shall scrutinize the application and supporting documents submitted by the Design Organization and conduct independent audit as per prescribed procedures, if required. CEMILAC shall either issue necessary amendment or issue a revised Design Approval Certificate after acceptance of the change.

GUIDANCE MATERIAL

Changes to the Design Organization shall be documented along with the rationale for each change. All such changes shall be traceable.

21.G1.5 PROVISIONS FOR AUDITS AND INVESTIGATIONS

REGULATION

The Design Organization shall have provisions for CEMILAC to conduct audits or investigations necessary to determine compliance with this Subpart G1 as and when required.

ACCEPTABLE MENS OF COMPLIANCE

a. Provisions shall be available for CEMILAC / CEMILAC authorized personnel to make audits and investigations of the Design Organization including its partners, subcontractors and suppliers as and when required.

b. This includes assisting and cooperating with CEMILAC in performing inspections and audits conducted during initial assessment and subsequent surveillance.

c. Towards audits and investigations, access to documents, data, personnel and facilities shall be ensured.

GUIDANCE MATERIAL

a. Audits include First time audit and surveillance audit.

b. Investigations refer to the activities arising due to failures of the Air System / Airborne Store or DAS which are not revealed during regular audits.

21.G1.6 REPORTING OF FINDINGS

REGULATION

Findings observed during Independent Monitoring of DAS by Independent Monitoring Group/Internal Audit/Periodic Audit /Surveillance Audit/ Investigation etc shall be notified to Head of the Design Organization and CEMILAC.

ACCEPTABLE MEANS OF COMPLIANCE

a. Findings observed during Independent Monitoring of DAS and Internal Audits shall be notified to the Head of the Design Organization and CEMILAC by the Independent Monitoring Team.

b. Head of the Design Organization shall be responsible to ensure corrective action on the findings observed during Audits/Periodic Surveillance/Investigation.

GUIDANCE MATERIAL

Findings shall be reported to the Head of the Organization in the prescribed format within three working days of observing.

21.G1.7 MITIGTION OF FINDINGS

REGULATION

After receipt of notification of findings, the Design Organization shall demonstrate corrective actions appropriate to the level of the findings.

ACCEPTABLE MEANS OF COMPLIANCE

a. When objective evidence is found showing non-compliance of the Design Organization with the applicable requirements of IMTAR-21, the finding shall be classified as follows:

   i. A *level 1 finding* is any non-compliance with the relevant IMTAR-21 Subpart, which could lead to a major risk affecting the Air Safety, unacceptable degradation of the performance of air system/airborne store or seriously hampering fleet availability.

   ii. A *level 2 finding* is any non-compliance with the relevant IMTAR-21 Subpart, which may not affect the air safety but may cause unacceptable degradation of the performance of air system/airborne store and seriously hamper fleet availability. 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* is any non-compliance that has been identified to contain problems that could lead to a non-compliance only and will not lead to any flight safety issue, unacceptable degradation of the performance of air system /airborne store and adverse effect on fleet availability.

   iv. Classification of a reported finding as level 1, 2 or 3 shall be carried out by the Design Organization in consultation with CEMILAC.

b. After receipt of notification of findings by the Design Organization, corrective action shall be demonstrated within the timelines stipulated by CEMILAC.

c. In case of level 1 or level 2 findings, the organization may be subject to a partial or full suspension or revocation of its approval/privileges as per 21.G1.11.

GUIDANCE MATERIAL

NIL

21.G1.8 PRIVILEGES

REGULATION

Design Organization shall be granted privileges by CEMILAC to discharge certification responsibilities in accordance with the applicable guidelines.

ACCEPTABLE MEANS OF COMPLIANCE

a. Design Organization shall operate privileges granted by CEMILAC in accordance with the applicable CEMILAC Airworthiness Directive. Failure to adhere to the terms and conditions for operation of privileges may lead to suspension/revoking of privileges and suspension/revoking of approval.

GUIDANCE MATERIAL

Design Organization should meticulously adhere to terms and conditions for operation of the privileges.

21.G1.9 VALIDITY OF APPROVAL

REGULATION

A Design Organization Approval shall be issued for an unlimited duration. It shall remain valid unless incidences demanding invalidation of approval occur.

ACCEPTABLE MEANS OF COMPLIANCE

Design Organization Approval shall become invalid if:--

a. The design organization fails to demonstrate compliance with the requirements of this Subpart; or

b. CEMILAC is prevented by the holder or any of its partners or subcontractors to perform the investigations in accordance with this Subpart; or

c. There is evidence that the design organization cannot maintain satisfactory control and supervision of the design of Air Systems / Airborne Stores or changes thereof under the approval; or

d. The approval certificate has been surrendered or revoked by CEMILAC; or

e. Changes to the Design Organization mandating change to DAS, DOE and authorized signatories are not intimated to CEMILAC

GUIDANCE MATERIAL

Design Organization should ensure compliance to the applicable requirements at all points of time and provide adequate support to various stakeholders viz. the Technical Airworthiness Authorities and Users.

21.G1.10 RECORD KEEPING

REGULATION

All the relevant records required to ensure type design of an air system/airborne store throughout its life cycle viz. design documents, drawings, analysis reports, test reports and inspection records etc. shall be held by the Design Organization for the stipulated period of time

ACCEPTABLE MEANS OF COMPLIANCE

a. Configuration management of documents shall be ensured in accordance with the established processes/procedures.

b. Documents shall be archived, retrieved and distributed in accordance with the established processes/procedures.

c. Documents shall be easily accessible to the stakeholders as and when required.

d. The documents shall be retained for a minimum of 5 years beyond the Out-of-Service date of Air System/Airborne Store.

e. Any alterations to the records shall be duly authenticated / approved in accordance with the applicable requirement and shall be traceable.

f. Design Organization shall ensure that established processes/procedures of record keeping are adhered to by their design & development partners/sub-contractors.

GUIDANCE MATERIAL

NIL.

21.G1.11 Suspension / Revocation of Privileges / Approvals

Regulation

If ASDO/SDO fails to comply with or misuses the conditions stipulated for approval, CEMILAC may suspend or revoke the privileges / approval granted to such Design Organizations.

Acceptable Means of Compliance

a. If CEMILAC is convinced that there is sufficient ground for suspension/revocation of privileges/approvals, for reasons to be recorded in writing, CEMILAC may:

   i. Suspend approval or any or all of the privileges, for any specified period

   ii. Revoke approval or any or all of the privileges

   iii. Suspend/revoke of Air System / Airborne Store approvals granted by CEMILAC

b. The decision of CEMILAC, as to whether any ground is considered sufficient for suspension/revocation of any privilege or approval under this regulation, shall be final and binding.

Guidance Material

NIL

ANNEXURE 21.G1.A

DESIGN ASSURANCE SYSTEM (DAS)

1. For proper functioning of Design Organisation (DO), it is required that the organization has a well-defined Design Assurance System (DAS) to meet the scope of DOA. Following are the attributes of well-defined design assurance system:

   a. Well-defined Organisational structure and clear responsibilities assigned to various personnel as per structure of organisation.

   b. Adequate Resources (Manpower, Space, facilities) to ensure the proper functioning of the design organisation.

   c. Documented processes/procedures (It covers from requirements stage to issue of TC/AMTC/SMTC or TA and till Continued Airworthiness is to be supported by DO) for all those planned and systematic activities required for design and development as per IMTAR-21.

   d. Prepare a DOE bringing out all the details of Paras (a) and (c). CEMILAC Airworthiness Directive on DOE will bring out the information required to be incorporated in the DOE.

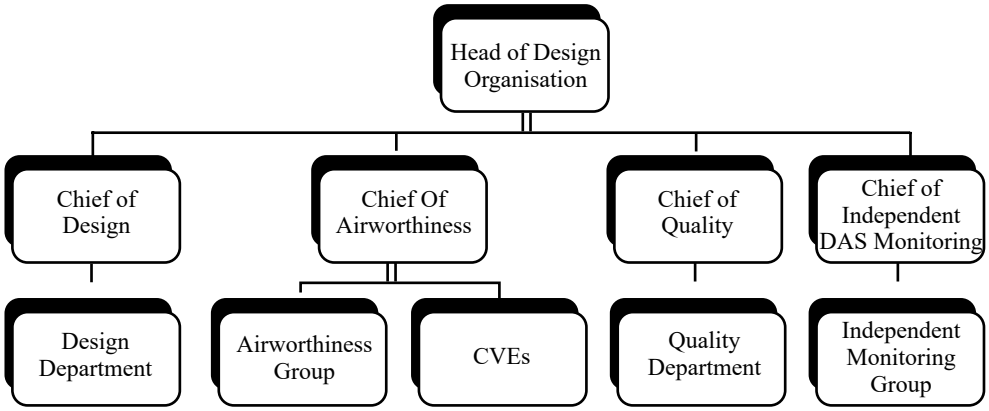
   e. For continuous improvement of Design Assurance System (DAS), the design organisation should have:

      i. Processes/procedure to regularly and independently monitor by evaluating adequacy and compliance to DAS. The DAS shall have necessary provisions for the data to be accessible for the independent monitoring.

      ii. In case any non-conformity/shortcoming is observed in DAS, then proper investigation shall be carried out by the design organisation to arrive at root cause of non-conformity. Then necessary corrective action is to be taken by DO to eliminate the non-confmity/shortcoming and modify the DOE if required.

      iii. The outcomes of independent monitoring shall be documented and retained.

2. Organisation Structure requirement for DAS



Note: Chief of Quality, Chief of Airworthiness and Chief of Independent DAS monitoring may report to Head of Design Organization or any higher authority to whom Chief of Design is reporting to.

a. Head of Design Organisation: All department heads/chiefs (Chief of Design, Chief of Airworthiness, Chief of Independent DAS Monitoring, Quality Department Head) report to Head of Design Organisation. Head of Design Organisation shall provide the necessary resources for the proper functioning of the Design Organisation. The functions of Head of Design Organisation and Chief of Design may not be performed by the same person so as to maintain the independence of the assurance activity.

b. Chief of Design: Chief of design reports directly to the Head of the Design Organisation. Chief of design heads the design department. Chief of Design is responsible for design and development of products and demonstrating compliance to certification requirements.

c. Chief of Airworthiness: Chief of Airworthiness heads the Airworthiness Group (AWG). Chief of Airworthiness reports directly to the Head of the Design Organisation. Responsibilities of AWG are to:

   i. Ensure that a DOE is prepared and updated.

   ii. Carry out all activities within the organisation that requires to be accepted/ approved with CEMILAC. Once the AWG completes the activity then only all the documents to be forwarded to CEMILAC for study/evaluation/analysis/ finalisation/acceptance/approval. Airworthiness Group shall also sign the documents before forwarding to CEMILAC. To bring clarity, a few examples of the activities by AWG are listed below:

      A. Ensure all reviews (for example, requirement, testing, design etc.) are carried out.

      B. Ensure safety analysis (SSA, FHA, FTA, FMECA etc.) are carried out.

      C. Ensure designers prepare Airworthiness Certification Plan, TCB/TAB, SOP/ACBS, TTS/QTP, ATP, Repair/overhaul Manuals etc. Subsequently,

AWG shall evaluate these documents for adequacy, completeness and correctness before forwarding to CEMILAC.

D. Ensure the initiation of necessary activities as a response to failure (accident/ incident/ in-service occurrence) evaluation and complaints from the operation and providing of information on the same to CEMILAC.

E. Establish and maintain check list for bringing out compliance towards verification &Validation (V&V) activities and then forwarding it the compliance report to CEMILAC.

F. Ensure that required independence is maintained in V&V activities.

G. Ensure that Compliance Verification Engineer (CVE) verifies correctness and completeness with respect to means of compliance of TCB/TAB before forwarding to CEMILAC for acceptance/clearance/approval.

H. Ensure designer prepares compliance document with respect to requirements/technical specification, design, testing, analysis, ACP, Certification Criteria, TCB/TAB etc. AWG to then ensure that Compliance Verification Engineer (CVE) verifies correctness & completeness of compliance then forward it to CEMILAC with comments on non-compliances /shortcomings and limitations.

I. During Continued Airworthiness phase, AWG shall evaluate adequacy, completeness and correctness of Urgent Operating Notice (UON), Servicing Instruction (SI), Special Technical Instruction (STI) and Service Bulletin (SB) before forwarding to CEMILAC.

iii. Act as liaison between the Design Organisation and CEMILAC with respect to all aspects of Airworthiness Certification. Participate in all activities in which presence of CEMILAC representative is mandatory.

iv. Provide clarification, if required any, within the DO regarding various processes/ procedures/activity with respect to Airworthiness Certification.

d. Compliance Verification Engineer: There should be Compliance Verification Engineers (CVE) in the required discipline for verification of compliance with respect to requirements/technical specification, design, testing, analysis, ACP, Certification Criteria, TCB/TAB etc. Compliance Verification Engineer (CVE) is required for each discipline for a given design activity. CVE is required to sign the documents after verification of compliance. CVE is only responsible for verifying the compliance and CVE is not responsible for creating the compliance data.

e. Chief of Independent DAS Monitoring: Chief of Independent DAS Monitoring heads the independent DAS monitoring group and reports directly to the Head of the Design Organisation. Responsibility of independent DAS monitoring group is towards continuous improvement of Design Assurance System (DAS). Following are some of the activities to be performed by this group:

i. Prepare processes/procedures for regular and independent monitoring by evaluating adequacy, effectiveness and compliance to DAS.

ii. During independently monitoring of DAS, various evidences (Documents, Drawings, Records, Reports, and Certificates etc.) shall be looked into by independent DAS monitoring group.

iii. Ensure that in case any non-compliance/shortcoming is pointed out in DAS, then proper investigation is carried out by the DO to arrive at root cause of non-compliance/shortcoming. Then necessary corrective action shall be taken by DO to eliminate non-compliance/shortcoming and modify the DOE, if required.

iv. Report the non-compliance/shortcomings, root cause and corrective action taken by DO to CEMILAC.

f. Head of Quality: Head of Quality heads the quality department and reports directly to the Head of the Design Organization. Quality department is responsible for all quality aspects during design, development, manufacturing and Airworthiness Certification phases.

SUBPART G2
PRODUCTION ORGANISATION APPROVAL SCHEME (POAS)

RATIONALE

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 organisations taking up production of Air Systems/Airborne Stores, possess the requisite technical capability, infrastructure and human resources to undertake such activities, a Production Organisation Approval scheme (POAS) is established. The Production Organisation Approval Scheme (POAS) is a mechanism by which the competence of an organisation to carry out production of Air Systems and Airborne Stores is assessed. Two categories of Production Approved Organisations schemes are proposed, namely Air System Production Organisations (ASPO) and Store Production Organisations (SPO). Approval under POAS is subject to adherence with the established procedures and rules governing the responsibilities and privileges for Military Production Approved Organisations. Both ASPO and SPO are collectively called as Production Organisations (PO).

Intentionally Left Blank

CONTENTS

21.G2.1 Production Organisation Approval---------- G2-5
21.G2.2 Quality Management System ---------- G2-7
21.G2.3 Approval Requirements ---------- G2-9
21.G2.4 Certifying Staff ----------G2-12
21.G2.5 Changes to the Approved Production Organisation --G2-13
21.G2.6 Terms of Approval ----------G2-14
21.G2.7 Production Process Verification ----------G2-15
21.G2.8 Investigations ----------G2-16
21.G2.9 Validity of Approval ----------G2-17
21.G2.10 Privileges ----------G2-18
21.G2.11 Obligations ----------G2-19

Intentionally Left Blank

21.G2.1 PRODUCTION ORGANISATION APPROVAL

REGULATION

Production Organisation (ASPO/SPO) shall fulfil the Production Organisation responsibilities as stipulated by DGAQA.

ACCEPTABLE MEANS OF COMPLIANCE

a. Eligibility: A firm 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 for development/supply/service of military Air Systems and Airborne Stores and associated Ground Handling/Ground Support Equipment.

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 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.

   ii. Possess design data for Airborne Stores obtained through a licence agreement.

c. Application: The firm (ASPO/SPO) seeking approval should apply to DGAQA Ministry of Defence, New Delhi through Regional office (wherever available) and subsequently, DGAQA shall 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.

d. AFQMS issued by DGAQA shall also be used as an alternate means of compliance where applicable.

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, it 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 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 organisation has 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 shall be responsible for executive QA 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 Airborne Stores, its criticality and effectiveness of the firm's QMS. Conduct of Quality audits, spot checks by DGAQA shall be based on criticality of Airborne Stores, areas of concern, priorities and customer complaints.

d. DGAQA Approval may be granted for the following categories: -

   i. Air System Production Organisation Approval (ASPOA) for the organisations involved in manufacturing of an Air System and Store Production Organisation Approval (SPOA) for the Organisation involved in manufacturing of Airborne Stores used in an Air System.

   ii. 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.

   iii. Process workshops (Protective Treatment, Heat Treatment, Plating, Surface Treatment, Painting etc.).

   iv. 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.

   v. Test Houses or Laboratories for testing to specific requirements/specifications.

   vi. 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 organisation shall demonstrate that it has established and is able to maintain a quality management system.

ACCEPTABLE MEANS OF COMPLIANCE

a. The production organisation shall demonstrate that it has established a quality system in accordance with the requirements of DGAQA. The quality system shall be documented. This quality system shall be such as to enable the organisation to ensure that each Air System or Airborne Store produced by the organisation or by its partners, or supplied from or subcontracted to outside parties, conforms to the applicable design data and is in condition for safe operation.

b. The quality system shall contain the following as applicable within the scope of approval, control procedures for:

   i. Document issue, approval, or change.

   ii. Vendor and subcontractor assessment audit and control.

   iii. Verification that incoming 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 Air System 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 POE and ultimately to the manager referred to ensure corrective actions.

GUIDANCE MATERIAL

a. Each manufacturer of an Air System, subsystem, accessories, LRUs, parts being manufactured under this Subpart shall:

i. Make each product or part available for inspection by DGAQA. 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 military type-certificate, restricted military type-certificate or type approval in dealing with any continuing airworthiness actions that are related to the Air Systems and Airborne Stores 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 military type-certificate, restricted military type-certificate or type 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 military type-certificate, restricted military type-certificate or type approval to identify those deviations which could lead to an unsafe condition.

vi. Report to DGAQA 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 Air

Systems or Airborne Stores to that organisation and subsequently identified them to have possible deviations from the applicable design data.

b. The organisation shall determine the boundaries and applicability of the quality management system to establish its scope. When determining this scope, the organisation shall consider:

   i. The external and internal issues

   ii. The requirements of relevant interested parties

   iii. The products and Services of the organisation.

c. The scope of the organisation's quality management system shall be available and maintained as documented information. The scope shall state the types of products and Services covered, and provide justification for any requirement of this Subpart that the organisation 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 organisation's ability or responsibility to ensure the conformity of its products and Services and the enhancement of customer satisfaction. The organisation's quality management system shall also address customer and applicable statutory and regulatory quality management system requirements.

e. Compliance to applicable provisions of AFQMS issued by DGAQA.

21.G2.3 Approval Requirements

Regulation

The production organisation 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 organisation 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 organisation are adequate to discharge obligations under this Subpart.

b. The production organisation shall possess the permission from the holder of, or applicant for, the military type-certificate, restricted military type-certificate or type approval, to determine conformity with the applicable design data.

c. The production organisation 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.

d. A manager has to be nominated by the production organisation who is accountable to the Govt inspection agencies. His or her responsibility within the organisation shall consist of ensuring that all production is performed to the required standards and that the production organisation is continuously in compliance with the data and procedures identified in the production organisation exposition.

e. A person or group of persons have been nominated by the production organisation to ensure that the organisation is in compliance with the requirements of this Subpart, 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 (f) above. The persons nominated shall be able to show the appropriate knowledge, background and experience to discharge their responsibilities.

f. 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 organisation in respect of airworthiness, and environmental regulations.

GUIDANCE MATERIAL

a. The organisation shall submit to DGAQA 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 includes 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 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-Confirming 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 DGAQA 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 QAP.

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 organisation 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 organisation), 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 organisation 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. The approved person shall have an adequate number of QA /QC personnel (adequate strength 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. The approved person shall also co-ordinate approval of the QA personnel from resident DGAQA office/ DGAQA HQ for respective scope of work and also be responsible to ensure that only competent & approved QA personnel certify the activity in respective work centers.

b. Quality Department Head (QDH) 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. The QDH 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 control of the Head of Quality Assurance Department. It is desirable that all the personnel in the quality department to be under the administrative control of the Head of Quality Assurance Department.

c. Release Note Signatories: A candidate will be eligible for consideration of DGAQA approval if he/ she meets the eligibility requirements similar to Quality Head. Approval to Release note signatories normally will be limited to three i. e. Quality Head, Deputy Quality Head and one additional personnel at similar level of Dy Quality Head.

21.G2.5 Changes to the Approved Production Organisation

Regulation

Any significant change to the approved production organisation 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 organisation approval, each change to the approved production organisation that is significant to the showing of conformity or to the airworthiness and environmental regulations of the Air System or Airborne Store, particularly changes to the quality system, shall be approved by DGAQA. An application for approval shall be submitted in writing to DGAQA and the organisation 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 organisation 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 organisation shall be deemed of significance and therefore shall comply with regulation 21.G2.6.

d. Except as a result of a change in ownership, which is deemed significant for the purposes of approval, a production organisation approval is not transferable.

Guidance Material

a. Approved firm shall inform DGAQA, HQ through resident RDAQA/Officer In-charge for any change in scope of approval required. DGAQA, HQ 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 organisation determines the need for changes to the quality management system, the changes shall be carried out in a planned manner. The organisation 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 organisation shall be included in the POAS and awarded approval for a defined range of Air Systems and Airborne Stores only when the organisation has been assessed and accepted by DGAQA.

Acceptable Means of Compliance

a. The terms of approval shall be issued as part of a production organisation 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 organisation shall ensure that externally provided processes, products, and Services conform to requirements.

b. The organisation shall be responsible for the conformity of all externally provided processes, products, and Services, including from sources defined by the customer.

c. The organisation shall ensure, when required, that customer-designated or approved external providers, including process sources (e.g., special processes), are used.

d. The organisation 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 organisation 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 organisation shall conduct Production Process Verification to the satisfaction of DGAQA.

ACCEPTABLE MEANS OF COMPLIANCE

a. The organisation 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 organisation 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 organisation shall retain documented information on the results of production process verification which shall cover all design characteristics mentioned in the drawing & specification. Records of same to be maintained and attached with clearance request to DGAQA for first article clearance. The organisation 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 organisation shall facilitate DGAQA to make any investigations and audit as and when required.

ACCEPTABLE MEANS OF COMPLIANCE

a. A production organisation 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 organisation approval with the applicable requirements of this IMTAR-21, the finding shall be classified as follows:

   i. A level 1 finding is any non-compliance with this IMTAR 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 2 finding is any non-compliance with this IMTAR which is not classified as level one.

   iii. A level 3 finding is any item where it has been identified, by objective evidence, to contain potential problems that could lead to non-compliance under levels c(i) and c(ii).

d. In case of a level 1 finding, the holder of the production organisation approval shall demonstrate corrective action to the satisfaction of DGAQA within 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 2 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 3 finding shall not require immediate action by the holder of the production organisation approval.

g. In case of level 1 or level 2 findings, the production organisation approval may be subject to a partial or full limitation, suspension or revocation. The holder of the production organisation approval shall provide confirmation of receipt of the notice of limitation, suspension or revocation of the production organisation approval in a timely manner.

GUIDANCE MATERIAL

The organisation's non-conformity control process shall be maintained as documented information including the provisions for:

a. Defining the responsibility and authority for the review and disposition of non-conforming 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 organisation 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 organisation approval shall be issued for a limited duration, however typically not exceeding three years. It shall remain valid unless:

   i. The production organisation 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 21.G2.8; or

   iii. There is evidence that the production organisation cannot maintain satisfactory control of the manufacture of Air Systems or Airborne Stores under the approval; or

   iv. The production organisation 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/DGAQA,HQ.

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 DGAQA, HQ. 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 organisation approval, certain privileges are granted to the production organisation by DGAQA within the scope of approval.

ACCEPTABLE MEANS OF COMPLIANCE

a. Pursuant to the terms of approval issued under 21.G2.6, the holder of a production organisation approval may:

   i. Perform production activities under this IMTAR-21.

   ii. The holder POA is authorised to prepare a "Statement of Conformity" under Subpart F, in the case of complete Air System production and is also authorised to obtain a "Certificate of Airworthiness" in the form of Signal out Certificate from DGAQA as per Subpart H.

   iii. The holder of POA is authorised to prepare a Release Note Certificate for production of Airbornes Stores under Subpart F.

   iv. Maintain a new Air System that it has produced and issue a certificate of release to service 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 may 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/ NAS-410

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) or 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 agreement, before the Approval of the firm and its Quality Management System (QMS) is granted.

21.G2.11 Obligations

Regulation

Production organisation 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 organisation approval shall:

i. Ensure that the production organisation exposition furnished in accordance with this Subpart and the documents, to which it refers, are used as basic working documents with in the organisation.

ii. Maintain the production organisation in conformity with the data and procedures approved for the production organisation approval.

A. Determine that each completed aircraft/UAS is airworthy prior to submitting Statements of Conformity to the DGAQA, or

B. 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 to certify conformity to approved design data and condition for safe operation, and

C. 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.

D. Determine that other Air Systems and Airborne Stores conform to the applicable data before issuing Form 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 type approval, all cases where Air Systems or Airborne Stores have been released by the production organisation and subsequently identified to have possible deviations from the applicable design data, and investigate with the holder of the military type-certificate or type 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 organisation approval is acting as a supplier to another production organisation, report also to that other organisation all cases where it has released Air Systems or Airborne Stores to that organisation 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 type approval in dealing with any continuing airworthiness actions that are related to the Air Systems or Airborne Stores 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 Air Systems/Airborne Stores. 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 Air Systems/Airborne Stores.

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 organisation 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 organisation, 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 organisation's quality management system, at planned intervals, to ensure its continuing suitability, adequacy, effectiveness, and alignment with the strategic direction of the organisation. The organisation 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.

Intentionally Left Blank

SUBPART G3
MAINTENANCE ORGANISATION APPROVAL SCHEME (MOAS)

RATIONALE

Firms engaged in Maintenance, Repair, Overhaul (MRO) and Servicing of Air Systems viz Aircraft, 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 approval from DGAQA for carrying out such regular activities.

Maintenance is a part of continuing airworthiness activities required for ensuring that the Air System/Airborne Stores 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.

Two Types of Maintenance Organisations namely Air System Maintenance Organisations (ASMO), and Store Maintenance Organisations (SMO) involved in Maintenance of Air Systems and its associated Airborne Stores are envisaged. The Maintenance Organisation Approval Scheme (MOAS) is a mechanism by which the competence of these Organisations assessed. Approval under MOAS is subject to adherence with the established procedures and rules governing the responsibilities and privileges for Maintenance Approved Organisations.

Intentionally Left Blank

CONTENTS

21.G3.1	**Applicability**	**G3-5**
21.G3.2	**User Requirements**	**G3-5**
21.G3.3	**Maintenance Organisation Approval Scheme (MOAS) Approval**	**G3-6**
21.G3.4	**Application for MOAS Approval**	**G3-8**
21.G3.5	**Production of Spare Parts for Repair**	**G3-10**
21.G3.6	**Military-run Maintenance Organisation (MMO)**	**G3-11**
21.G3.7	**Air System Maintenance Programme**	**G3-11**
21.G3.8	**ASMO/SMO Support Requirements**	**G3-12**
21.G3.9	**Quality Assurance**	**G3-13**
21.G3.10	**Certification of Air System /Airborne Store Release**	**G3-16**
21.G3.11	**Certifying Staff**	**G3-18**
21.G3.12	**Configuration Control**	**G3-19**
21.G3.13	**Maintenance Equipment and Tools**	**G3-20**
21.G3.14	**Military Airworthiness Review**	**G3-21**
21.G3.15	**Special Checks for Ageing Air Systems**	**G3-22**
21.G3.16	**Air System Maintenance Documentation, Forms and Certificates**	**G3-23**
21.G3.17	**Military Continuing Airworthiness Management Organisation (Mil CAMO)**	**G3-25**
21.G3.18	**Continuing Airworthiness Management Records**	**G3-27**
21.G3.19	**Instructions for Sustaining Type Airworthiness**	**G3-30**

Intentionally Left Blank

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 Aircraft (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/SMO organisations 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/SMO organisation shall meet technical requirements as well as the specific logistic and ergonomic User requirements.

b. Repair/service/maintenance carried out on the Air System /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/SMO organisation shall not deteriorate the ease of use for the systems/sub systems.

GUIDANCE MATERIAL

a. User requirements invole User interface with a system and its output.

b. The time schedules, logistics management etc are to be worked out in consultation with the Users.

21.G3.3 MAINTENANCE ORGANISATION APPROVAL SCHEME (MOAS) APPROVAL

REGULATION

The Main Contractor and a contractor-run organisation who intends to carryout maintenance on a specific type of Air System (Air System Maintenance Organisaiton, ASMO) & on a specific Airborne Store (Store Maintenance Organisation, SMO) should have the approval of DGAQA for the Maintenance of military registered Air Systems or Air borne stores through the Maintenance Organisation Approval Scheme (MOAS).

ACCEPTABLE MEANS OF COMPLIANCE

a. Eligibility: The organisation seeking approval of DGAQA should provide evidence that either it is in possession or likely to receive an order from User Services or MoD for service of military air Systems, Airborne Stores and associated Ground Handling/ Ground Support Equipment.

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 holder of an approval of that specific design, satisfactory coordination between maintenance, production and design.

   iv. Possess design/manufacturing data for Airborne Stores obtained through a license agreement.

c. On-aircraft Maintenance and off-aircraft Maintenance shall only be carried out by organisations 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 & SMO can be carried out at:-

i. The locations identified in the approval certificate and in the exposition; or

ii. At another organisation that is working under the quality system of the ASMO/ SMO; or

iii. At any location subject to the need for such maintenance arising either from the un-serviceability of the Air System 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 organisation must submit a Maintenance Organisation 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.A. The exposition shall be amended as necessary to remain an up-to-date description of the Air Systems Maintenance Organisations (ASMO)/Store Maintenance Organisation (SMO). The exposition and any subsequent amendment shall be approved by DGAQA.

GUIDANCE MATERIAL

a. Continuing Airworthiness can be carried out by Military-run Maintenance Organisations (MMO) or by the Main Contractor who is involved in licensed production or the contractor-run approved Air System Maintenance Organisations (ASMO).

b. A military-run maintenance organisation (MMO) does not require a MOAS approval to maintain military registered Air Systems or Airborne Stores, but compliance to various servicing schedules and maintenance procedure is to be ensured by Service HQ.

c. In some cases, ASMO or SMO 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 organisation 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/SMO'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 organisation or the person.

21.G3.4 Application for MOAS Approval

Regulation

An application for the issue or variation of Maintenance Organisation Approval Scheme (MOAS) approval should be submitted to the DGAQA for the issue of ASMO/SMO approval 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 organisation's need for approval and the required level of clearance.

b. For obtaining the approval from DGAQA, the organisation should confirm that it is ready to comply with the following requirements: -

   i. Allow DGAQA and its authorized representatives to inspect the organisation 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 its 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 organisation 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 organisation, DGAQA will issue an approval certificate to the maintenance organisation.

GUIDANCE MATERIAL

a. The firm seeking approval should apply to DGAQA Ministry of Defence, New Delhi through Regional office (wherever available) and subsequently DGAQA will 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, it 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/SMO approval issued by DGAQA 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 Organisation 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-contracting/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 organisation 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.

   ii. For any amendment of the approval required, the application should be submitted to the DGAQA. In addition, the organisation should notify DGAQA of the following changes in order for DGAQA to amend, if necessary, the approval certificate:

      A. The ownership of the organisation or its parent company.

      B. The name of the organisation.

      C. The main location of the organisation.

      D. Additional locations of the organisation at which the task covered in the approval will be exercised.

      E. 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. Airborne Stores 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 G1 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 TAA.

GUIDANCE MATERIAL

Nil

21.G3.6 MILITARY-RUN MAINTENANCE ORGANISATION (MMO)

REGULATION

A Military-run Maintenance Organisation (MMO) shall be entitled to maintain any Air System and/or Airborne Store for which it has been established to do so by the relevant front-line command of the User Service.

ACCEPTABLE MEANS OF COMPLIANCE

a. Maintenance activity carried out by an MMO should be conducted under the management of the relevant Continuing Airworthiness Management Organisation (CAMO).

b. A military-run maintenance organisation (MMO) does not require a MOAS approval to maintain military registered Air Systems or Airborne Stores, but compliance to 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 in 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 Air System.

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 organisation shall establish procedures to minimize the risk of multiple errors and capture errors on critical systems.

GUIDANCE MATERIAL

Nil

21.G3.8 ASMO/SMO SUPPORT REQUIREMENTS

REGULATION

The Maintenance organisation 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 organisation shall have adequate management systems in place, tailored to meet the complexity of the work required in order to ensure its safe completion.

b. 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.

c. An Accountable Manager (Maintenance) (AM(M)) shall be designated/appointed who has a basic understanding of policies and has organisational 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/SMO organisation approval.

iii. Establishing and promoting the safety and quality policy in ASMO/SMO organisation.

GUIDANCE MATERIAL

a. In order to successfully complete Air System and Airborne Store Maintenance, an organisation must consider the resources needed to achieve such tasks in order to ensure Air System/Airborne Stores availability and compliance with procedures. If a Maintenance organisation 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 organisation applying for approval is required to appoint a number of positions within the organisation, with each having specific responsibilities, and detail them in the exposition. Without the appointment of specific roles within a maintenance organisation, personnel leadership and management of essential functions could be compromised, thus increasing the risk of a maintenance occurrence and the organisation operating outside its scope of work.

d. A record of the qualification and competence assessment should be kept. The maintenance organisation should have in place procedures for:

   i. Ensuring that all personnel are competent by virtue of their training and experience for the tasks on which they are employed.

   ii. Ensuring staff are trained, assessed and authorized for specific tasks.

   iii. Providing initial and continuation training by a suitable organisation.

   iv. Maintaining a record system detailing the training and qualification of all staff.

   v. Maintaining a record of all personnel authorizations.

21.G3.9 QUALITY ASSURANCE

REGULATION

ASMO /SMO organisation should operate with a defined quality policy and establish Quality Management System to deliver assurance of approved Maintenance procedures.

ACCEPTABLE MEANS OF COMPLIANCE

a. ASMO /SMO 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 /SMO organisation should conform to the requirements specified by DGAQA for their approval. All engineering and logistics organisations 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/AS9100.

c. Military Maintenance Organisations (MMOs) shall operate within the Air Safety Management System (ASMS) developed by the relevant User Service by following its applicable quality policy. Approved Air System Maintenance Organisations (ASMOs) shall establish a safety and quality policy for the organisation, to be included in the Maintenance Organisation 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 organisation 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 organisation

   iii. Maintenance Procedures should be reviewed and updated at an appropriate periodicity to ensure that they reflect current best practices. It is the responsibility of all organisations' employees to report any unauthorized deviation from approved procedures via their organisation'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.

g. The organisation 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.

A. 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.

B. Independent audits should include a percentage of random audits carried out on a sample basis when Maintenance is being carried out.

C. The independent audit should ensure that all aspects are checked every 12 months including all subcontracted 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.

D. 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.

ii. 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.

iii. 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.

iv. 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.

v. 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 organisations 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 organisation remains in compliance with procedures and policies.

21.G3.10 Certification of Air System /Airborne Store Release

Regulation

ASMO /SMO organisation 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 organisation when it has been verified that all maintenance has been properly carried out by the organisation 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 (SIs), 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/Airborne Store 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 Airborne Stores 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 lifed 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)/SIs, repairs and modifications known to have been incorporated or, if no ADs/SIs, repairs or modifications are not to be incorporated, then the same should be so stated. Software implemented on the Airborne Store should be specified clearly giving the version number and date of installation.

iv. Details 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 Airborne Store release. The maintenance history record and acceptance test report or statement, if applicable, should be attached to the Certificate of Airborne Store release.

f. Items must be endorsed with a Certificate of Airborne Store release:

i. Prior to transfer between maintenance organisations.

ii. Prior to movement within the same maintenance organisation 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 organisation 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 Organisation, as appropriate. This work order should be referenced with the Certification of Airborne Store release.

h. On occasions when a maintenance activity cannot comply with relevant Technical Information (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 may 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 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 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. PSEPe. For ASMO/SMOs 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.

e. Any organisation undertaking Airborne Store Maintenance shall have appropriately qualified certifying staff, to be suitably authorized for Airborne Store Maintenance activities.

GUIDANCE MATERIAL

a. The organisation 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 organisation procedures. Authorization shall be limited to those Air Systems and/or Airborne Stores on which they have been qualified.

b. The organisation 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 organisation shall ensure that all certifying staff and support staff with supervisory responsibilities have at least 6 months of actual relevant Air System or Airborne Store maintenance experience in any consecutive 2 year period following initial authorization.

d. The organisation 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, organisation procedures and Human Factor issues. The organisation shall establish a programme for this purpose.

e. The organisation 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 organisation 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 life cycles.

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 organisation and satisfies the airworthiness design change certification process.

GUIDANCE MATERIAL

Nil

21.G3.13 MAINTENANCE EQUIPMENT AND TOOLS

REGULATION

The ASMO/SMO organisation 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 organisation shall use that tool or equipment, unless the use of alternative tooling or equipment is agreed by DGAQA, via approved procedures.

b. For ASMO/SMOs, such procedures shall be detailed in the Maintenance Organisation Exposition (MOE).

c. The Organisation shall ensure that it can account for any equipment, tool or material used on an Air System or Airborne Store and that the Air System or Airborne Store is clear of all equipment, tools and materials on completion of any continuing airworthiness activity.

d. The organisation should define and document a process to readily identify on which Air System or 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 organisation 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 organisation.

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 organisation 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/SMO organisation 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 Organisation (Mil CAMO) may 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 organisation 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 organisation 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. Airborne Store 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 prolonged grounding of the Air System or Airborne Store that are out of the flying for longer duration, fall under the 2nd line Maintenance. Here the task is done at the same base. It may include, but not limited to: -

i. Scheduled Maintenance of Air Systems which requires extensive dismantling.

ii. Major repairs and Modifications.

iii. Special checks.

iv. Scheduled Servicing on Air borne Stores like Ejection Seat etc.

v. Calibration and Repair of Airborne Stores.

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 Air Systems

Regulation

The risk to airworthiness due to the ageing of Air Systems in service to be mitigated by Integrity Management through additional rigorous periodic audit of trend data, procedures and the Air System's physical condition.

Acceptable Means of Compliance

a. Technical Airworthiness Authority (TAA) should initiate an independent Ageing Air System Audit (AAA) for each ageing Air System 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 sooner. Repeat audits should be conducted at 10-year intervals thereafter.

b. The Ageing Air System Audit should cover the airworthiness and Integrity Management of the Air System, giving particular consideration to ageing. TAA 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 Air System, 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 Air Systems, 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 Air System.

e. The TAA may appoint an Ageing Air System Audit Coordinator who is responsible for controlling the interfaces between the Audits and for coordinating the Ageing Air System Audit results. A list of all Audits and the demarcation between them will be included in an Ageing Air System Audit Coordination Document.

f. A final Ageing Air System Audit Report, covering all Audits, will be produced and accepted before the Ageing Air System Audit can be considered complete; the Report will include recommendations. Advisers, DOs and OEMs, where contracted, may assist the TAA to interpret the Ageing Air System Audit report and findings. Additionally, generic Air System airworthiness and cross-platform risks identified by the Ageing Air System Audit are to be reported by the TAA to the appropriate Airworthiness Management Group.

g. The TAA will provide the recommendations in the Ageing Air System 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 Air System 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 Airborne Stores to be maintained for supporting both type and continuing airworthiness coverage.

Acceptable Means of Compliance

a. 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 Airborne Stores.

b. The documentation system should be capable of identifying the maintenance condition, usage and repair status of the individual Air System and related Airborne Stores. 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 by the organisation.

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 Airborne Stores 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 adverse 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 Organisation (Mil CAMO)

Regulation

Military Continuing Airworthiness Management Organisation (Mil CAMO) may 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 Organisation (Mil CAMO) for a particular Air System and this group may function as per the procedures laid down by the respective Services. This type of Mil CAMO does not require any approval from TAA.

b. The Mil CAMO may 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.

c. Preventive maintenance may comprise flight servicing, scheduled maintenance and condition-based maintenance.

d. Corrective maintenance includes all those maintenance activities required to return an Air System or Airborne Store to a serviceable state following an unscheduled arising.

e. 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 (AMP), 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 Air System Maintenance Programme, and certificate of release 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 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 Organisations (MMOs) or Approved Air System Maintenance Organisations (ASMOs) 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 organisations 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 may 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 and the replacement of service life limited parts. Where a service life limited part's life cannot be ascertained, the Mil CAMO may 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 may 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 may Initiate and coordinate any necessary actions and follow-up activity highlighted by an Occurrence report.

GUIDANCE MATERIAL

a. The Air System commander may declare an Air System, if on continuous charge, to be unserviceable if he considers that a fault is unacceptable for further flight. The Air System commander of an Air System shall ensure that all faults (including pre-flight accepted faults) that become apparent while he is responsible for the Air System are reported to the responsible maintenance organisation as part of the post-flight declaration and entered in the relevant form (MOD Form 700). He may also report when an Air System under his charge has been subject to an exceedance or an incident that may be considered hazardous.

b. Corrective maintenance may use the principles of 'Inspect and Repair As Necessary' (IRAN). The extent of IRAN will be based on the stores/component OEM guidelines. Further, Technical Airworthiness Authorities (TAA) shall define and promulgate the extent of corrective maintenance that is within the capabilities of forward maintenance organisations and the arrangements for that corrective maintenance which is beyond their capabilities.

21.G3.18 Continuing Airworthiness Management Records

Regulation

Military Continuing Airworthiness Management Organisation (Mil CAMO) may manage records of Continuing Airworthiness activity carried out on Air Systems and Airborne Stores which are essential for airworthiness decision making, provide a legal record, and enable quality assurance, data exploitation and investigations.

Acceptable Means of Compliance

a. The Mil CAMO may ensure that all Continuing Airworthiness activities are recorded and include, as a minimum:

i. Details of the Air System type, the registration mark and the date, together with:

A. Total flight time.

B. Total flight cycles.

C. Total number of landings.

D. Any other airworthiness data specified by the Technical Airworthiness Authorities (TAA).

ii. The current Air System status, including:

A. Status of Special Instructions (Technical)

B. Status of modifications and repairs

C. Status of compliance with the Air System Maintenance Programme (AMP).

D. Status of service life limited components, including life remaining.

E. Weight and balance report.

F. Status of deferred maintenance and operational limitations.

G. Symmetry check report (if required by the Air System Document Set).

H. Status of the Military Airworthiness Review Certificate (MARC) and

supporting information.

iii. A technical log for each Air System, including:

A. Information about each flight, necessary to ensure continued Flight Safety.

B. The document containing the certification of Air System Release.

C. 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.

D. A copy of the current MARC.

E. List of deferred maintenance and operational limitations.

F. 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 organisation

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 organisation may record all details of maintenance work carried out. As a minimum, the organisation may retain records necessary to prove that all requirements have been met for endorsing the certification of Air System/ Airborne Store 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 may ensure the retention of Continuing Airworthiness records and meets the following conditions:

A. Airworthiness Information Management (AIM) records may 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.

B. Other Continuing Airworthiness records that are classified as "significant Air Safety documentation" may be retained for a minimum of 5 years beyond the out of service date.

C. Records may be stored in a manner that ensures protection from damage, alteration and theft.

D. The records may remain readable and accessible for the duration of the retention period.

E. Physical separation of live and backup records should be maintained.

F. Maintenance records, together with all supporting documents, may be classified as significant air safety documentation.

G. Maintenance records may 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).

iii. Records Audit: All Continuing Airworthiness records that have been mandated for retention may be available for audit purposes.

iv. Quarantine of Records: Whenever the requirement arises, the Mil CAMO may quarantine the Continuing Airworthiness records:

A. The records may be made available to accident investigators on request.

B. Access to quarantined records, including copies and the live information system, may be controlled through a means specified by the Mil CAMO, so as not to prejudice any investigation.

C. Release of the records for full read/write access post quarantine may be strictly controlled and meet the needs of Accident investigators.

v. Lost, Corrupted or Inaccurate Records: The Mil CAMO may 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.

vi. Records Transfer: The Mil CAMO may ensure that, where a maintenance organisation terminates its operation, all retained maintenance records are

transferred to the relevant Mil CAMO, which may 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.

vii. Organisation Closure: Where a Mil CAMO terminates its operation, all retained records should be transferred to the operating organisation, unless determined otherwise by the TAA.

viii. Air System Transfer: Air System and Airborne Store transfers may 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.

ix. Records Disposal: The Mil CAMO may 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 may be subject to certification that the electronic copy is a true, legible and complete facsimile of the original.

x. 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 TAA.

Acceptable Means of Compliance

a. The organisation 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 Organisation (Mil CAMO), the organisation shall hold such data when the work is in progress.

b. The organisation 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 organisation 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 DGAQA. 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 organisation 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 Airborne Store, increasing the likelihood of an occurrence. This section requires a maintenance organisation 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 (SI) or Airworthiness Directives (AD) issued by the authority .

iii. Continuing Airworthiness instructions issued by Design Organisation, 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 organisation 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 organisation's planned scope of work whether a Military Maintenance Organisation (MMO) or a contracted maintenance organisation seeking approval.

ii. Service Bulletins, Service Letters and Service instructions (SI,STI,UON,AN). Refer to Subpart L on Continued & Continuing Airworthiness.

iii. Modification leaflets.

iv. Non-Destructive Testing/Non-Destructive Inspection manual.

d. An organisation 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. SIs, Service Bulletins and Service Letters.

e. An organisation 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 organisation 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 organisation (MMO/ASMO/SMO) shall provide a common work card or work sheet system to be used throughout relevant parts of the organisation, (base

Maintenance, Line Maintenance, Workshops/Labs). The worksheets are to be used as follows:

i. The organisation 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 organisation 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.

ANNEXURE 21.G3.A

MAINTENANCE ORGANISATION EXPOSITION (MOE)

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 organisation 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 Organisation's intended scope of work.

1.10 Notification procedure to the TAA regarding changes to the organisation'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 Air System components and material from outside contractors.

2.3 Storage, tagging and release of Air System components and material to Air System 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 Air System/Airborne Stores 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 Air System/Airborne Store Release or issuing a Certificate of Maintenance.

2.17 Records for the MOD.

2.18 Reporting of faults to the Technical Airworthiness Authorities (TAA)/ Continuing Airworthiness Management Organisation (CAMO).

2.19 Return of faulty Air System 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 Air System pressure run procedures.

2.24.3 Air System towing procedures.

2.24.4 Air System 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 Air System 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 Air System.

L2.7 Line procedure control of critical tasks.

Part 3 – Quality System Procedures

3.1 Quality audit of organisation procedures.

3.2 Quality audit of Air System and/or Airborne Stores.

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 Air System or Airborne Store component maintenance tasks exemption process control.

3.10 Concession control for deviation from organisation'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 organisations.

SUBPART H
CERTIFICATE OF AIRWORTHINESS (COA) FOR AIR SYSTEMS

RATIONALE

Prior to delivery to the User Services for operational use, DGAQA is responsible to establish the compliance of the Air Systems to the baseline configuration approved by CEMILAC and ensure its state of airworthiness. This baseline is the fundamental starting point for all subsequent Military Airworthiness Reviews. Configuration variations will occur throughout 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 certify that each of the Air Systems after production or maintenance/overhaul is compliant to approved baseline configuration and performance requirements.

Intentionally Left Blank

CONTENTS

21.H.1	**Applicability**	**H-5**
21.H.2	**Certificate of Airworthiness (CoA)**	**H-5**
21.H.3	**Eligibility**	**H-6**
21.H.4	**Application for CoA**	**H-6**
21.H.5	**CoA during the Production & Maintenance of Air System**	**H-7**
21.H.6	**Duration and Continued Validity**	**H-8**

Intentionally Left Blank

21.H.1 APPLICABILITY

REGULATION

Every Air System 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 Subpart is on the issue of Certificate of Airworthiness and is applicable to the following categories:

   i. Release of the Air Systems to the User Services during the limited series or bulk production phase.

   ii. Release of the Air Systems to the User Services after the completion of any modification or upgradation or maintenance activities.

GUIDANCE MATERIAL

Nil

21.H.2 CERTIFICATE OF AIRWORTHINESS (COA) - FORM 25

REGULATION

Certificate of Airworthiness (CoA) is an endorsement by authorized certifying staff on behalf of the organisation or by DGAQA or the designated Quality Assurance agencies, when it has been verified that each of the Air System 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 production /maintenance phase:

   i. A Certificate of Airworthiness in the form of Signal Out Certificate (SOC) is issued by DGAQA, prior to release to service of an Air System manufactured by the Main Contractor to the approved baseline configuration, on completion of inspection and acceptance.

   ii. On completion of maintenance/overhaul activities of an Air System, a Certificate of Airworthiness is issued by DGAQA prior to release to service on completion of necessary inspection and acceptance.

b. During service operation: During the operational phase of an Air System in Indian Defence Services, issuing of CoA is managed by the respective Services in their own Forms & Procedures (eg: MOD Form 700 used in Indian Air Force)

Guidance Material

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 have demonstrated their capability for design, development and production of an Air System with the TAA shall be eligible to apply for a CoA.

Acceptable Means of Compliance

a. Any organisation which intends to produce Military Air Systems shall hold a relevant Production Organisation Approval (POA) under provisions mentioned at Subpart G2 for the production of such type of Air Systems.

b. An organisation which holds a valid Military Type Certificate (MTC)/Restricted MTC or an organisation which holds a license for the production of such Air Systems 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 - Form 25A

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 Air System, following documents shall be submitted:

A. A copy of MTC/RMTC & License agreements for production, if any and production organisation approval certificates from the TAA.

B. A statement of conformity to applicable Type Certification Data Sheet (TCDS).

C. A work done report on the activities carried out duly coordinated by the respective QA agencies.

D. The flight manual and any other manuals required by the authority responsible for registration of the Air System, as applicable.

ii. For a modified /upgraded Air System, in addition to the above documents, the following documents shall also be submitted:

A. Historical records to establish the production, modification, and maintenance standard of the Air System, including all limitations associated with a restricted certificate of airworthiness.

B. Records showing the total life consumed by each installed life-limited Air System, engine and propeller component.

C. 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.

D. Details of any accidents or incidents in which the Air System has been involved.

E. Details of any major repairs or modifications performed on the Air System, engines and propellers and verification that they have been properly approved and incorporated.

GUIDANCE MATERIAL

DGAQA directive on Certificate of Safety for Flight and Technical Standing Order (TSO) issued by DGAQA.

21.H.5 CoA during the Production & Maintenance of Air System

REGULATION

Military Air Systems released after production or maintenance from Main Contractor/ Maintenance Organisation to User Services shall hold a valid CoA issued by DGAQA.

ACCEPTABLE MEANS OF COMPLIANCE

A Certificate of Airworthiness in the form of Signal Out Certificate (SOC) is issued by DGAQA prior to release to User service of an Air System manufactured or maintained/ overhauled by the Main Contractor/Maintenance Organisation to the approved baseline configuration on completion of necessary inspection and acceptance.

GUIDANCE MATERIAL

Refer Subpart F on Production of Air Systems & Airborne Stores.

21.H.6 DURATION AND CONTINUED VALIDITY

REGULATION

A Certificate of Airworthiness (CoA) for an Air System may be issued for an unlimited duration.

ACCEPTABLE MEANS OF COMPLIANCE

a. CoA remains valid subject to:

   i. Compliance with the applicable type design, airworthiness directives and instructions for continuing airworthiness.

   ii. The type certificate or restricted type certificate under which it is issued, not being previously invalidated under IMTAR-21 Subpart B.

b. The certificate has not been surrendered or revoked by DGAQA.

GUIDANCE MATERIAL

Nil

SUBPART I
RESEARCH AIR SYSTEMS AND AIRBORNE STORES

RATIONALE

It may be required to prove and demonstrate innovative/novel technologies of an Air System/ 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 Air System/Airborne Store for its demonstration trials.

Intentionally Left Blank

CONTENTS

21.I.1	**Declaration by Main Contractor**	**I-5**
21.I.2	**TRL and DRCL Criterion**	**I-5**
21.I.3	**Application by the Main Contractor**	**I-5**
21.I.4	**No Objection from User Services**	**I-6**
21.I.5	**Identification and Authorization of Personnel/Group**	**I-7**
21.I.6	**Privileges to Main Contractor**	**I-7**
21.I.7	**Air System /Airborne Store Airworthiness Coverage by Delegated TAA**	**I-8**
21.I.8	**Documentation**	**I-9**
21.I.9	**Minimum One Airworthiness Audit**	**I-9**
21.I.10	**Failure Reporting**	**I-10**
21.1.11	**Transition to Ab-initio Development and Certification**	**I-10**

Intentionally Left Blank

21.I.1 DECLARATION BY D&D ORGANISATION

REGULATION

The D&D organization has to declare that the Air System/Airborne Store is for research purposes and shall not be delivered for regular operation by the User Services till it will be under the Research category.

ACCEPTABLE MEANS OF COMPLIANCE

A Letter of declaration from D&D organisation to TAA.

GUIDANCE MATERIAL

a. D&D Organisation means any research organization, main contractor or user services for undertaking research under purview of this subpart.

b. Discussion with user services may bring clarity.

c. In case, the main contractor itself is user, the research may continue with self-declaration

21.I.2 TRL AND DRCL CRITERION

REGULATION

The D&D organisation shall follow the Research category based on the System/Store Technology Readiness Level (TRL) and Designer Research Capability Level (DRCL) of D&D organisation.

ACCEPTABLE MEANS OF COMPLIANCE

Air System or Airborne Store shall be accepted under research category based on the TRL and DRCL level

GUIDANCE MATERIAL

a. TRL criterion – Annexure 1

b. DRCL criterion – Annexure 2

21.I.3 APPLICATION BY THE MAIN CONTRACTOR

REGULATION

D&D organisation shall apply to TAA under research category with relevant details.

ACCEPTABLE MEANS OF COMPLIANCE

An application with details as follow shall be provided to TAA:

a. Details of the project.

b. No Objection from User Services as compliance to 21.I.4.

c. Verification records of the TRL & DRCL level.

d. Requirement and Objective

e. Identification of the system

f. Estimated number of flights required for Research

g. Operational area for conducting experimental flight.

h. Changes on a previously type certified air system, if applicable

i. In case of organization approved under DOAS, DRCL assessment is exempted

GUIDANCE MATERIAL

a. TRL criterion (Annexure 1)

b. DRCL criterion (Annexure 2)

c. Procedure for RAS (Annexure 3)

d. IMAP-2023 Chapter 8

21.I.4 NO OBJECTION FROM USER SERVICES

REGULATION

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.I.5 Identification and Authorization of Personnel / Group

Regulation

The D&D organisation shall identify the Airworthiness Group & Internal QA Group of D&D organisation to perform the role of CEMILAC & DGAQA respectively as delegated TAA.

Acceptable Means of Compliance

a. List of authorized personnel and their roles & responsibilities to be provided to TAA by the D&D organization for authorization as delegated TAA.

b. The list shall also contain the signatures of the authorized personnel.

c. In case of organization approved under DOAS, approval number may be quoted and should be sufficient.

Guidance Material

The Airworthiness Certification Plan may be used to define the roles and responsibilities of the individuals in the development.

21.I.6 Privileges to D&D Organisation

Regulation

Technical Airworthiness Authority (TAA), ensures the privileges for D&D organization under the research category.

Acceptable Means of Compliance

Declarations for ensuring privileges by delegated TAA for research category system/ store shall be submitted to TAA for authorisation.

Guidance Material

List of privileges may be referred from the following list.

a. To maintain SOP for the air system/ airborne store to ensure the traceability of parts.

b. To maintain the test reports and internally approve the results under research category.

c. To prepare and approve the Ground Test and Flight Test plans under research category.

d. Ground tests on approval by the delegated TAA of the organisation.

e. To perform the flight test in the restricted air space for Air system on approval by the delegated TAA of the organisation.

f. To manage FRACAS internally for the Air System/Airborne Store within the research period.

g. To carry out SSA internally with an objective to reduce the identified risk at nascent stage of design and exploration for the air system/ airborne store within the research period.

21.I.7 Air System / Airborne Store Airworthiness Coverage by Delegated TAA

Regulation

The airworthiness procedure during research of the Air System/Airborne Store shall follow the regularization of Subpart B (B1, B2, B3, and B4) for Air Systems and Subpart C for Airborne Stores as applicable.

Acceptable Means of Compliance

a. Self-Compliance to Subpart B

b. Self-Compliance to Subpart C

c. Compliance to Provisions of Para 8.4.2, Chapter 8 of IMAP-2023

Guidance Material

The roles of TAA may be replaced by the delegated TAA as identified at 21.I.5. The provisions of Para 8.4.2, Chapter 8 of IMAP-2023 to be ensured by delegated TAA are as follows:

a. Delegated TAA/ D&D organisation shall ensure that all the applicable airworthiness processes as per IMAP-2023 are followed during RAS phase.

b. The Air System shall be registered under the, Indian Military Register and issued with a suitable tail number or authorised by competent authority.

c. The Air System shall be installed with an approved Data Recorder (flight/ on-Ground).

d. Flight Testing shall be carried out in a segregated and designated airspace only.

e. Flight testing shall be carried out by Flight test crew, both the Test Pilot and the Flight Test Engineer, shall be a graduate of a recognized Test Pilot School or shall have undergone a suitable course on flight testing.

f. No part of the Air System and its Airborne Store shall be salvaged or reused for other airborne application, outside the fleet of the research Air System.

g. After the completion of the program objectives, the LRUs shall be yellow colour banded with appropriate ‘NOT FOR FLIGHT’ tags.

h. The Airworthiness Non-Compliances during audit may lead to curtailing of privileges and this will depend on the type and impact of the non-conformances.

i. Any violations in airworthiness practices observed during the entire research period phase will lead to the research flight grounding by TAA. This may also have impact on the future airworthiness certifications to be obtained from TAA.

j. The emergency checks including failure test case handling procedure for the Air System/Airborne Store shall be ensured.

21.I.8 DOCUMENTATION

REGULATION

The D&D Organisation shall prepare & maintain the documentation of the development duly signed by authorized signatories.

ACCEPTABLE MEANS OF COMPLIANCE

a. Documentation shall be as followed for a design & development project.

b. The authorized personnel as per 21.I.5 shall be the approving signatories to the documentation as applicable

GUIDANCE MATERIAL

a. A structured cataloguing and archiving system may be followed, that facilitates in retrieving the relevant information to be presented to TAA upon request.

b. A structured documentation facilitates in transition to Design & Development phase if the situation arises in future.

21.I.9 MINIMUM ONE AIRWORTHINESS AUDIT

REGULATION

a. The D&D organisation has to qualify Minimum One Airworthiness Audit (MOAA) criteria with TAA within the entire research period.

b. D&D organisation/ Delegated TAA shall ensure all the airworthiness process during RAS.

c. D&D organization/ Delegated TAA is liable for any violation in airworthiness process resulting in loss of civilian life (collateral damage).

Acceptable Means of Compliance

a. List of documents and evidences prepared may be provided to TAA.

b. Identified documentation may be provided to TAA upon request

Guidance Material

Procedure for RAS (Annexure 3 to Subpart-I, Chapter 8 of IMAP-2023).

21.I.10 Failure Reporting

Regulation

The D&D organisation shall have Failure Reporting, Analysis and Corrective Action System (FRACAS) to report and resolve the defects/failures during research.

Acceptable Means of Compliance :

a. FRACAS shall capture the defects, failures, snags for entire research period.

b. Accidents/ Major Incidents during research flight shall be investigated by delegated TAA in consultation with TAA.

c. All configuration control measures should be followed for any amendments

Guidance Material

Chapter 8 of IMAP-2023.

21.I.11 Transition to Ab-initio Development and Certification

Regulation

The D&D organization, on successful completion of research phase objectives, may opt for transition to ab-initio development and certification as per the provision of Part 2, Chapter 1, Para 1.3 of IMAP-2023.

Acceptable Means of Compliance:

a. Application to TAA as per provisions of Part 2, Chapter 1, Para 1.3 of IMAP-2023.

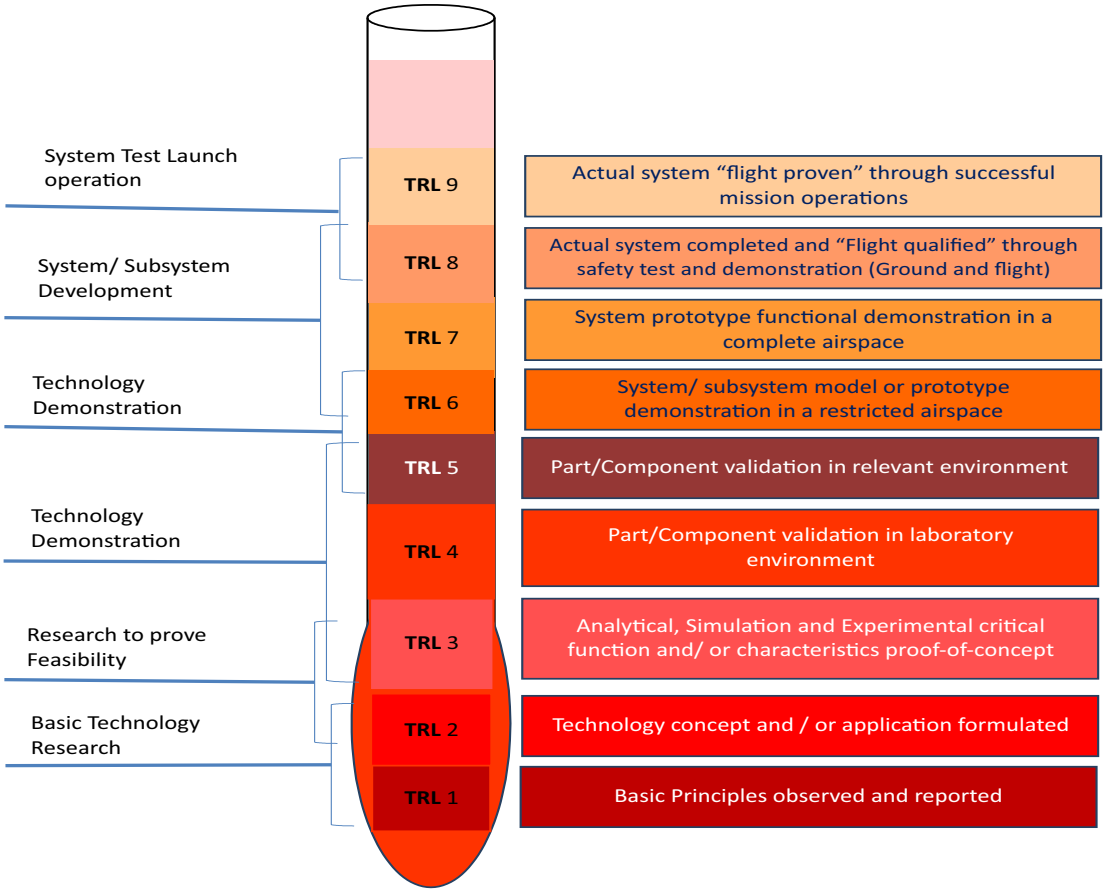
b. Compliance to 21.I.1 to 21.I.10 of Subpart I.

Guidance Material:

a. Compliance to the Regulations in Subpart I, facilitates transition to Ab-initio Design & Development.

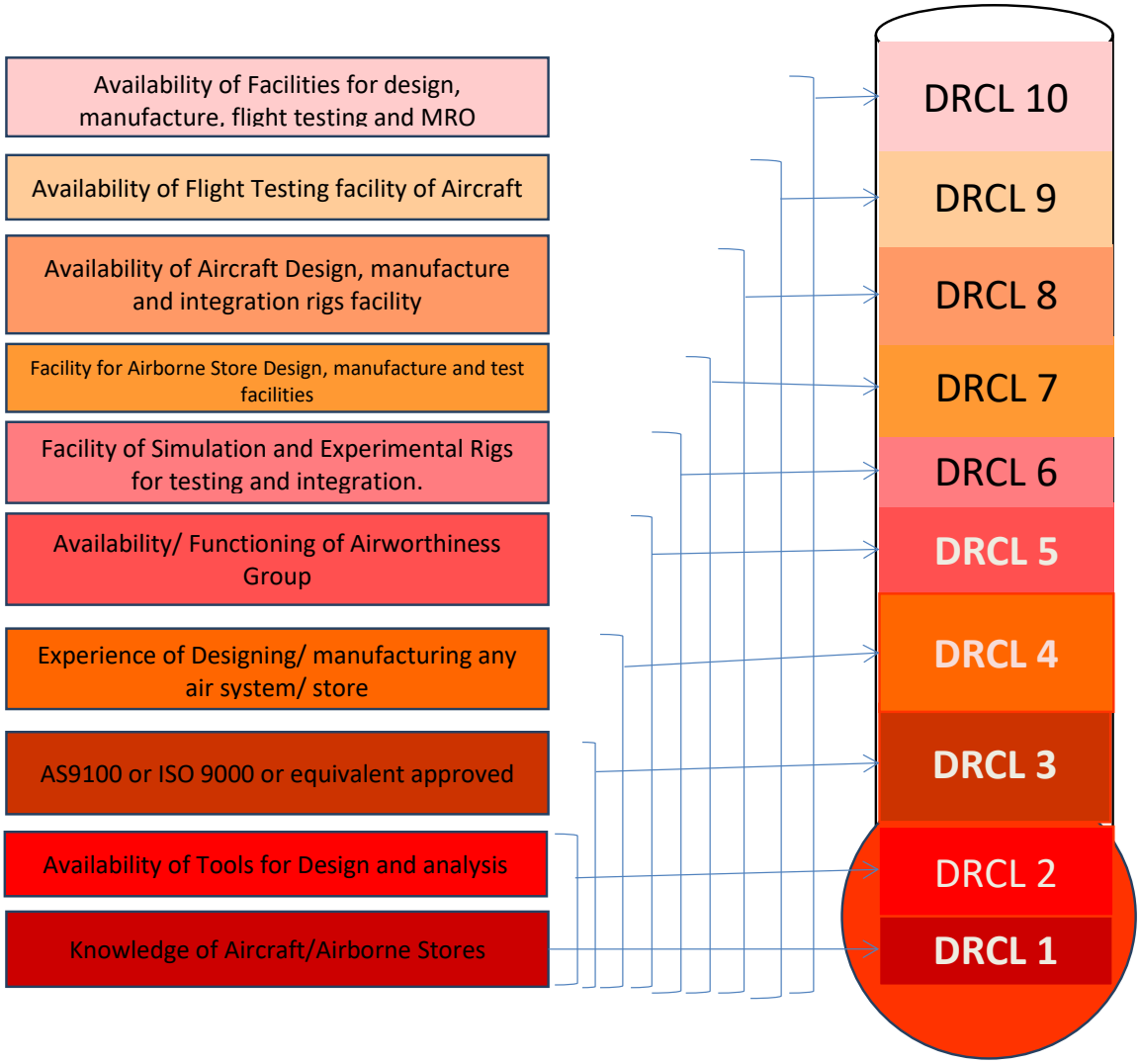
b. The read across shall be decided by the TAA on case-to-case basis depending on the documentation provided and the project under consideration.

Annexure 1



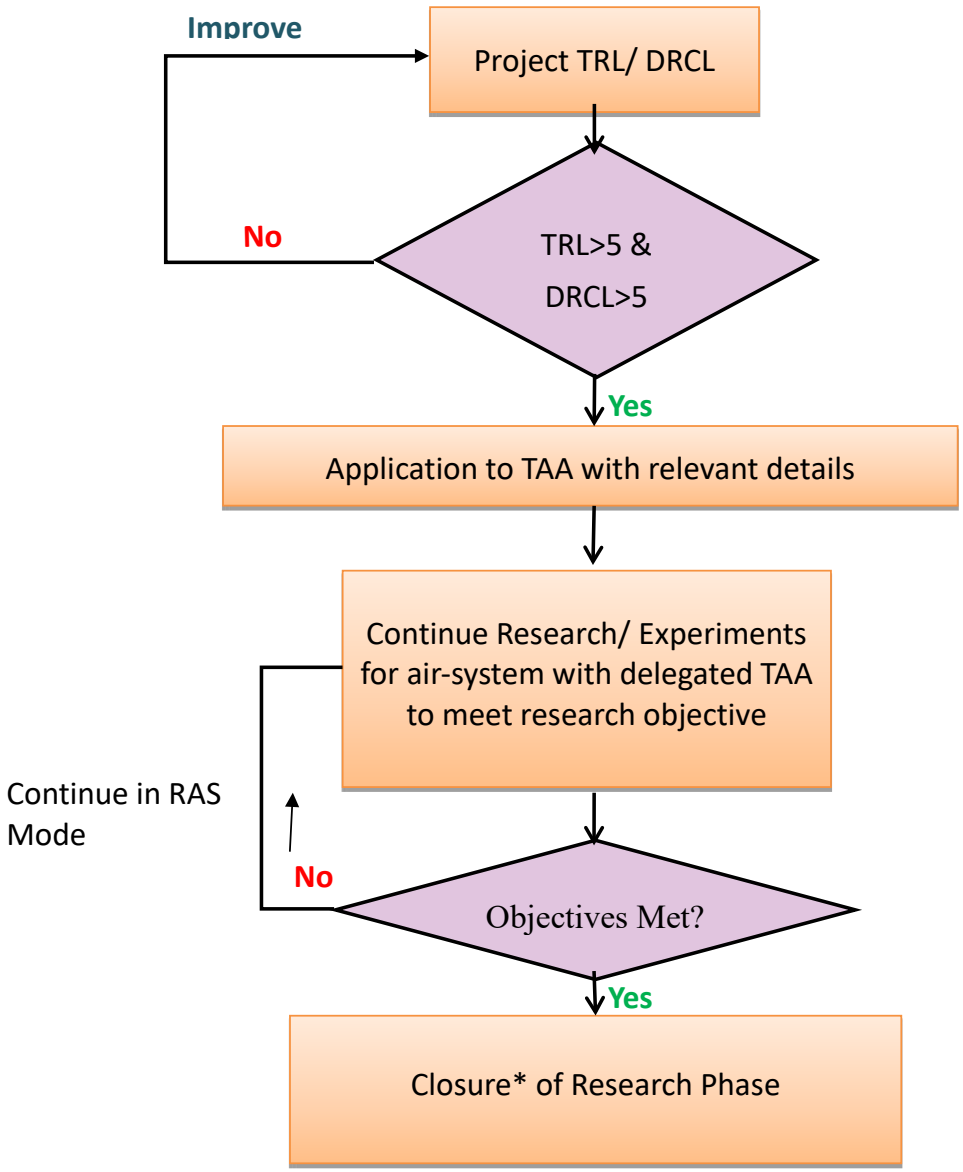
TRL CRITERION

Annexure 2



DRCL CRITERION

Annexure 3



*Note: *Provided Minimum One Airworthiness Criteria is satisfied*

RESEARCH AIR SYSTEM/ AIRBORNE STORE PROCEDURE

Intentionally Left Blank

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 Air System 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 Depots (Equipment Depots, Base Repair Depots, CIMD), Naval Aircraft Yards (NAYs), Army Base Workshops etc.

Intentionally Left Blank

CONTENTS

21.K.1	**Applicability**	**K-5**
21.K.2	**Indigenisation Agency**	**K-5**
21.K.3	**Responsibilities of Indigenisation Agency**	**K-6**
21.K.4	**Local Type Certification Committee (LTCC)**	**K-7**
21.K.5	**Criticality Classification of Airborne Stores by LTCC**	**K-8**
21.K.6	**Airworthiness Certification Approach**	**K-8**
21.K.7	**Development and Prototyping of Non-critical Airborne Stores**	**K-9**
21.K.8	**Test and Evaluation Phase**	**K-10**
21.K.9	**Airworthiness Clearance**	**K-11**
21.K.10	**Production of Non-Critical Airborne Stores for Indigenous Substitution**	**K-11**
21.K.11	**Withdrawal of Airworthiness Clearance**	**K-12**

Intentionally Left Blank

21.K.1 APPLICABILITY

REGULATION

All types of Airborne Stores from a foreign origin, such as airborne equipment, materials, standard parts etc. can be taken up for indigenous substitution. Such stores shall be cleared as per provisions given in this Subpart.

ACCEPTABLE MEANS OF COMPLIANCE

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 ab-initio developed Airborne Stores with another indigenous Airborne Store shall not be covered in this Subpart and shall be handled using the provisions given in Chapter-1, Part-2 of IMAP-2023 document and associated regulations given in Subpart C on Ab-initio development of Airborne Stores.

c. Substitution of a material with an indigenously developed Airborne Material shall not be covered in this Subpart and shall be handled using the provisions given in Subpart C3 on Development of Airborne Materials leading to LoA.

d. Indigenous substitution for ground based systems such as Test Rigs and TTGEs etc. bought out from foreign sources shall also be provided with TAA coverage by following the regulations given in Subpart T.

e. 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 cleared using these policy provisions.

f. 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

REGULATION

The Main Contractor, who initiates the indigenisation process shall be considered as

the Indigenisation Agency.

ACCEPTABLE MEANS OF COMPLIANCE

a. Indigenous substitution can be taken up by any agency i.e, Public Sector, Private Sector, Government Agencies or the Organisations within the User Services responsible for indigenisation activities such as Depots, NAYs, Army Base Workshops etc., hereinafter referred as the Indigenisation Agency.

b. The Indigenisation Agency shall identify the stores which are to indigenized and finalise the methodology for indigenisation.

c. Indigenisation Agencies (IA) must have a defined internal Quality Control Process.

d. In cases where the indigenisation of stores is done by vendors identified by the Indigenisation Agency, the Indigenisation Agency shall ensure that the vendors are capable of carrying out such activities.

GUIDANCE MATERIAL

NIL

21.K.3 RESPONSIBILITIES OF INDIGENISATION AGENCY

REGULATION

The Indigenisation Agency 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 Indigenisation Agency shall ensure that the vendors comply with the airworthiness certification requirements. Towards this, provisions related to Airworthiness Certification requirements shall be necessarily included in the RFP.

ACCEPTABLE MEANS OF COMPLIANCE

a. The Indigenisation Agency shall handle all the issues related to the Intellectual Property Rights (IPR).

b. The Indigenisation agency shall ensure that, wherever specific requirements in the form of Specifications/ Qualitative Requirements/ Service Requirements for the Airborne Store to be indigenized have been issued by the User Services, the same are taken into consideration.

c. The Indigenisation Agency shall ensure the availability of necessary test facilities at all the applicable levels at which testing is envisaged.

d. The Indigenisation Agency shall identify the Authorized Holder of Sealed Particulars (AHSP) for the Airborne Store.

e. List of indigenised items may be provided to TAA at regular periodicity.

GUIDANCE MATERIAL

NIL

21.K.4 LOCAL TYPE CERTIFICATION COMMITTEE (LTCC)

REGULATION

A Local Type Certification Committee (LTCC) shall be constituted to classify the criticality of the Airborne Store and clear the technical aspects of indigenous substitution.

ACCEPTABLE MEANS OF COMPLIANCE

a. LTCC shall be constituted by CEMILAC for the Indigenisation Agency with relevant stakeholders and it shall assess & classify the Airborne Stores to be indigenously substituted based on their criticality as 'critical' and 'non-critical'.

b. Upon consideration, LTCC shall refer the critical Airborne Stores to CEMILAC for clearance. Non-critical Airborne Stores shall be cleared by LTCC itself.

c. The composition of LTCC shall be as follows:

Chairman:	CEMILAC Representative
Members:	Head of Indigenisation, Indigenisation Agency (IA)
	Representative of the Design Department
	Head of Quality Department
	Domain Expert to be nominated by CEMILAC
	DGAQA Representative (or reps of QA nominated by User Services)
	User Representative
Member Secretary:	IA Rep handling Indigenisation project

GUIDANCE MATERIAL

NIL

21.K.5 Criticality Classification of Airborne Stores by LTCC

Regulation

LTCC shall classify the criticality of the Airborne Store.

Acceptable Means of Compliance

LTCC is empowered to classify Airborne Stores as Critical and Non-Critical. Detailed Analysis shall be carried out for the system to identify failure modes and their effect on Flight safety or Mission safety. Based on such analysis only, stores/ components shall be classified as Critical or Non-Critical.

Guidance Material

a. Critical: Airborne Store, whose failure/malfunctioning endangers the safety of the Air System/ Flight Crew or results in aborting the mission is termed as a critical Airborne Store.

b. Non-Critical : Airborne Store, which is not classified as critical, is termed as non-critical Airborne Store.

21.K.6 Airworthiness Certification Approach

Regulation

The approach to airworthiness certification including the extent of testing would depend on the criticality of the Airborne Store.

Acceptable Means of Compliance

a. The Airborne Stores, identified as critical by the LTCC, shall follow the activities leading to clearance of the store as per Subpart C, with QA coverage by DGAQA / QA agency of the User Services. This certification procedure can be suitably tailored in concurrence with TAA for its effective application for indigenously substituted airborne stores.

b. The Airborne Stores, identified as non-critical by the LTCC, the airworthiness certification coverage shall be as follows:

   i. The indigenisation agency shall put up the detailed plan for indigenisation including technical specification and development plan to the LTCC for review and ratification. Self-approvals of test plan and procedures shall be enabled by LTCC for Non-Critical airborne stores subject to test adequacy being ensured.

ii. On completion of the activities, the indigenisation agency shall submit the test results and compliance report to LTCC for clearance.

c. For the indigenous substitution of non-critical Airborne Stores, identified based on criticality classification by LTCC, and development of TTGEs by the User Services organisations, the respective service HQ may designate appropriate authorities within these organisations who can provide the necessary coverage including clearance. The clearance by the competent authority within the Services shall be treated as final.

GUIDANCE MATERIAL

NIL

21.K.7 DEVELOPMENT AND PROTOTYPING OF NON-CRITICAL AIRBORNE STORES

REGULATION

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.

ACCEPTABLE MEANS OF COMPLIANCE

a. Technical specifications for the Airborne Store shall be prepared and approved by the Indigenisation Agency based on the review and ratification by the LTCC as per 21.K.6 AMC (b)(i).

b. The Indigenisation Agency shall establish appropriate processes for Configuration Control and Defect Investigation during all the phases.

c. Use of COTS elements and Standard parts not only significantly reduces the developmental efforts but also provides many benefits during the life cycle of air systems and airborne stores. When such non -developmental items are used, due considerations shall be taken by all the relevant stakeholders so as to ensure that these elements / parts do not impact the technical and operational airworthiness.

GUIDANCE MATERIAL

NIL

21.K.8 Test and Evaluation Phase

Regulation

The Airborne Store under indigenous substitution shall be subjected to necessary test and evaluation prior to its clearance.

Acceptable Means of Compliance

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. Self-approvals of test plan and procedures as well as QA requirements shall be enabled by LTCC for Non-Critical airborne stores subject to test adequacy being ensured.

d. LTCC shall enable acceptance of industry standard quality assurance requirements such as AS9102 (First Article Inspection) for vendors / sub-contractors.

e. All the test results shall be generated and provided to LTCC, preferably in digital format, for faster processing of approvals.

f. Qualification tests shall be carried out at NABL/ Govt. approved test houses/ Laboratories as far as possible.

g. Qualification tests shall be witnessed by the internal quality assurance group of the Indigenisation Agency. Qualification test results from these test houses/ laboratories shall be coordinated by internal QA group of IA for their acceptance towards issuance of clearance.

h. Flight Testing: In regard to Airborne Stores where flight tests are required for their evaluation, views of the end Users/flight test agency shall be taken into consideration before finalizing the flight test specification. Flight Test specification shall be prepared by the Indigenisation Agency.

Guidance Material

a. Qualification Test Plan Document

b. QT Results and Compliance to QTP

21.K.9 AIRWORTHINESS CLEARANCE

REGULATION

Airborne Store shall be issued with the necessary clearances prior to its integration on Air Systems.

ACCEPTABLE MEANS OF COMPLIANCE

a. Airworthiness clearance for the non-critical Airborne Stores shall be issued by the LTCC through the Minutes of the Meeting (MoM).

b. The clearance for critical Airborne Stores shall be issued by CEMILAC as per Subpart C.

GUIDANCE MATERIAL

NIL

21.K.10. PRODUCTION OF NON-CRITICAL AIRBORNE STORES FOR INDIGENOUS SUBSTITUTION

REGULATION

The Indigenisation Agency shall produce the Airborne Store as per the Standard of Preparation released as a part of clearance process.

ACCEPTABLE MEANS OF COMPLIANCE

a. Production of the Airborne Store shall be progressed as per Subpart F.

b. Quality Assurance aspects during production shall be ensured by the identified QA authority.

c. Periodic Qualification Test (PQT)/ Acceptance Tests: The Indigenisation Agency shall conduct the necessary tests (PQT & AT as applicable) on the Airborne Store produced as per the schedule mutually agreed with relevant stakeholders.

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 Indigenisation Agency. Procedure for modifications during production and in-service phase shall be as given in Subpart E/Subpart L with the involvement of the Indigenisation Agency.

GUIDANCE MATERIAL

NIL

21.K.11 Withdrawal of Airworthiness Clearance

Regulation

Indigenised Airborne Stores if found to be unsatisfactory, the clearances shall be withdrawn by LTCC.

Acceptable Means of Compliance

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 technical justification and investigation with the Indegenization Agency.

Guidance Material

NIL

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 Air System /Airborne Store enters the in-service phase, the focus is to ensure that airworthiness of the design is sustained throughout the operational life. Continued airworthiness activities like defect investigation, issue of service instructions, incident and accident investigation, lifing & life extension, modification and upgrades and Continuing Airworthiness or Operational Airworthiness activities to ensure that the Air System / Airborne Store is airworthy at any given time, therefore forms an essential part of the Air System life cycle.

Intentionally Left Blank

CONTENTS

21.L.1 Applicability---------- L-5
21.L.2 Operational Failure Reporting, Analysis and Corrective Action System---------- L-5
21.L.3 Service Instructions---------- L-6
21.L.4 Incident and Accident investigation ---------- L-7
21.L.5 Lifing and Life Extension---------- L-8
21.L.6 Modifications and Upgrades ---------- L-8
21.L.7 Continuing Airworthiness ---------- L-9

Intentionally Left Blank

21.L.1 APPLICABILITY

REGULATION

Continued and Continuing Airworthiness activities of the Air System/Airborne Stores to keep them airworthy, shall be in accordance with approved processes and practices.

ACCEPTABLE MEANS OF COMPLIANCE

a. This regulation detailed in this Subpart shall take effect after the Initial Airworthiness Clearances are issued.

b. The Subpart shall apply for Air Systems, Airborne Stores and TTGE (used during maintenance, servicing and operation).

c. This Subpart shall be applied to the Air Systems and Airborne Stores which are produced under initial airworthiness clearances, license manufactured and bought out.

GUIDANCE MATERIAL

The Main Contractor and the User Services may establish mechanisms for ensuring that the Air Systems 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 stakeholders 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. Main Contractor may form defect investigation committee in consultation with the User Services, with members from Services, CEMILAC and DGAQA for investigation of failures/incidents, if necessary. The findings and recommendations/ remedial measures shall be culminated in the form of a DI report.

c. A Defect Investigation Review committee shall be formed at the Contractor's workplace to review and ensure that the actions of the Defect Investigation committee are properly carried out. The constitution of this review committee shall be with Quality Chief of the Main Contractor as Chairman and CEMILAC, DGAQA, User

Services, representatives of Quality Department, Production Department and Design Department of the contractor firm as members. The committee shall meet periodically for analysing all defect investigations and review of the necessary remedial measures.

d. 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 Review Committee (DIRC) to review the defect data. The committee shall meet at least once in a quarter for analysing all defect investigations and review of the necessary remedial measures.

c. A database of all defects and incidents reported by Service Head Quarters maybe maintained by the contractor firm. The Main Contractor to carryout, 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 Head Quarters, Maintenance/servicing organisations of User Services (Eg. CSDO/AFLE/IAF PMT/ BRD/NASDO/MAG(Avn)/Eqvt), 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

a. 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 and informed to the Service HQ.

b. It is the responsibility of the Service HQ to ensure that the Service Instructions are promulgated to the applicable Operation bases.

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)

b. The User Services shall establish a process/mechanism for the promulgation of the Service Instructions to the Operation bases.

GUIDANCE MATERIAL

a. Any operating instruction that is critical to the safety of flight and updating of applicable publications may take time, shall be immediately intimated to applicable operating bases through an Urgent operating Notice/Alert Notice (UONs). UoNs are normally issued by the Main Contractor duly co-ordinated by CEMILAC and flight test department of the Main Contractor. These are to be promulgated immediately by Service HQrs.

b. STIs and SIs, prepared by the Main Contractor are coordinated by CEMILAC and forwarded to Service Head Quarters. STIs and SIs are issued by the Service Head Quarters to the respective Squadrons, Bases and Maintenance Organisation of the Services.

c. STIs are issued to carry out certain modifications arising out of investigations on all the applicable Air Systems and Airborne Stores, which need to be implemented on an urgent basis, where LMC is not conducted.

d. SIs are issued to carry out certain inspection activities on all the applicable Air Systems to ensure compliance/or to obtain feedback related to investigations.

e. The SBs are issued by the OEM of the bought out system or the licensor in the case of license produced system or the Main Contractor in case of indigenous developed system, to inform modifications that may be carried out on the product.

21.L.4 INCIDENT AND ACCIDENT INVESTIGATION

REGULATION

The User Services and Main Contractor shall provide necessary incident/accident information to the TAAs for Air Systems and Airborne Stores where Indian TAA have provided certification and QA coverage.

ACCEPTABLE MEANS OF COMPLIANCE

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

a. The User Services (with respect to in service incidents/accidents) and Main Contractor (with respect to production incident/accident) may involve the TAA during the incident/accident investigation. This gives the TAA the first hand information on the incident/accident.

b. 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

REGULATION

The Main Contractor shall carry out periodic assessment of the initial assigned life with the involvement of all stakeholders, Service HQ and TAA .

ACCEPTABLE MEANS OF COMPLIANCE

a. The Main Contractor shall formulate a lifing plan document as a part of 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 stakeholders 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.8.

21.L.6 MODIFICATIONS AND UPGRADES

REGULATION

The User Services implement the continued airworthiness activities for the Air System fleet/Airborne Store maintained by them as per the documentation provided by the

OEM of the system. For cases where the User Services decide to modify or upgrade the Air System/Airborne Store, the Services may involve the Indian TAA for aspects which may affect the safety of the Air System.

ACCEPTABLE MEANS OF COMPLIANCE

a. The User Services may involve TAA for aspects that may affect the safety of the Air System. 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. A task directive or equivalent from the Service HQ stating the roles and responsibilities of the stakeholders.

c. Subpart D & Subpart E are applicable.

d. Indigenous substitution of Airborne Stores 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 Air Systems 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 Air System 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.

21.L.7 CONTINUING AIRWORTHINESS

REGULATION

The User Services shall carry out all necessary tasks on the Air System throughout its in-service life cycle to ensure the Continuing Airworthiness of the Air System.

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 department 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

c. Process and Procedure documentation of the respective User Services.

SUBPART M
REPAIR OF AIR SYSTEMS AND AIRBORNE STORES

RATIONALE

There could be deviations during the manufacturing process or some damages during the operational use of the Air System 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.

Intentionally Left Blank

CONTENTS

21.M.1	**Eligibility and Demonstration of Capability for taking up Repair of an Air System or an Airborne Store**	**M-5**
21.M.2	**Classification of Repairs of an Air System**	**M-5**
21.M.3	**Repair Design Procedure for an Air System**	**M-7**
21.M.4	**Issue of a Repair Design Approval of an Air System**	**M-10**
21.M.5	**Repair of an Airborne Store**	**M-12**
21.M.6	**Production of Airborne Stores used for Repair and embodiment of Repair**	**M-13**
21.M.7	**Unrepaired Damage**	**M-13**
21.M.8	**Record Keeping**	**M-14**
21.M.9	**Instructions for Sustaining Type Airworthiness**	**M-14**

Intentionally Left Blank

21.M.1 Eligibility and Demonstration of Capability for taking up Repair of an Air System or an Airborne Store

Regulation

a. MTC/AMTC/SMTC holders are eligible as an applicant for Repair of an Air System and TA/LoA/IMATSOA holders are eligible as an applicant for repair of an Airborne Store.

b. Any organisation 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 Air System/Airborne Stores under the conditions laid down in this Subpart.

Acceptable Means of Compliance

a. An organisation approved under DOAS (Subpart G1) will be eligible for carrying out the repair design of an Air System/Airborne Store .

b. An Organisation approved under POAS (Subpart G2) will be eligible for Production of a Repair Part of an Air System/Airborne Store.

c. An Organisation approved under POAS (Subpart G2) or MOAS (Subpart G3) will be eligible for the embodiment of Repair on an Air System/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

Subpart G & Subpart D.

21.M.2 Classification of Repairs of an Air System

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 corrective actions requiring no further demonstration of compliance with Type Certification Basis (TCB).

b. Major Repairs: Major changes to type design or corrective actions where additional work is necessary to demonstrate compliance with the TCB and environmental protection requirements.

Guidance Material

Clarification of the terms major/minor

a. Repair by definition is the restoration of the Air System/Airborne Store to its original build standard which doesn't require any further demonstration of compliance with original certification basis. However, at times a minor re-design may be necessitated due to the absence of original parts/material or due to inability on carrying out a re-work on the damaged part.

b. Repairs are such actions which are limited to a particular serial number of Air System/ Airborne Store.

c. Minor Repairs:

   i. Repairs carried out following the guidelines of Repair Manuals of the type Air System/Airborne Store are considered as minor.

   ii. Repairs whose effects are considered minor and require minimal or no assessment of the original certification substantiation data to ensure that the Air System/Airborne Store still complies with all the relevant requirements, are to be considered minor.

   iii. When the Repair Scheme is not covered under Repair Manual or when not all the certification substantiation data is available to those Persons/organisations 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.

d. Major Repairs:

   i. A new repair is classified as major if the result on the approved Type Design has an appreciable effect on structural strength, weight, balance, systems, operational characteristics or other characteristics affecting the Airworthiness of the product, part or appliance.

   ii. 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.

e. 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 organisation shall demonstrate that the repair is in compliance with the Military Type certificate/SMTC 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 duly approved Repair Manual or Repair Scheme approved in accordance with the provisions of this Subpart.

b. ASDO shall provide evidence to CEMILAC that Air System complies with all the relevant requirements and require no further demonstration of compliance.

c. ASDO shall ensure that the work carried are recorded in the relevant Air System 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 Air System Maintenance Manual (AMM) or equivalent.

e. The applicant for approval of a repair design should submit all necessary data in applicable form.

f. QA coverage for such actions shall be provided by DGAQA or DGAQA authorized QA personnel of Main Contractor or the QA personnel authorized within the User Services.

Repair Procedure for major Repair:

a. The applicant for approval of a repair design should submit all the 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.

b. 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 Document (RSD) and Service Instructions.

c. The DO should respect any extant design limits and comply with the following requirements:

i. The DO should notify CEMILAC 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, wherein it is established that it will not lead to unsafe condition.

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.

d. DO to ensure that the effect of the changes made to the Air System on maintenance and operations are captured in the relevant documents or equivalent (SB/SI/STI) and provided to the User Services.

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 IMATSOA 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 shall inherently meet the full load spectrum of the Air System’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 center of gravity due to the installation of a repair scheme is to be recorded in the Air System Documentation.

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 CEMILAC explicitly details otherwise, compliance with prescribed design limitations is taken to mean:

A. That the repair provides effective restoration of structural integrity (ie static ultimate load), without under or over stiffening, and therefore the Air System RSD is unaffected.

B. That the repair is durable for the remaining life of the airframe, or for an explicitly specified duration where operationally necessary.

C. 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 organisation is designing a new repair (based on data not published in the Air System Documentation set 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:

A. Damage identification and reporting source.

B. Major repair design approval sheet identifying applicable specifications and references of justifications.

C. Repair drawing and/or instructions and scheme identifier.

D. Correspondence with the CEMILAC, DO or IMATSOA holder, if its advice on the design has been sought.

E. Structural justification (static strength, fatigue, damage tolerance, flutter etc) or references to this data.

F. Effect on the aircraft, engines and/or systems (performance, flight handling, etc as appropriate).

G. Effect on maintenance programme.

H. Effect on airworthiness limitations, the Flight Manual and the Operating Manual.

I. Weight and moment change.

J. 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 CEMILAC, when deemed necessary

v. Repairs to engine critical parts should normally only be accepted with the involvement of the CEMILAC.

21.M.4 Issue of a Repair Design Approval of an Air System

Regulation

CEMILAC shall ensure that the repair design complies with the applicable TCB prior to approval and DO shall ensue that the relevant documents are updated.

Acceptable Means of Compliance

a. The approval shall be issued only:

i. By CEMILAC.

ii. For minor repairs only, by an appropriately approved DO under privilege.

b. In order for the CEMILAC to approve major repair design the following is 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 CEMILAC.

c. A summary list of all repair approvals shall be provided to CEMILAC on a regular basis as agreed.

Products Type Certified by the CEMILAC

CEMILAC approval is necessary 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. Separate approval of repair scheme is not required if repair is as per the duly approved repair manual.

b. Approval by DO. Approval of repairs through the use of privileges invoked by CEMILAC, means an approval issued by the DO without requiring CEMILAC involvement. CEMILAC will monitor application of this procedure within the surveillance plan for the relevant organisation. When the organisation exercises this privilege, the repair release documentation is to clearly state that the privilege has been identified under their DOAS approval.

c. 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 previous approved repair design, (structural justifications still valid, possible Airworthiness limitations unchanged), the solution can be considered approved and can be used again.

d. 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.

e. 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 or a Repair Scheme duly approved in accordance with the provisions of this Sub Part.

Acceptable Means of Compliance

a. Repair Manual shall be prepared by the OEM and duly approved by CEMILAC or the Certification of the Country of Origin.

b. Repair scheme applicable to an airborne store shall be duly approved: --

   i. By CEMILAC in case of Major Repairs

   ii. By CEMILAC or by an appropriately approved DO under privilege in case of Major Repairs

c. Work done report in compliance to the approved Repair Manual/ Repair Scheme shall be coordinated by DGAQA or QA department of Main Contractor/Production Organisation (PO)/ Maintenance Organisation (MO)/User Services.

Guidance Material

a. Separate approval of repair scheme is not required if repair is as per the duly approved repair manual.

b. Repair is an unscheduled maintenance activity carried out due to unforeseen circumstances like occurrence of snag/defect/failure/ damage to the airborne store in order to restore the accessory to a serviceable condition.

c. Repair Manual of an Airborne Store shall be evolved by the OEM/Main Contractor. The repair manual shall be finalized after considering the comments of all stakeholders and shall be approved by CEMILAC or the Certification Agency of the country of Origin. 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

d. Repair scheme for an airborne store shall be prepared by the DO after analyzing the extent of damage, duly evaluating efficacy of repair work and impact analysis for the repair work. Such repair scheme shall be duly approved before carrying out repair work in accordance with the provisions of this Sub Part. Necessary changes to manuals, documentation, additional checks, if required and limitations, if any, owing to the repair work shall be clearly brought out by the DO.

21.M.6 Production of Airborne Stores used for Repair and Embodiment of Repair

Regulation

a. Airborne Stores 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 DO:

   i. By a Production Organisation (PO) appropriately recognized vide Subpart G2

   ii. By an Approved Maintenance Organisation (MO) vide 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 Organisation, 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, store is left unrepaired and is not covered by previously approved data, CEMILAC or an appropriately approved DO under privilege shall approve its continued use only after necessary assessments.

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 organisation evaluating the unrepaired damage is neither the ASDO nor the DO, this organisation 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

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 Air System Documentation set/Repair Manual.

21.M.8 RECORD KEEPING

REGULATION

For each repair, all relevant design information, drawings, test reports, instructions, limitations, 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.

ACCEPTABLE MEANS OF COMPLIANCE

a. A mechanism for archiving and retrieval of repair records to be established by the repair design approval holder.

b. Relevant information may be produced to TAA upon request.

GUIDANCE MATERIAL

Nil

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.

Intentionally Left Blank

SUBPART N
BOUGHT-OUT AIR SYSTEMS AND AIRBORNE STORES

RATIONALE

Procurement of Air System/Airborne Stores from foreign sources is inevitable at times to fulfil the urgent/essential need of the defence requirements. Additionally, in order to increase the potential of the Air System and/or to cater for obsolescence, modifications / upgradation to the bought out Air System, leading to change in Type Design are expected. Procedure for the approval of changes to type designs and type certificates from airworthiness considerations and to establish the rights and obligations of the holders of those approvals needs to be undertaken in a systematic manner.

Intentionally Left Blank

CONTENTS

21.N.1	**Applicability**	**N-5**
21.N.2	**Association of TAA in Bought-out Air System/ Airborne Stores**	**N-5**
21.N.3	**Revalidation of Approvals by TAA**	**N-6**
21.N.4	**Modifications on Bought-out Air System/ Airborne Stores**	**N-6**
21.N.5	**Indigenous Substitution of Bought-out Airborne Stores**	**N-7**
21.N.6	**Major upgrades on Air System/Airborne Stores**	**N-7**
21.N.7	**Repair of Bought-out Air System/ Airborne Stores**	**N-7**
21.N.8	**Life Extension Programme for Bought-out Air System/ Airborne Stores**	**N-8**

Intentionally Left Blank

21.N.1 APPLICABILITY

REGULATION

a. The regulations contained in this Subpart are applicable to bought out Air System and Airborne Stores for Indian military applications.

b. In order for the TAA to provide airworthiness certification and QA coverage in an effective manner, the user services / main contractors shall include all the requirements pertaining to airworthiness certification and QA at the initial stages of the procurement / acquisition of air systems and airborne stores.

ACCEPTABLE MEANS OF COMPLIANCE

The provisions shall be applicable during procurement and in service exploitation of the Air System and Airborne Stores.

GUIDANCE MATERIAL

Nil

21.N.2 ASSOCIATION OF TAA IN BOUGHT-OUT AIR SYSTEM/ AIRBORNE STORES

REGULATION

TAA and approved design agency shall be associated in the negotiations during purchase of any Air System/Airborne Stores from foreign countries to ensure that the certification basis/airworthiness certification plan requirements are met.

ACCEPTABLE MEANS OF COMPLIANCE

a. TAA requirements may be captured during the initial stage of procurement/acquisition.

b. TAA may be involved in all technical discussions associated with the Air System/ Airborne Store.

c. All relevant technical details and documentation during the negotiations phase may be shared with TAA.

GUIDANCE MATERIAL

a. Association of TAA during procurement enables them in carrying out continued airworthiness as well as upgradation activities of the Air System and Airborne Stores, if envisaged in the future.

b. TAA and approved design agency shall ensure that all certification requirements are met and also to ensure that type records including all details about fatigue test, fatigue life, EMI/EMC map, vibration and environmental map, reliability data etc., are transferred whenever possible along with the Air System/Airborne Store

21.N.3 Revalidation of Approvals by TAA

Regulation

The initial airworthiness approvals from country of origin shall be appropriately re-validated for the Air System by TAA if requested by User Services.

Acceptable Means of Compliance

a. TAA will scrutinize the technical documents provided by the manufacturer for the bought out Air System on case to case basis as mutually agreed between User Services and TAA.TAA shall provide their recommendation on the technical airworthiness of the Air System to the User Services.

b. Bought out Item clearance shall be issued by CEMILAC for all the bought out Airborne Stores based on the necessary technical information as per the prescribed format submitted by the applicant.

Guidance Material

On certain occasions, it may be necessary to consider Air Systems & Airborne Stores Type cleared by Civil Agencies, for use in Services. The procedure to be followed for such cases is detailed in Subpart R.

21.N.4 Modifications on Bought-out Air System/ Airborne Stores

Regulation

The bought out Air System/Airborne Stores shall be modified if need arises. Any modification shall be approved by TAA.

Acceptable Means of Compliance

Procedures detailed in “Subpart D” for modifications of an Air System and “Subpart E” for modification of an Airborne Store shall be applicable.

Guidance Material

Subpart D & Subpart E

21.N.5 Indigenous Substitution of Bought-out Airborne Stores

Regulation

The indigenous substitution shall be allowed to replace bought out Airborne Stores if need arises. Any indigenous substitution shall be approved by TAA.

Acceptable Means of Compliance

Procedures detailed in Subpart K shall be applicable for indigenous substitution of Airborne Stores

Guidance Material

Subpart K

21.N.6 Major upgrades on Air System/Airborne Stores

Regulation

Major upgrades to the bought out Air System/Airborne Stores shall be allowed if need arises. Any major upgrades shall be approved by TAA.

Acceptable Means of Compliance

Procedures detailed in “Subpart D” for modifications of an Air System and “Subpart E” for modification of Airborne Store shall be applicable

Guidance Material

Subpart D & Subpart E.

21.N.7 Repair of Bought-out Air System/ Airborne Stores

Regulation

The bought out Air System/Airborne Stores shall be repaired in the event of any malfunction observed. Any repair shall be approved by TAA.

Acceptable Means of Compliance

a. Procedure detailed in subpart M for Repair of specific Bought-out (identified by tail no. or serial no)

b. Procedure detailed in subpart D&E Repair of bought out items applicable to batch of Air System /Airborne Store.

Guidance Material

Subpart M, D & E

21.N.8 Life Extension Programme for Bought-out Air System/ Airborne Stores

Regulation

The bought out Air System/Airborne Stores shall be life extended based on the request by the approved design agency or the User Services. 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 shall be followed in the life extension program

Guidance Material

a. Life Extension Program includes the following:

   i. The life of Air System and Airborne Stores are restricted in terms of both calendar life and flying hours for TTL and TBO.

   ii. While TTL flying hour 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 & Equipment

   iii. Mechanical Equipment

   iv. Electrical & Avionics Equipment

   v. Rubber seals & Hoses

As complete design data of the bought out aircraft may not be supplied, considering the operator's 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 Air System. Corrosion as a major factor for operations in Coastal areas shall 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 fibre 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 items are a deciding factor for the TCL of the aircraft system and store.

For airframe following points need to be considered

A. Experiences on structural inspection, micrometry measurement and crack detection during overhaul.

B. Calculation of design reserve factors of the critical/primary load bearing structural members.

C. Analytical evaluation of fatigue life loading for important structural members.

D. Consideration of structural modification related to Airframe fatigue.

E. Fatigue/Endurance testing of airframe and structural components.

ii. Aircraft System & Equipment

A. Experiences on dismantling, stripping, micrometric measurement and crack detection during overhaul of equipment.

B. Field failure data and defect investigation of high-density failure components.

C. Artificial ageing by Intensified Simulated Alternating Test (ISAT) for avionics components.

D. Artificial ageing to simulate calendar life for mechanical equipment.

E. Endurance testing of artificial aged components for simulated service life.

F. 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.

G. Field experiences on flight incidences and accident at times indicate requirement of reduction of life. The life of Air System and Airborne Stores are therefore periodically reviewed by lifing committee headed by CEMILAC with design agency, Government Inspection agency and User as members.

iii. Rubber Seals and Hoses

A. The life of rubber based components is fixed after carrying out artificial ageing and measuring the ageing co-efficient for the various samples. CEMILAC directive CEMILAC/5390/AW/C/T/4/DIRECTIVES dated 18th June 2015 may be referred.

B. 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. Further, 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 the case of 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.

Intentionally Left Blank

SUBPART P
FLIGHT TESTING OF AIR SYSTEMS AND AIRBORNE STORES

RATIONALE

Flight testing of an unproven ab-initio designed and developed Air System or an embodiment by way of modification, upgrades on an existing Air System or production acceptance or post-scheduled maintenance, for system design validation, performance, repeatability, robustness and safety are vital inputs to airworthiness and certification.

Flight testing is a high risk activity and therefore it has to be performed in a judicious and a systematic manner only by competent professionals, taking into account all the necessary processes, procedures and clearances from the competent authorities, for safe testing within the prescribed boundaries of operation.

Intentionally Left Blank

CONTENTS

21.P.1	**Applicability**	**P-5**
21.P.2	**Flight Testing Platform**	**P-5**
21.P.3	**Flight Testing Agency**	**P-6**
21.P.4	**Flight Testing Personnel**	**P-7**
21.P.5	**Air and Ground space for Flight Testing**	**P-8**
21.P.6	**Flight Test Specification**	**P-9**
21.P.7	**Flight Test Plan**	**P-9**
21.P.8	**Flight Test Schedule**	**P-10**
21.P.9	**Flight Test Instrumentation**	**P-10**
21.P.10	**Flight Clearance for Ab-initio Developed Air Systems**	**P-11**
21.P.11	**Flight Clearance for In-service Air Systems**	**P-13**
21.P.12	**Flight Clearance for Production Air Systems**	**P-15**
21.P.13	**Block Clearance (Block FPCM)**	**P-15**
21.P.14	**Flight Test Report**	**P-16**

Intentionally Left Blank

21.P.1 APPLICABILITY

REGULATION

This Subpart is applicable for the flight testing of Air Systems 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 ALMs and Engines

   iii. Flight testing of Airborne Stores

   iv. Flight testing of new production Air System which is indigenously developed or licence built

   v. Flight testing of Aircraft & UAS for customer acceptance

   vi. Flight testing of Service Aircraft & UAS after modifications and upgrades

   vii. Flight testing after maintenance/overhaul activities

b. Subpart is also applicable for flying the Aircraft/UAS to an exhibition/show and participation during exhibition/show, before the issue of RMTC/MTC.

c. Ferry flights of ab-initio design and developed Aircraft/UAS to another location for undertaking specific trials before the issue of RMTC/MTC.

GUIDANCE MATERIAL

a. Flight testing of an unproven ab-initio design or a design embodiment by way of modification, upgrades & maintenance, needs to be undertaken in a cautious and a systematic manner.

b. Flight test demonstration for system design validation, performance, repeatability, robustness and safety are vital inputs to airworthiness and certification.

21.P.2 FLIGHT TESTING PLATFORM

REGULATION

Flight testing shall be carried out on an aircraft/UAS registered under Indian Military Register with the User Services or on an Air System which has been issued with a Military Tail Number.

ACCEPTABLE MEANS OF COMPLIANCE

a. All test Aircraft/UAS 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.

b. The tail number of the flight test platform for the flight testing of a modification/ upgrade of an existing in-service Air System shall be allotted by the Service HQ. Letter of allotment to be provided to TAA.

c. If flight testing platform is having a civil tail number, then necessary concurrence from DGCA shall be obtained for undertaking flight testing activities.

GUIDANCE MATERIAL

a. In cases of concurrent flight testing of Air Systems for both Civil and Military applications, necessary MoU should be arrived at between the respective divisions of DGCA and TAAs.

b. In case of flight testing of research Air Systems for military applications, the registration/tail number shall be obtained from relevant branch of User Services or from an authorised agency approved by Govt. of India.

21.P.3 FLIGHT TESTING AGENCY

REGULATION

Flight testing of military Air Systems shall be conducted only by authorised Flight Testing Agencies.

ACCEPTABLE MEANS OF COMPLIANCE

a. The flight test department of the Main Contractor or Services HQ authorized flight testing agency are authorised for the flight testing of ab-initio designed Air Systems and Airborne Stores.

b. For flight testing of modifications/upgrades of in-service aircraft, respective Service HQ shall designate the flight testing agency through task directive. A copy of the task directive shall be forwarded to TAAs.

c. The authorised flight test department of the Main Contractor/licencee shall undertake production acceptance flight tests and post maintenance/overhaul flight tests.

d. For User Evaluation Trials (UET) of an ab-initio developed/modified/upgraded Air System, Service HQ shall designate the flight test agency. The Chief Test Pilot (CTP) of the flight test agency / Service HQ shall authorise the flight evaluation crew.

e. CTP of the flight test agency shall be responsible for flight testing and safety of the Aircraft /UAV during flight testing.

f. It may be necessary for certain system development agencies to carry out specific flight tests in context of their development work. The design agency/User Services responsible for the aircraft serving as the Flying Test Bed (FTB) shall seek concurrence from CEMILAC for the modification towards the integration of the system and flight clearance for conducting flight trials. CEMILAC shall mandatorily examine safety of flight and performance issues. For carrying out a particular flight, the certificate of safety for flight (F-1090) is to be issued by DGAQA, if the QA coverage is provided by them.

GUIDANCE MATERIAL

a. In some cases, for preliminary evaluation of a particular modification or upgrade on an in-service Air System, the flight test agency of the Main Contractor/licencee may also undertake flight testing, with due authorization from the Service HQ.

b. Maintenance organisations of the respective User Services may be associated during flight testing as and when necessary.

21.P.4 FLIGHT TESTING PERSONNEL

REGULATION

Flight Testing of Military Air Systems shall be conducted only by authorised flight testing personnel.

ACCEPTABLE MEANS OF COMPLIANCE

a. Flight test crew, Test Pilot and the Flight Test Engineer shall be a graduate of a recognized Test Pilot School or shall have undergone a suitable course on flight testing of UAS for undertaking developmental, experimental or production flight testing. Flight testing after production or overhaul may also be undertaken by a pilot who has undergone production flight test course at a recognised Test Pilots School and qualified on the particular aircraft/ UAS type.

b. The Chief Test Pilot (CTP)/Head of the flight testing agency and the Flight Test Crew authorized by them are the responsible personnel to undertake the flight testing of an ab-initio developed Air System or modified/upgraded in-service Air System.

c. For flight testing of ab-initio developed Air System, the name and the signature of the crew shall be filled in Form 1090 before taking custody of the Air System for Flight trials. However while handing over the Air System from the Main Contractor to the User Services, that will fly under Form 1090, the User Services shall provide the authorization details of the flight crew to DGAQA.

GUIDANCE MATERIAL

a. Flight testing an ab-initio Air System with non-flight test crew for demonstration purposes is permitted under the following conditions.

   i. The CTP/Head of the flight testing agency shall authorise such personnel to undertake the sortie.

   ii. The Air System shall be flown by authorised flight testing personnel only.

b. For joint development flight testing with User Service pilots, the CTP of Main Contractor/Head of Flight Test Agency shall authorise the flight test crew of the User Services.

21.P.5 AIR AND GROUND SPACE FOR FLIGHT TESTING

REGULATION

Flight testing of military Air Systems shall be conducted only within designated Air and Ground space.

ACCEPTABLE MEANS OF COMPLIANCE

a. The flight test agency is responsible for seeking the air space clearance from the competent authorities to undertake flight testing.

b. For flight testing of ab-initio developed Air System, the Main Contractor shall liaise with the proprietor of the ground space/ship space to ensure the serviceability of the runway/deck, and the arrestor barrier system/arrestor recovery system, etc. (as necessary) before undertaking flight testing. This responsibility shall be with the User for flight testing of in-service Air System for modifications/upgrades on a User Services owned ground space.

GUIDANCE MATERIAL

All associated aspects of safety, external to the Air System, to carry out safe flight testing of an unproven platform or an unproven upgrade needs to be ensured.

21.P.6 FLIGHT TEST SPECIFICATION

REGULATION

A Flight Test Specification document capturing the flight test demonstration requirements to be prepared jointly by the Main Contractor, flight test agency , CEMILAC and approved by CEMILAC.

ACCEPTABLE MEANS OF COMPLIANCE

a. The document shall contain subsystem/system and platform level flight test demonstration requirements.

b. For ab-initio developed Air System, this document shall be prepared by the Main Contractor in consultation with the flight test Agency and CEMILAC.

c. For in-service Air System undergoing modification/upgrade by a Main Contractor, this document shall be prepared by the Main contractor in consultation with the authorised flight test agency and CEMILAC.

GUIDANCE MATERIAL

a. The Main Contractor may arrange for committee/meetings with all the stakeholders to arrive at the requirements.

b. The tests of subsystem/system that cannot be performed on ground tests rigs, shall be flight tested after due deliberation that flight safety is not compromised.

21.P.7 FLIGHT TEST PLAN

REGULATION

A Flight Test Plan document shall be prepared for important phases of flight by the flight test agency in consultation with the Main Contractor.

ACCEPTABLE MEANS OF COMPLIANCE

The flight test plan shall contain the objectives and other information as necessary for planning a phase of flight tests, based on approved flight test specification.

GUIDANCE MATERIAL

a. The flight test plan may be phase wise/ block wise or trial wise.

b. The flight test agency may choose to arrange for discussions with concerned stakeholders, in arriving at the flight test plan.

21.P.8 FLIGHT TEST SCHEDULE

REGULATION

A Flight Test Schedule capturing the flight test points for the individual sortie shall be prepared by the flight test agency.

ACCEPTABLE MEANS OF COMPLIANCE

a. The flight test schedule of the individual development flight test sorties shall be in accordance with the overall flight test specifications and the objectives of the flight test plan.

b. The schedule may also contain the applicable safety related operational aspects the flight crew needs to know.

GUIDANCE MATERIAL

a. The schedule is to be prepared within the cleared FCC limits.

b. Flight test agency may adopt a mechanism for mapping of the flight test points with the flight test specification.

21.P.9 FLIGHT TEST INSTRUMENTATION

REGULATION

Necessary clearance shall be obtained for the Flight Test Instrumentation (FTI) plan prior to flight testing.

ACCEPTABLE MEANS OF COMPLIANCE

a. FTI shall be implemented depending on the criticality of the flight test objective.

b. For ab-initio designed Air System,

   i. The Main Contractor in consultation with the flight test agency is responsible for ensuring that the platform is adequately instrumented as per the agreed instrumentation scheme including all On-board Flight Test Instrumentation LRUS.

   ii. FTI Scheme may be arrived at in consultation with CEMILAC.

   iii. The Main Contractor in consultation with the flight test agency, shall be responsible for ground telemetry system.

c. For in-service Air System evaluated for the modification/upgrades.

i. The Main Contractor/ flight test agency of the User Services, as applicable, is responsible for ensuring that the platform is adequately instrumented depending on the criticality of the modification.

ii. If the User Services is responsible for the Flight test instrumentation then the instrumentation scheme shall be approved by CRPO for the IAF/ equivalent authority for Indian Army and Indian Navy.

d. Flight Data Recorders/Crash Data Recorder shall be installed during development trials of new Air Systems or major modifications affecting safety of Air System. This is in addition to the instrumentation and special recorder required for the evaluation of the Air System/Airborne Stores. The details of the essential parameters to be recorded by the FDRs/CDRs should be finalised by Main Contractor in consultation with flight test agency and CEMILAC.

GUIDANCE MATERIAL

a. The term 'instrumentation' in this regulation refers to all items which are fitted temporarily on an Air System specifically for carrying out flight trials and which will be subsequently removed.

b. Instrumentation is often required for the flight trials of new types of Air Systems or an Air System incorporating major modifications, to facilitate the gathering of trial data.

c. Airborne Stores/components, which may subsequently become a part of the Air System shall not be considered as an FTI.

d. Depending on the criticality of the modification/upgrade, the nature and the extent of instrumentation may be arrived at, in consultation with CEMILAC.

e. The clearance of Flight test instrumentation LRUs on the aircraft will be based on COC provided by the vendor. The Flight Test directorate of the Main Contractor will be solely responsible for the technical and functional specifications of the FTI LRUs. FTI LRUs will be installed on the aircraft based on Flight Test Directorate's functional testing report and COC provided by the vendor.

f. The Flight test directorate of the main contractor will be responsible for setting up the complimentary telemetry ground station.

21.P.10 FLIGHT CLEARANCE FOR AB-INITIO DEVELOPED AIR SYSTEMS

REGULATION

Flight testing of ab-initio and upgraded Air System shall be authorised only after necessary clearances are issued by the Technical Airworthiness Authorities (TAA).

ACCEPTABLE MEANS OF COMPLIANCE

a. This regulation shall be applied when the ab-initio developed or upgraded Air System is held in the inventory of the Main Contractor and the flight testing is carried out by the flight test agency of Main Contractor or Service HQ authorised flight test agency.

b. User Evaluation Trials (UET) by the authorised flight test agency of User Services either independently or as a joint exercise along with the flight test agency, while the design clearances are still not issued, shall also follow this regulation.

c. The QA of the Main Contractor shall ensure that all the Airborne Stores and associated equipment installed in the Air Systems holds necessary clearances/approvals from competent authorities.

d. Ground integration tests of the Air System, as per CEMILAC approved test plan shall be completed and a comprehensive Work Done Report shall be prepared by the Main Contractor in co-ordination with DGAQA.

e. Flight testing of the Airborne Store to validate its design, functionality and integration aspects shall be cleared by CEMILAC through a Development Flight Clearance (DFC) for the Airborne Store (Regulation 21.C1.22).

f. For development flight testing of Air System, CEMILAC shall issue Certificate of Flight Trials in the form of Flight Clearance Certificate (FCC). FCC shall be issued based on satisfactory Ground Test report(s).

g. The Flight Clearance Certificate (FCC) shall be prepared by the Main Contractor in consultation with CEMILAC and shall be jointly approved by the Chief of Design of the Main Contractor and CEMILAC.

h. FCC shall be amended whenever significant configuration changes to the Air System is carried out. Minor changes in limitations or any of the conditions for clearance, that do not affect safety, flight test planning or its execution may be addressed through FPCM. Necessary tests to validate the configuration changes to be carried out in coordination with DGAQA.

i The Air System shall be prepared for flight in accordance with the configuration requirements (store configuration, hardware/ software versions of important LRUs, fuel etc.) provided by the flight test agency, in the form of a flying program or any other document.

j Based on the DGAQA coordinated Work done report including snag disposition details and data analysis of the previous sortie, the flight clearance shall be issued by CEMILAC through the Flight Program Clearance Memo (FPCM). However, in exceptional cases, if data analysis is not possible before the next sortie, it must be completed by the end of the day and next sortie may be cleared based on Pilot debrief. The FPCM shall be prepared by the Main Contractor and approved by CEMILAC.

k. DGAQA shall issue Certificate of Safety for Flight through Form 1090 for undertaking the flight based on the approval of FPCM by CEMILAC.

l. Certificate of safety for flight Form 1090 is valid for 24 hours. If flight has not happened on the day of issue of Form 1090, it is permitted for re-validation of F-1090 on the following day by DGAQA approved inspector after Daily Inspection.

m. Flight testing by customer's pilots at the Main Contractor's workplace for the purpose of acceptance and delivery of aircraft and ferrying to customer's place, will be covered under F-1090 issued by DGAQA.

n. If, as a result of an accident or any untoward incident, CEMILAC considers that it would be prudent to restrict further trials pending further investigation, CEMILAC will advise, Service Head Quarters, DGAQA and Main Contractor that the current FCC for Flight Trials is temporarily withdrawn.

GUIDANCE MATERIAL

a. A copy of the Flight Clearance Certificate (FCC) & FPCM shall be forwarded to DGAQA, Main contractor and the Flight Test Agency.

b. Generally FCC should be amended wherever there is a change to its contents. However, in certain cases, where FCC amendment for a minor change in the aircraft build is not warranted/feasible, configuration changes and any associated limitations thereof may be endorsed on the FPCM by CEMILAC.

c. Flight data analysis/ debrief required to confirm airworthiness of the air system is to be completed before the next flight. However, in exceptional cases, if data analysis is not possible before the next sortie, it must be completed by the end of the day and next sortie may be cleared based on Pilot debrief. CEMILAC may participate in flight data debriefs.

d. DGAQA coordinated Work Done Report (WDR) including technical snags and their disposition details on the air system since the previous activity, shall be coordinated by DGAQA and forwarded to CEMILAC by the Main Contractor for the clearance of FPCM. The same shall also be forwarded to the Flight Test Agency for flight test preparation.

e. The FCC issued by CEMILAC, the Work Done Report signed by DGAQA (ensuring the inspection, snag disposition and Air System readiness) Flight data analysis of the previous sortie, forms the basis for FPCM clearance by CEMILAC.

21.P.11 FLIGHT CLEARANCE FOR IN-SERVICE AIR SYSTEMS

REGULATION

Flight testing of modified/upgraded Air System shall be authorised only after necessary clearances are issued by the Technical Airworthiness Authorities.

ACCEPTABLE MEANS OF COMPLIANCE

a. This regulation shall be applied when the Air System is held in the inventory of User Services and the flight testing is carried out by User Services or flight test agency of the User Services. However, if the modification/upgradation is done by Main Contractor, applicable provisions given in regulation 21.P.10 shall apply.

b. For the flight testing of an Airborne Store for its performance evaluation, the store shall hold a Development Flight Clearance (DFC) from CEMILAC prior to obtaining the flight clearance for the Air System (Regulation 21.C1.22).

c. CEMILAC shall issue the Certificate of Flight trials in the form of Flight Clearance Certificate (FCC) for the Air System for the flight evaluation of trial modification/ upgrades.

d. If the QA coverage for the Air System is provided by DGAQA, certificate for safety of flight, Form 1090 for each sorties under development trial, shall be issued by DGAQA .

e. For other Air Systems, the updated and approved Form 700 or equivalent Clearance, by the competent authority of User Services shall be the basis for undertaking each sorties.

f. Clearance for flight trial evaluation of minor mods carried out by the User Services may be accorded by CRPO/designated competent authority within the respective User Services.

g. Flight test clearance of certain airborne stores for demonstrations/ NC-NC projects/ Op-Capability enhancement requirements/Fast track procurements may be accorded by CRPO for the IAF/equivalent for Indian Army and Indian Navy for a limited flight envelope. However, if such activities are resulting in fleet modifications, then necessary clearance shall be obtained from CEMILAC by providing requisite data.

h. If the modification/upgradation of Air System is carried out by a third party other than the OEM, and if the QA coverage for the Air System is provided by DGAQA, certificate for safety of flight, Form 1090 for each sorties under development trial, shall be issued by DGAQA based on FPCM approved by CEMILAC.

GUIDANCE MATERIAL

a. Necessity of the issuance of FCC, FPCM and F-1090 shall be discussed and finalised between CEMILAC, DGAQA and flight test agencies/User Services.

b. If there are no design changes in the Air System for the integration of the Airborne Store under evaluation, and if the Air System is still under the inventory of User Services/flown under Form 700 or equivalent, flight trials may be undertaken by the Services based on the issue of DFC for the Airborne Store.

21.P.12 Flight Clearance for Production Air Systems

Regulation

Flight testing of Air System during regular production, overhaul or repair shall be authorised only after necessary clearances are issued by DGAQA.

Acceptable Means of Compliance

a. Each production/overhaul/repair 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. For production acceptance test by the flight test agency of the Main Contractor the certificate of safety for flight, F-1090 is issued by DGAQA on completion of necessary acceptance checks.

c. For ferrying the Air System to User bases, DGAQA shall issue a safety of flight certificate, F-1090 for ferry flights.

Guidance Material

Production flight testing shall be carried out by qualified test crew having necessary clearance for such activities.

21.P.13 Block Clearance (Block FPCM)

Regulation

A block clearance in the form of block FPCM may be authorized whenever CEMILAC's clearance for each flight is not considered necessary.

Acceptable Means of Compliance

a. Limits specified in the cleared FCC shall be adhered to when undertaking flight testing under block clearance.

b. Block FPCM shall be issued only for mature Air Systems, where sufficient confidence has been gained on airworthiness of the Air System, in general.

c. Block clearance is valid only if,

   i. There are no changes to the cleared build standard, flight envelopes of the Air System

ii. Detailed data analysis is completed for each sortie, and there are no major negative fallout or technical snags or deviations from the expected results. However, in exceptional cases, if data analysis is not possible before the next sortie, it must be completed by the end of the day and next sortie may be cleared based on Pilot debrief.

d. For In-service Air System evaluation of modifications/upgrades,

i. The block FPCM will be based on the criticality and nature of the upgrade.

ii. In some cases, block FPCM may be authorised after satisfactory preliminary flight evaluation of the upgrade integrity.

e. If the QA coverage for the Air System is provided by DGAQA, Certificate for Safety of flight, Form 1090 for each sortie under development trial, shall be issued by DGAQA. For in Service Air Systems, Form 700 or equivalent Clearance, by the competent authority of User Services shall be the basis for undertaking each sortie.

f. CEMILAC shall be informed of any minor snags or defects that occur during Block FPCM phase by the Main Contractor or by DGAQA.

g. The block FPCM can be reviewed and revalidated or withdrawn, if necessary in case of appearance of snags / defects affecting flight safety or changes in build standard / SOP, provided the same is brought to the notice of CEMILAC. However, the block FPCM shall stand cancelled if there is violation of the FCC or appearance of snags / defects affecting flight safety or change in the build standard / SOP which is not brought to the notice of CEMILAC.

GUIDANCE MATERIAL

a. An ab-initio designed Air System may be issued block FPCM after gaining sufficient confidence in the satisfactory systems performance and overall Air System safety. The Main Contractor in consultation with the Flight test agency shall provide documented information/ data/analysis as deemed necessary by CEMILAC for the issuance of block FPCM.

b. Exceptional cases where clearance is based on pilot debrief shall be decided by the Main Contractor in consultation with CTP/Head of Flight Test Agency.

21.P.14 FLIGHT TEST REPORT

REGULATION

Flight Test Reports endorsed by the competent authority shall be submitted to CEMILAC.

ACCEPTABLE MEANS OF COMPLIANCE

a. For flight testing of ab-initio developed Air System,

   i. Flight test reports after a block of flights or after completion of a milestone activity shall be prepared by the Main Contractor in consultation with flight test agency and forwarded to CEMILAC.

   ii. If the flight test agency is responsible for the preparation of the flight test report, a copy of the report shall be forwarded to CEMILAC.

b. For flight testing of in-service Air System for upgrade evaluation,

   i. Flight evaluation trial reports at the conclusion of every stage of evaluation and a consolidated report after the completion of the evaluation, prepared by the flight testing agency and co-ordinated by Service HQ shall be forwarded to CEMILAC.

GUIDANCE MATERIAL

a. The report shall clearly bring out the outcome of the flight testing as against the objectives of the flight test specifications and the flight test schedule.

b. The Main Contractor may provide any additional flight test analysis\data as requested by CEMILAC.

Intentionally Left Blank

SUBPART Q
IDENTIFICATION OF AIR SYSTEMS AND AIRBORNE STORES

RATIONALE

Identification of Air Systems and Airborne Stores is important for configuration control, interchangeability and traceability requirements. Proper identification helps not only in safety and operations but also provides economic benefits.

Intentionally Left Blank

CONTENTS

21.Q.1 Identification of Air Systems----------Q-5
21.Q.2 Handling of Identification Data ----------Q-5
21.Q.3 Identification of Airborne Stores----------Q-6
21.Q.4 Identification of IMATSOA Article----------Q-7
21.Q.5 Identification of indigenous Test rigs and TTGE ---------Q-7

Intentionally Left Blank

21.Q.1 IDENTIFICATION OF AIR SYSTEMS

REGULATION

The identification of Air System shall be unique and shall include the specific information like Type/Part Number, Product designation, Manufacturer's name and the Manufacturer's Serial Number, Month and Year of manufacture and/or Tail No. and any other information found appropriate.

ACCEPTABLE MEANS OF COMPLIANCE

a. The organisation that manufactures an Air System should identify the 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 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

a. Following conventions may be used:

   i. Aircraft/UAS –Type/Part No. & Manufacturer Serial Number.

   ii. Engine/ALM Part No & Sl. No.

b. Tail No. shall be issued by authorised agency.

21.Q.2 HANDLING OF IDENTIFICATION DATA

REGULATION

Only approved Design, Production or Maintenance Organisations, or Military Services shall place, remove or change identification information on any Air System.

ACCEPTABLE MEANS OF COMPLIANCE

a. Any organisation performing maintenance work can remove, change, or place identification information only in accordance with methods, techniques and practices identified along with TAA.

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

REGULATION

Each Airborne Store shall be uniquely identified and permanently & legibly marked in accordance with the applicable identification data.

ACCEPTABLE MEANS OF COMPLIANCE

a. The organisation 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., Date of manufature, Software/ CEH 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 an Airborne 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. Alternately, a mechanism to record the details of the sub-assemblies shall be established with the approval of 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

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 Air Systems or Airborne Stores.

21.Q.4 IDENTIFICATION OF IMATSOA ARTICLE

REGULATION

Each IMATSOA article shall have unique identification.

ACCEPTABLE MEANS OF COMPLIANCE

a. Each holder of an IMATSO authorisation under Subpart 21.C5 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 IMATSO 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

21.Q.5 IDENTIFICATION OF INDIGENOUS TEST RIGS AND TTGE

REGULATION

The identification shall be unique and shall include the specific information of development agency, Manufacturer's name/code, Product designation, Type/Part No and the Manufacturer's Serial Number, date of manufacture and any other information found appropriate.

ACCEPTABLE MEANS OF COMPLIANCE

a. Any organisation that manufactures a test rigs and TTGE should identify that test rigs and TTGEs by means of a plate that has the information specified marked on it by etching, stamping, engraving, or other approved method of marking.

b. The identification plate shall have necessary provisions to identify the current configuration such as Mod No./Modification Status, if any.

c. The identification plate should be placed 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.

GUIDANCE MATERIAL

The indigenous test rigs and TTGEs are identified with OEM part number followed by suffix letter 'I'.

SUBPART R
CIVIL CERTIFIED MILITARY AIR SYSTEMS

RATIONALE

New Indian Military Air Systems that are intended to be operated on the Indian Military Aircraft Register in the Service Environment shall be certified prior to their Release to Service. This regulation shall be followed if the Air System is a derivative of Civil Certified version. It shall be ensured that the certified version of Air System or its modified version shall comply with the User requirements and Indian airworthiness regulations.

Intentionally Left Blank

CONTENTS

21.R.1 User Requirements---------- R-5
21.R.2 Certification Basis---------- R-7
21.R.3 Certification Program---------- R-8
21.R.4 Compliance to Airworthiness Certification Criteria----- R-9
21.R.5 Continuing Airworthiness---------- R-10
21.R.6 Modifications----------R-11

Intentionally Left Blank

21.R.1 User Requirements

Regulation

Users shall finalise the Qualitative Requirements for the Air System to be acquired in the form of Request for Proposal (RFP). TAA shall be consulted to finalise 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 Air System without any modifications.

   ii. Procurement of Civil Certified Air System with modifications/ up-gradations by OEM to suite the requirements of Indian Services.

   iii. Procurement of Civil Certified Air System with/without modifications by OEM followed by modifications /up-gradations in India before operational use.

   iv. Procurement of Civil Certified Air System with licence production/TOT for subsequent manufacturing in India.

   v. Procurement of Civil Certified Air System / Airborne Stores developed by Indian Firms.

Guidance Material

a. The User shall finalise the requirements to meet the operational requirements. However, the certification requirements shall be explicitly brought in the requirements and CEMILAC & DGAQA shall be signatories to the same.

b. Any details required for future modifications/upgrade shall be in accordance with Subpart N. The modifications/up-gradations in India shall be certified in accordance with Subpart D.

c. The procurement may be classified into one of the following categories:

   i. Procurement of a Civil Certified Air System without any modifications.

   If the Air System 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 Air System shall be accepted by the User without any further certification process, provided the following conditions are met with.

   A. The Civil Certification Agency of the country of origin is recognized by the Indian counterpart.

   B. The Air System Type shall hold a Type Certificate (TC) or Amended TC or Supplemental TC or equivalent.

C. The individual Air Systems by Serial Number are delivered with a Certificate of Airworthiness from the Country of origin.

D. There are no changes in the operational limits from the certified configuration.

E. No modifications to the certified configurations.

ii. Procurement of Civil Certified Air System with modifications/ up-gradations by OEM.

If the Air System to be procured is a modified or up-graded version of a Civil Certified version from the country of origin, the Air System shall be accepted by the User through any of the following routes:

A. The modifications/up-gradations shall be certified by the Civil/ Military Certification Authority of the country of origin. An Amended/ Supplemental TC or equivalent shall be issued with.

B. The Civil/Military Certification Authority of the country of origin is recognized by the Indian counterpart.

C. In case the Civil/Military Certification Authority of the country of origin is not certifying the modifications/up-gradations, Indian TAA shall be approached for certification.

iii. Procurement of Civil Certified Air System with/without modifications followed by modifications /up-gradations in India.

A. The conditions mentioned in para a and (or) b above shall be met with.

B. The Indian design agency involved in modifications /up-gradations in India shall be identified with.

C. Subsequent modifications carried out in India shall be certified by the Indian TAA.

D. 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 of Civil Certified Air System with license production/ TOT for subsequent manufacturing in India, provisions mentioned in Subpart F for production under license agreement, shall be followed.

v. In case of procurement of Civil Certified Air System/Airborne Stores developed by Indian Firms, provisions mentioned in relevant subparts in Subpart B and C shall be followed.

21.R.2 CERTIFICATION BASIS

REGULATION

The TAA shall ensure the use of applicable Airworthiness Certification Criteria as a standard means to show compliance of products, parts and appliances with the essential requirements in RFP. Such certification criteria shall be sufficiently detailed and shall be specific to indicate the conditions under which the Air Systems will be accepted.

ACCEPTABLE MEANS OF COMPLIANCE

a. Procurement of a Civil Certified Air System 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 Air System shall hold a valid Type Certificate (TC), Amended TC or Supplemental TC (STC) from certification agency of the country of origin or from a certification agency recognized by DGCA/FAA/ EASA.

   iii. Such Air Systems shall be registered with Indian Military Services without any further certification.

b. Procurement of Civil Certified Air System with modifications/up-gradations by OEM:

   i. The Civil Certification Authority of the country of origin shall be recognized by the DGCA/FAA/EASA.

   ii. The Air System shall hold a valid Type Certificate (TC), Amended TC or Supplemental TC (STC) from Certification Authority 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 and etc. shall be acceptable certification regulations/certification criteria.

   iv. Such Air Systems shall be registered with Indian Military Services without any further certification if an STC is issued at the country of origin. Otherwise, CEMILAC may issue an SMTC after following the due certification process.

c. Procurement of Civil Certified Air System with/without modifications by OEM and subsequent modifications /up-gradations in India:

   i. The Civil Certification Authority of the country of origin shall be recognized by the DGCA/FAA/EASA.

   ii. The Air System shall hold a valid Type Certificate (TC), Amended TC or Supplemental TC (STC) from Certification Authority 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. Indian TAA shall provide the airworthiness certification coverage for any military modification carried out in India.

GUIDANCE MATERIAL

a. FAR 21/CAR 21 /CS 21 or its equivalent regulations prevailing in the country of origin shall be the default basis for certification.

b. FAR, MIL STD, DEF STAN or equivalent civil/military codes /regulations are acceptable certification criteria.

c. Any proposed alternative Airworthiness Certification Criteria shall 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 Certification Criteria.

ACCEPTABLE MEANS OF COMPLIANCE

A Certification Program shall describe the certification process in each of the 3 categories mentioned at 21.R.2 above.

a. Procurement of a Civil Certified Air System without any modifications

i. If the Air System 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 Air System shall be accepted by the User without any further certification process. No specific Certification Program is required.

b. Procurement of Civil Certified Air System with Modifications/ up-gradations by OEM

i. If the Air System 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:

A. In case the Civil/Military Certification Authority of the country of origin is the certifying agency, a certification plan in consultation with the authority shall be finalised.

B. 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/ Subpart E, depending on the scope of activities.

c. Procurement of Civil Certified Air System 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, Subpart C, Subpart D & Subpart E, depending on the scope of activities.

iii. The Indian agency, which is carrying out the modifications and upgradations shall have necessary organisation approvals as mandated in Subpart B, Subpart C, Subpart D & Subpart E.

GUIDANCE MATERIAL

a. FAR 21/CAR 21 or its equivalent regulations prevailing in the country of origin shall be the default basis for certification.

b. FAR, MIL-STD, DEF STAN or equivalent civil/military certification criteria/ regulations are acceptable certification codes.

c. Airworthiness Certification Criteria detailed in Subpart B and Subpart C also shall be used in applicable cases.

d. Any proposed alternative Airworthiness Certification Criteria 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 CERTIFICATION CRITERIA

REGULATION

The TAA shall ensure that the Aircraft is certified to approved Airworthiness Certification Criteria

ACCEPTABLE MEANS OF COMPLIANCE

a. User Services in consultation with the OEM of the Air Systems and TAA shall finalise an acceptance program where the compliance to applicable airworthiness certification criteria as finalized in the certification program shall be checked for.

b. Any additional testing required to ensure such compliance shall also be included.

c. In case the Indian TAA is providing the certification coverage, on satisfactory completion of these activities, an application to Supplemental Type Certificate (STC) shall be generated by the OEM in accordance with Subpart D and submitted to CEMILAC.

GUIDANCE MATERIAL

a. FAR or equivalent civil regulations prevailing in the country of origin shall be the default airworthiness code.

b. Any proposed alternative Airworthiness Certification Criteria 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 Air Systems shall be the responsibility of the User Services

ACCEPTABLE MEANS OF COMPLIANCE

a. The Air Systems 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 Air Systems 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 shall be approved by OEM and respective certification agencies.

b. Operating instructions shall be released by OEM as well as User Services.

21.R.6 MODIFICATIONS

REGULATION

Modifications carried out on the Air Systems 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 Air System 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 Subpart 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 Air System, 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. Subpart D & Subpart E.

b. Service Bulletins and Instructions by the OEM.

Intentionally Left Blank

SUBPART S
CUSTOMER FURNISHED EQUIPMENT AND CUSTOMER SPECIFIED EQUIPMENT

RATIONALE

The User Services may prefer on using an Airborne Store specified by them. Such Airborne Store may already be held in their inventory or may be procured by them directly and furnished for installation on Air Systems. Such type of Airborne Stores are identified as Customer Furnished Equipment (CFE). In some cases, Services may specify certain Airborne Stores to Air System integrator to be installed on Air Systems to meet their specific operational requirements or to have commonality with other platforms in their inventory. Such Airborne Stores are identified as Customer Specified Equipment (CSE).

There may be instance when, additional equipment have to be procured by the Air System integrator, so as to ensure performance of the CFE/CSE by the Services. The details of additional equipment may not be specified by the User Services at the time of contract with the Air System integrator. If these additional equipment are 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 Air System is not compromised with the installation of CFE/CSE.

Intentionally Left Blank

CONTENTS

21.S.1 Customer Furnished Equipment (CFE)---------- S-5
21.S.2 Customer Specified Equipment (CSE)---------- S-6
21.S.3 Transfer of Technology (ToT) for Manufacturing-------- S-7
21.S.4 Continued Airworthiness ---------- S-8

Intentionally Left Blank

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, Air System integrator & TAA.

ACCEPTABLE MEANS OF COMPLIANCE

a. For CFEs, already held in Services inventory as a part of their earlier Air System installation, TAA shall ensure that the operational envelope requirements of the intended Air System are adequately met. In case of some mismatch in operational envelope requirements of earlier Air System installation and intended Air System 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 Air System necessary for ensuring integrity and safety after integration onto the Air System.

c. The Air System integrator in consultation with TAA shall carry out necessary analysis and tests to demonstrate that the installation of CFEs doesn't affect the safety and performance of the Air System.

d. If any design changes are implemented to make the equipment suitable for Air System 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 Air System integrator should evaluate the equipment and bring out the shortfalls if any, in terms of functional, performance, environment parameters, life of the equipment and their effect on the Air Systems where such equipment are used.

f. The Air System integrator should inform the TAAs as well as concerned Service HQ of any shortfalls 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 is supplied by the OEM of bought out Air Systems, so as to address obsolescence or to increase operation capability, Air System OEM may integrate new equipment/replace an equipment /or through some authorised Air System integrator (authorised by Air System OEM). Certification of equipment & its integration will

be the responsibility of Air System 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/Air System 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

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 Air System integrator, User & TAA shall ensure the safety, performance, reliability and life of those equipment which are specified by the User Services for fitment on Air System.

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 Air System necessary for ensuring integrity and safety after integration onto the Air System.

c. The User Services, Air System integrator & TAA should verify that safety and performance parameters of the Air System are not affected by the installation of such equipment.

d. If any design changes are implemented to make the equipment suitable for Air System 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 defined format 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 Air System are adequately met. In case of any deficiency, TAA will specify for additional qualification testing. User Services are responsible for ensuring qualification independently or through integrator/OEM according to platform requirements as stipulated by TAA.

f. The Air System 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 Air System.

g. The Air System integrator should however evaluate the equipment and bring out the shortfalls if any, in terms of functional, performance, environment parameters and the life of the equipment and their effect on the Air Systems or systems where such equipment are used.

h. The Air System integrator should inform the TAA as well as concerned Service HQ of any shortfalls 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.

GUIDANCE MATERIAL

a. The term Buyer Nominated Equipment (BNE) is also used in some cases to identify CSE.

b. 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 CFE/CSE are manufactured under license in India.

ACCEPTABLE MEANS OF COMPLIANCE

a. Production under license agreement shall be carried out as per Subpart F.

b. The items produced under license agreement shall also be treated as CFE and CSE.

GUIDANCE MATERIAL

Nil

21.S.4 CONTINUED AIRWORTHINESS

REGULATION

User Services shall be responsible for the continued airworthiness of the CFE. For CSE, User Services, Air System integrator & TAA (where design details are shared by equipment OEM) are responsible for continued airworthiness.

ACCEPTABLE MEANS OF COMPLIANCE

a. Failure Reporting, Modification, Upgradation, Maintenance, Lifing, Storage of CSE store shall be addressed by the User Services in consultation with OEM and Air System integrator.

b. For CSE items, continued airworthiness activities shall be carried out in accordance with Subpart L.

GUIDANCE MATERIAL

Nil

SUBPART T
TEST RIGS AND TOOLS, TESTERS & GROUND EQUIPMENT (TTGE)

RATIONALE

Test Rigs are the equipment / test facilities which are used for the functional & performance evaluation of Air Systems and Airborne Stores during the design, development, production and overhaul phases. 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 Air System and Airborne Stores during their operational use. Some of the TTGE may be required during development and production phases also particularly during development and production acceptance flight testing of Air Systems. Test Rigs and TTGE play a vital role in establishing the veracity of the tests performed and in maintaining the Air Systems as per the required standards. Certification of the Rigs and TTGE are therefore essential for facilitating in maintaining the airworthiness of the Air Systems and Airborne Stores

This Subpart is applicable to Test Rigs and TTGE that are required during development, production and /or to be delivered to the User Services for facilitating continuing airworthiness.

Intentionally Left Blank

CONTENTS

SUBPART T
TEST RIGS AND TOOLS, TESTERS &
GROUND EQUIPMENT (TTGE)---------- T-1

SUBPART T1
TEST RIGS----------T1-1

SUBPART T2
TOOLS, TESTERS & GROUND EQUIPMENT (TTGE) ----------T2-1

Intentionally Left Blank

SUBPART T1
TEST RIGS

RATIONALE

For the Air System development programs, Test rigs are required so that functional & performance evaluation can be carried out to demonstrate that the Air System/Airborne Store satisfactorily meets the design & safety requirements as required in Type Certification Basis/Type Approval Basis.

The approval of Test Rigs is essential so as to ensure that they are safe to use and are capable of providing the required functionality.

Intentionally Left Blank

CONTENTS

21.T1.1	**Applicability**	**T1-5**
21.T1.2	**Categorisation and Criticality Level of Test Rigs**	**T1-6**
21.T1.3	**Inclusion of Test Rig Requirements at RFP Stage**	**T1-6**
21.T1.4	**Approval Process for Test Rigs**	**T1-7**
21.T1.5	**Approval Basis**	**T1-8**
21.T1.6	**Technical Specifications**	**T1-9**
21.T1.7	**Design and Development**	**T1-10**
21.T1.8	**Test Rig Software**	**T1-11**
21.T1.9	**Fabrication of Test Rigs**	**T1-11**
21.T1.10	**Identification of Test Rigs**	**T1-12**
21.T1.11	**Qualification Testing**	**T1-12**
21.T1.12	**Documentation Requirements**	**T1-13**
21.T1.13	**Acceptance of Test Rigs for Approval**	**T1-14**
21.T1.14	**Standalone Test Rigs**	**T1-15**
21.T1.15	**Production of Test Rigs**	**T1-16**
21.T1.16	**Transfer of Technology (ToT)**	**T1-16**
21.T1.17	**Modifications/Up-gradations of Test Rigs**	**T1-17**

Intentionally Left Blank

21.T1.1 APPLICABILITY

REGULATION

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, 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 Air Systems and Airborne Stores.

b. Test rigs, as described above, which are used during production phase of Air Systems and Airborne Stores.

c. Test Rigs used during development/production phase/overhaul and further delivered to User Services.

d. Air Systems such as Flying Test Bed (FTB) used for the development flight testing of Airborne Stores shall not be considered as Test Rigs.

e. Development/indigenous substitution of Test Rigs for existing Air Systems/Airborne Stores shall also be covered under this Subpart.

f. Test Rigs set up under TOT/Licensed production shall also be covered under this Subpart.

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 Air System 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 Air System/Airborne Store, the detailed requirements regarding servicing and maintenance aspects shall be finalized in consultation with servicing development organisations of User Services such as MAG (Avn)/CSDO/NASDO etc.

c. Suitability/Validation of Jigs & Fixtures shall be ascertained during FAI activities along with DGAQA. However, no technical specification approval is required from CEMILAC.

GUIDANCE MATERIAL

NIL

21.T1.2 Categorisation and Criticality Level of Test Rigs

Regulation

Test Rigs shall be categorised depending on their role, functionality and scope of usage and their criticality level shall be arrived at based on the criticality level of the subsystem of the Air System or an Airborne Store to be tested using these test rigs.

Acceptable Means of Compliance

a. 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

b. The criticality level of the test rig used for a subsystem of an Air System or an Airborne Store shall be arrived by giving due consideration to the criticality level of such subsystem/Airborne Store.

c. The regulations given in this Subpart are applicable for the test rigs of the highest criticality level and can be tailored further by deliberations amongst all the stakeholders for their application for the test rigs of other criticality levels. Self-approvals shall be enabled by TAA during test and evaluation phase for the test rigs associated with Non-Critical airborne stores. Such tailoring aspects may be addressed in the ACP

Guidance Material

The development telemetry systems used during the development flight testing of Air Systems shall be treated as Flight Test Instrumentation.

21.T1.3 Inclusion of Test Rig Requirements at RFP Stage

Regulation

The requirements for test rigs for Air System 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 Air Systems/Airborne Stores including their Calibration/Servicing/ Maintenance requirements 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 Air Systems, 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 Air Systems/Airborne Stores.

GUIDANCE MATERIAL

Involvement of Servicing Development Organisations 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 PROCESS FOR 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/Licensor/ OEM shall normally 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 and calibration status. However, some running in tests may be required as per the ATP approved by DGAQA.

b. For the ab-inito 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 Subpart T1.2 and shall be as given below:

Type 1: Type 1 test rigs shall be 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 approved by DGAQA based on technical specifications approved by CEMILAC

Type 4: Type 4 test rigs shall be approved by DGAQA based on the Technical Specifications approved by CEMILAC. Servicing Development Organisations 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.

   i. Class 1: Test Rig permanently installed or stored in an Air System for use in flight.

   ii. Class 2: Test Rig used in the vicinity of an Air System, in tracked and wheeled vehicles

   iii. Class 3: Partially protected Test Rig

   iv. Class 4: Test Rig used in light buildings, structures and vehicles where it is protected from direct rain, sun etc.

v. Class 5: Test Rig used in permanent buildings

vi. 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. The Approval Basis (AB) for the test rigs shall be prepared by the development agency in consultation with the Main Contractor of the Air System and Airborne Stores utilising the test rig and accepted by the TAA responsible for the approval of test rig.

GUIDANCE MATERIAL

JSS 6625-01 or its equivalent document shall be the basis for environment specification and JSS 55555 or its equivalent document shall be the basis for qualification testing.

21.T1.6 TECHNICAL SPECIFICATIONS

REGULATION

The test rig development agency shall bring out the detailed technical specifications document based on the User services 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 Air System and Airborne Stores utilising the test rig.

b. For preparation of technical specifications of Type-4 test rigs, Servicing Development Organisations of User Services such as MAG (Avn) /CSDO/NASDO shall also be consulted.

c. Approval Basis (AB) identified in 21.T1.5 above shall be taken into account while preparing the technical specifications.

d. The document shall address the end use requirements and shall take into account the User requirements, if available.

e. The responsibility for the approval of technical specifications for all types of test rigs shall be with CEMILAC.

GUIDANCE MATERIAL

Guidance Material on contents of major documents for test rigs and TTGEs given at Annexure 21.T.A.

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. QAP for Type-1 test rigs may be approved by the internal QA group of the main contractor.

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, reliability 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 Air System/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 Air System or an Airborne Store shall be arrived at based on the criticality level of such subsystem/Airborne Store.

c. The test rig software shall be evaluated as per the applicable regulations given in Subpart C6.

d. 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 regulation Subpart 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 baseline configuration.

b. DGAQA shall carryout necessary inspection during fabrication of test rigs as per approved QAP or may authorise the internal QA of the development agency to carryout necessary inspection depending upon the criticality of test rig.

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.

c. The extent of qualification testing shall be arrived at based on the identified class of the Type 4 Test Rigs as per Subpart 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. Interface Control Document

c. Design Document

d. Quality Assurance Plan (QAP)

e. All applicable drawings (Part drawings, Mechanical and Electrical assembly drawings, schematics drawings, etc) including Master Drawing Index (MDI)

f. Bill of Material (BOM).

g. Qualification Test Procedure (QTP) – as applicable

h. Qualification Test Report (QTR) – as applicable

i. Acceptance Test Plan (ATP)

j. Acceptance Test Report (ATR)

k. Manuals – Test Rig User Manual/Installation Manual/Operating Manual & Maintenance Manual including calibration requirement, product support, list of spare parts etc.

l. Software Documents (Minimum Set):

i. Software Requirement Specification (SRS)

ii. Software Configuration Management Plan (SCMP)

iii. Software Certification Plan (SCP)

iv. Software Test Procedure & Software Test Report

v. Independent Verification & Validation (IV & V) Plan & Report

vi. Software Version Description Document (VDD)

GUIDANCE MATERIAL

A broad list of the attributes which shall be included in various documents are brought out in Annexure 21.T.A 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 as per 21.T1.4 AMC (b) depending on the type 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. Self-approvals of test plan and procedures shall be enabled by TAA for test rigs associated with Non-Critical airborne stores subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the test rig development agency repeatedly fails to meet the certification requirements.

e. Self-approvals in quality assurance requirements shall be enabled by DGAQA for test rigs associated with Non-Critical airborne stores through AFQMS. The right to self-approvals can be revoked for a certain duration if the test rig development agency repeatedly fails to meet the quality assurance requirements.

f. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

g. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for first article inspection for vendor / sub-contractors.

h. 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.

i. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

j. The test rig development agency shall prepare a compliance report against the approval requirements listed in the approval basis as per Subpart 21.T1.5 and also the Technical Specifications as per Subpart 21.T1.6.

k. 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.

l. 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 Air Systems/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 Air Systems not deliverable to User Services such as research Air Systems/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 Air System/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 duly approved by DGAQA.

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. For production of test rigs deliverable to user services, the ATP and other documents shall be approved by DGAQA.

f. If test rigs are produced by an agency other than the development agency, proper ToT as per 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 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. Routine maintenance activities such as replacement of any item, dismantling and replacement of damaged items in the test rig during repair, overhaul, calibration etc. complying to the approved BOM of the test rig and not affecting approved design / technical specification may be carried out by the test rig development agency itself without any approval from TAA.

d. The adaptation of the test rigs developed for one type of Air System/Airborne Store for another shall be handled using this regulation.

e. The applicability of the regulations from the full set of regulations of Subpart 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.

f. 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.

Intentionally Left Blank

SUBPART 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 Air Systems.

The approval of TTGEs is essential so as to ensure that these are safe to use and are capable of providing the required functionality.

Intentionally Left Blank

CONTENTS

21.T2.1	**Definitions**	**T2-5**
21.T2.2	**Applicability**	**T2-5**
21.T2.3	**Categorisation of TTGEs**	**T2-6**
21.T2.4	**Identification of TTGE Requirements**	**T2-6**
21.T2.5	**Approval Process for TTGEs**	**T2-7**
21.T2.6	**Approval Basis**	**T2-7**
21.T2.7	**Technical Specifications**	**T2-9**
21.T2.8	**Design and Development**	**T2-10**
21.T2.9	**TTGE Software**	**T2-11**
21.T2.10	**Fabrication of TTGEs**	**T2-11**
21.T2.11	**Identification of TTGEs**	**T2-12**
21.T2.12	**Qualification Testing**	**T2-12**
21.T2.13	**Documentation Requirements**	**T2-13**
21.T2.14	**Acceptance of TTGEs for Approval**	**T2-14**
21.T2.15	**Production of TTGEs**	**T2-15**
21.T2.16	**Transfer of Technology (ToT)**	**T2-16**
21.T2.17	**Modifications/Up-gradations of TTGEs**	**T2-17**

Intentionally Left Blank

21.T2.1 DEFINITIONS

REGULATION

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 during Operational Service.

Ground Equipment: Ground handling and Ground support equipment required to operate/maintain the Air System/Airborne Store.

ACCEPTABLE MEANS OF COMPLIANCE

Ground Control Systems (GCS) for Unmanned Air Systems shall not be considered as Ground Equipment under TTGE

GUIDANCE MATERIAL

NIL

21.T2.2 APPLICABILITY

REGULATION

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.

d. O-Level and I-Level Testers shall also be considered as part of TTGEs.

e. Development/indigenous substitution of TTGEs for existing Air Systems/Airborne Stores shall also be covered under this Subpart.

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 / or from Licensor / OEM / OEM authorized source.

Type-B: Procurement and adaptation of Generic TTGEs/ Common TTGEs / TTGEs readily available from legacy Air Systems

Type-C: Ab-initio design & development of TTGEs

GUIDANCE MATERIAL

NIL

21.T2.4 IDENTIFICATION OF TTGE REQUIREMENTS

REGULATION

The requirements for TTGEs for Air System and Airborne Stores development programs shall be identified at the project proposal finalization stage itself and all the procurement activities for Air System/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 of the Air System/Airborne Stores shall identify the necessary facilities to be supplied as TTGE for the operational exploitation of Air Systems/ Airborne Stores.

c. Servicing Development Organisations 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 PROCESS FOR 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 confirming to national/international standards and procured from off-the-shelf sources or from Licensor / OEM/ OEM authorized source 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 and calibration status.

b. Type-B: TTGEs which are generic and common or are readily available from legacy Air Systems (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/Main Contractor (for TTGEs associated with Non-Critical Airborne Stores).

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.

    i. Class 1: TTGEs permanently installed or stored in an Air System for use in flight.

    ii. Class 2: TTGEs used in the vicinity of an Air System, in tracked and wheeled vehicles

    iii. Class 3: Partially protected TTGEs

    iv. Class 4: TTGEs used in light buildings, structures and vehicles where it is protected from direct rain, sun etc.

    v. Class 5: TTGEs used in permanent buildings

    vi. 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. The Approval Basis (AB) for the TTGEs shall be prepared by the development agency in consultation with the Main Contractor of the Air System and accepted by DGAQA.

Guidance Material

JSS 6625-01 or its equivalent document shall be the basis for environment specification and JSS 55555 or its equivalent document shall be the basis for qualification testing.

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 Air System 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 TTGE shall be based upon the category of the TTGE, as identified in Subpart 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 Air System/Airborne Store shall ensure that the technical specifications prepared by TTGE OEM are acceptable to the User services.

Type-B: Technical Specifications for Type-B TTGEs shall be approved by DGAQA.

Type-C: Technical Specifications for Type-C TTGEs associated with safety-critical & mission-critical airborne stores shall be approved by CEMILAC in consultation with Servicing Development Organisations of User Services such as MAG (Avn) /CSDO/NASDO. The Technical Specification of Type-C TTGEs associated with non-critical airborne stores shall be approved by the Main Contractor in consultation with Servicing Development Organisations of User Services such as MAG (Avn) /CSDO/NASDO.

GUIDANCE MATERIAL

Nil

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.

d. Design review is not required for Type-A and Type-B TTGEs.

e. Safety, reliability and maintainability features shall be included in the design of the TTGEs.

f. Adequate internal diagnosis features, BITE/POST features etc. shall be included in the design.

g. Hardware design details and installation drawings shall be provided by the development agency to certification authorities as part of review processes.

h. The design Standard of Preparation (SOP) of the TTGE shall be finalised by the TTGE development agency and approved by DGAQA. The design SOP shall include Bill of Materials (BOM) and Drawing Applicability List (DAL) including drawings.

i. The design shall be considered to be adequate for prototype realisation/fabrication based on the approval and baselining of the design standard of preparation.

j. Acceptance Test Procedure of the TTGE shall be prepared by the development agency and approved by DGAQA.

k. A configuration control mechanism shall be implemented during the design and development phase by the development agency.

l. 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 Air System/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 TTGE.

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 Air System 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.

d. The TTGE software shall be evaluated as per the applicable regulations given in Subpart C6.

e. 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 Subpart 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 TTGE.

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 Air Systems, the delta qualification testing required, if any shall be identified by the Main Contractor of Air System/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 organisations 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 –C TTGEs as per Subpart 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. Interface Control Document

c. Design Document

d. Quality Assurance Plan (QAP)

e. All applicable drawings (Part drawings, Mechanical and Electrical assemblydrawings, schematics drawings, etc) including Master Drawing Index (MDI)

f. Bill of Material (BOM).

g. Qualification Test Procedure (QTP)

h. Qualification Test Report (QTR)

i. Acceptance Test Plan (ATP)

j. Acceptance Test Report (ATR)

k. Manuals – TTGE User Manual/Installation Manual/Operating Manual & Maintenance Manual including calibration requirement, product support, list of spare parts etc.

l. Software Documents (Minimum Set):

i. Software Requirement Specification (SRS)
ii. Software Configuration Management Plan (SCMP)
iii. Software Certification Plan (SCP)
iv. Software Test Procedure & Software Test Report.
v. Independent Verification & Validation (IV & V) Plan & Report
vi. Version Description Document (VDD)

GUIDANCE MATERIAL

A broad list of the attributes which shall be included in various documents are brought out in Annexure 21.T.A 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/internal QA group of Main Contractor duly authorised by DGAQA based on ATP/ATR, Certificate of Compliance (CoC) from OEM and successful demonstration to User services on applicable platform.

ii. Type-B: As per the technical specifications approved by DGAQA, TTGEs 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.

iii. Type-C: As per technical specifications approved by CEMILAC/Main Contractor, 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, if authorised by DGAQA.

e. Self-approvals of test plan and procedures and QA requirements shall be enabled by DGAQA for TTGEs associated with Non-Critical airborne stores subject to test adequacy being ensured. The right to self-approvals can be revoked for a certain duration if the TTGE development agency repeatedly fails to meet the certification and QA requirements.

f. A joint test and evaluation team may be constituted for ensuring quality assurance during D&D and manufacturing phase to fast-track these activities.

g. DGAQA shall enable acceptance of industry standard quality assurance requirements such as AS9102 for first article inspection for vendor / sub-contractors.

h. 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.

i. All the test results shall be generated and provided to TAA, preferably in digital format, for faster processing of approvals.

j. The TTGE development agency shall prepare a compliance report against the approval requirements listed in the approval basis as per Subpart 21.T2.6 and also the Technical Specifications as per Subpart 21.T2.7.

k. 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.

l. 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. Acceptance 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 Subpart 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 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. Routine maintenance activities such as replacement of any item, dismantling and replacement of damaged items in the test rig during repair, overhaul, calibration etc. complying to the approved BOM of the TTGEs and not affecting approved design / technical specification may be carried out by the TTGE development agency itself without any approval from TAA

d. The applicability of the regulations from the full set of regulations of Subpart 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.

e. 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 doneby 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.

f. Servicing Development Organisations 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.

ANNEXURE 21.T.A

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:

i. Objective & scope of the Test Rig /TTGE.

ii. Physical requirement w.r.t. dimensions, weight, material, coating/painting etc.

iii. Electrical requirement w.r.t. power supply requirement, power consumption bonding, insulation, components rating requirement (if any) etc.

iv. Electrical and Mechanical Interface requirements.

v. Cooling requirements, if any.

vi. Functional & performance requirements including testing parameters for each LRU being tested on Test Rig/ TTGE.

vii. Software requirements, if any.

viii. Environmental/Qualification requirements w.r.t. applicable standards.

ix. Specific engineering practices to be followed during development for Mechanical & electrical/electronic part fabrication and software development of the rig.

x. Packaging, Marking, Transportability requirements.

xi. Calibration, maintenance, warranty/reliability requirements.

xii. Supporting instruments/testers/accessories requirement, if any as part of deliverables.

xiii. Requirement of supporting infrastructure, if any.

DOCUMENTS & REPORTS OF PRODUCTS AS PART OF DELIVERABLES

2 Standard of Preparation (SOP)

This consists of the following:

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.

Drawing Applicability List (DAL)

Drawing Applicability List shall contain details such as drawing No., nomenclature, Issue No. and drawing size etc. for all the applicable drawings along with the drawings. Drawings shall contain necessary foot notes, Critical Notes, Critical dimensions, scale, circuits, Part numbers, Material, Grade, Surface finish, tolerances, Title Block, Specific Note (if applicable), Process details etc.,

3 Design Document

Design Document shall broadly include:

i. Design Architecture

ii. Mechanical/Electrical design including interface details

iii. Stress/load analysis

iv. 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)

v. Reliability, life and periodic preventive maintenance requirements

vi. Software Requirements, if any

vii Compliance Matrix w.r.t. approved technical specification

4 Acceptance Test Plan (ATP)

Acceptance Test Plan shall broadly include:

i. Details of Test Rig/TTGE

ii. Standard of preparation and drawing applicability

iii. Objective and aim of the test

iv. Details of the test equipment to be used. Calibration of test equipment and instruments and their records

v. Test Setups, Test Procedures

vi. Measurements to be taken and instrumentation required, if any

vii. Record sheet(s)

viii. Pass/Fail criterion

5 Qualification Test Procedure (QTP)

Qualification Test Procedure, if applicable shall broadly include:

i. Details of Test Rig/TTGEs to be tested

ii. Objective and aim of the test

iii. Details of the test equipment to be used. Calibration of test equipment & instruments and their records

iv. Details of applicable tests including Environmental Test, Endurance Test etc.

v. Test Setups, Test Procedures

vi. Measurements to be taken and instrumentation required

vii. Record sheet(s)

viii. Pass/Fail criteria

SUBPART U
MUTUAL RECOGNITION OF NATIONAL AIRWORTHINESS AUTHORITIES (NAA)

RATIONALE

National Airworthiness Authorities (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 Air System/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 Air System/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.

Intentionally Left Blank

CONTENTS

21.U.1 Recognition of Airworthiness Authorities of Other Nations ---------- U-5
21.U.2 Recognition of MAA of other Nations---------- U-6
21.U.3 Recognition of CAA of other Nations ---------- U-6
21.U.4 Project Specific Memorandum of Understanding -------- U-7

Intentionally Left Blank

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 by 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) – cases where an Indian TAA and other country NAA are involved, the advantages in using each other's assurance activity could be identifed. This form of Recognition could be bi-lateral or multi-lateral.

b. One-Way Recognition–cases 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) – Wherever, a TAA satisfies its recognition requirements by using an existing recognition between other authorities rather than conduct its own recognition 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 organisation 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 organisation 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 organisation 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. The objective shall be the assessment of following:

a. Common regulatory framework;

b. Common certification processes;

c. Common documentation template

d. Common certification/design standards

In case of specific requirements for any co-developmental project, Foreign OEM should be responsible for airworthiness certification with respective authorities and Indian contractor should be responsible for Indian military certification based on the Foreign OEM Certificate and other type record document evidence in association with TAA.