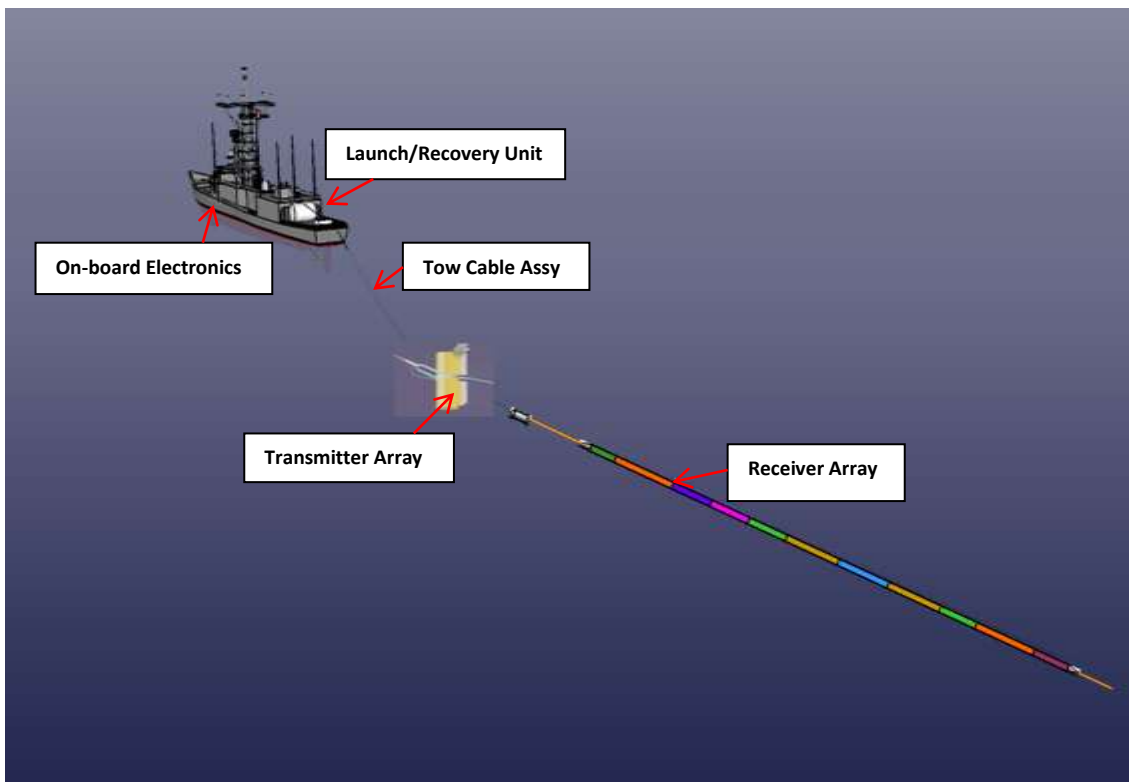


Expression of Interest

TOT OF WET END SUB-SYSTEM FOR ADVANCED LIGHT TOWED ARRAY SONAR (ALTAS)

1. Introduction

NPOL, Kochi, a premier laboratory under Defence R&D Organisation invites Expression of Interest (EOI) from Indian manufacturer(s) having sufficient experience, expertise and willingness to undertake Production of **WET END SUB-SYSTEM** for an Advanced Light Towed Array Sonar (ALTAS)



Schematic of ALTAS System

The Wet End Sub-System consists of Transmitter and Receiver Arrays and Tow Cable assembly. The Transmitter Array is housed in a Vertically stabilised body and is hooked on to the seamless Tow Cable with linear receiver Array. Technical specifications are enclosed at annexure 1

2. RESPONSIBILITIES OF MANUFACTURER OF WET END SUB-SYSTEM

ALTAS is a multidisciplinary sonar system consisting of technologies of transducers, mechanical engineering, ocean engineering, electrical and electronics engineering, power electronics and software. Realisation of the entire sonar system under one roof may not be practical because of the diversity of technologies, know-how and skill set required. And hence the hardware content of the sonar has been realised as subsystems through specialised Indian industries and integrated as ALTAS sonar system by incorporating dedicated software developed by NPOL. The responsibility of its installation onboard a naval ship and the role of lead system integrator was undertaken by NPOL. The performance validation of the system was done under the leadership of NPOL and with the association of Indian Navy through a series of structured sea trials with real targets deployed at strategic locations. Performance validation has since been completed, the Indian Navy will shortly evaluate the system as per mutually agreed trial plan and procedure. Indian Navy has plans to induct a few ALTAS sonar systems for its front line war ships soon after evaluation trials. The purpose of this EOI is to identify one / two potential Manufacturer for ALTAS **WET END SUB-SYSTEM**. Responsibilities of Sub-system manufacturer of 'WET END SUB-SYSTEM' is further elaborated in the succeeding sections.

2.1 Supply of Sub-system to Lead System Integrator (LSI) nominated by Indian Navy/NPOL

- a. Supply order will be placed on the manufacturer by a LSI nominated by Indian Navy/NPOL.
- b. Manufacturer will supply the 'WET END SUB-SYSTEM' as per TOT Documents. Detailed Specifications, Quality policy / program for component level to sub-system level, ATP, FAT's, HAT's and SAT's documents and BOM will be provided in the TOT documents.
- c. The manufacturer will field sub- system against RFP from LSI by submitting Technical, commercial and price bids appropriately.

2.2 Organising QT/ET/ATP at the premises of sub-system manufacturer.

- a. Manufacturer has to organise QT/ET at the manufacturers end as per sub-system acceptance document provided in the TOT document.

- b. Manufacturer has to conduct FAT's at the manufacturers end as per sub-system Factory acceptance document provided in the TOT document before despatch of sub-system for system Integration.

2.3 Auditing of Quality Process

- a. Manufacturer will ensure auditing of quality process by competent authority responsible for quality assurance as spelt out by LSI.
- b. LSI will have the right to nominate Competent authority responsible for quality assurance and inspection at the manufacturers premises.

3. TOT TERMS

- 3.1 As per DRDO Guidelines for Transfer of Technology (TOT), the first TOT will normally be given to the industry associated during development on priority so as to ensure high quality of manufacture within the limitations in hand-holding support of DRDO.
- 3.2 TOT will be given on non-exclusive basis only. The number of license on non-exclusive basis will be restricted. However, additional licence if required will be given by DRDO on need basis. The intellectual property rights shall always remain with DRDO.
- 3.3 The amount and payment stages of TOT fee will be as prescribed by DRDO. As per current guidelines it is upto 20% of its developmental cost.
- 3.4 Royalty fee @ 2% of the annual sales will be applicable uniformly for all industries.
- 3.5 Technical assessment of the industries submitting EOI's will be carried out by a Technical assessment committee for verification of the technical and financial capability/capacity of the industry.
- 3.6 Eligible parties will have to sign Confidentiality & Non-Disclosure Agreement (CNDA) with DRDO for technical discussion including specifications, following which they shall be considered for giving Transfer of Technology (TOT) on non-exclusive basis.

- 3.7 TOT to industry will be given based on their manufacturing capability, assurance on quality and capacity of production apart from other terms and conditions.
- 3.8 The licencing agreement for transfer of technology (LATOT) which is to be signed will be as per the template approved by Department of Legal affairs. Ministry of Law and Justice.
- 3.9 DRDO shall have the march-in rights to use the IP for its own use in the interest of the Govt. of India without any restrictions, irrespective of the nature of licence granted.
- 3.10 DRDO shall have the right to Revoke the Licence if the company fails to adhere to the terms and conditions especially with respect to adherence of Quality.
- 3.11 The firm expressing interest should be technically sound to Procure/manufacture, supply and maintain the system with requisite quality standards.

4. EOI TERMS

Interested Industries may write along with their company profile, financial & technical capabilities etc. as per the following format to Director, NPOL, Kochi and copy to Director DIITM on the following addresses within 45 days of this advertisement.

Director, NPOL
DRDO, Min. of Defence,
Thrikkakara P.O.
Kochi-682021
Contact No - 0484 2424878
FAX : 0484-2424858
Email: director@npol.drdo.in

Director, DIITM
Room No 446 DRDO Bhawan
DRDO HQrs Ministry of Defence
Rajaji Marg New Delhi – 110011
Contact No - (011) 23016216 / 23007446
FAX No. 011-23793008

- a) Memorandum and Articles of Association (Should be incorporated as per Indian Companies Act, 1956)
- b) Certificates of registration as a manufacturing unit, if any.
- c) Balance Sheet for the preceding three years.
- d) Income Tax returns for the preceding three year period

- e) Details of shareholding/ownership pattern especially foreign partners/ shareholders, foreign employees, directors, etc. The company must adhere to the prevailing Govt. of India policies and regulations on Foreign Direct Investment (FDI).
- f) Annual budget for R&D during last three years.
- g) Numbers and details of IPR or patents etc. held by the company.
- h) Number of technically or professionally qualified personnel.
- i) Record of past performance (e.g. Supply orders executed against Ministry of Defence orders, public sectors and paramilitary forces, if any).
- j) Availability of adequate infrastructure (List of machines and their production capacities) and technical expertise.
- k) List of Testing and Support equipment.
- l) ISO/ ISI certification or any other certification
- m) Relevant clearances from the authorities/ ministries (if any)
- n) Capacity and capability to undertake developmental work and to accept attendant financial and commercial risks.
- o) Capacity/Capability to market the product through the marketing network, sales and service network, reliability to maintain confidentiality.

WET END SUB-SYSTEM OF SONAR ALTAS**1. The Wet End System consists of:**

- 1.1 Towed Projector Unit (TPU)
- 1.2 Towed Receiver Array (TRA)
- 1.3 Tow Cable Assembly (TCA)
- 1.4 Array Data Interface Box

2. Towed Projector Unit. (TPU)

The Towed Projector Unit consists of:

- 2.1 Vertical Projector Array. (VPA)
- 2.2 Vertically Towed Body. (VTB)
- 2.3 Tuning Coil Box
- 2.4 Cable Harness Assembly.

The Towed Projector Unit is a vertical array of underwater sound projectors(VPA) housed in a free flooded hydro dynamically stabilised Vertically Towed Body (VTB). The Electronics are housed in a pressure tight Tuning Coil Box at the base of the Vertical Projector Array to operate at an ocean depth of 300 meters

3. Towed Receiver Array

The Towed receiver array is an assembly of different modules consisting of acoustic sensor modules and isolation modules. The acoustic sensor module is a linear array of acoustic sensors, along with signal conditioning electronics. The acoustic sensors and electronics are housed in a flexible tube filled with oil or jelly . The sub-systems of Receiver array consists of :

- 3.1 Isolation Module Level-1
- 3.2 Acoustic Sensor Module Level-1
- 3.3 Acoustic Sensor Module Level-2
- 3.4 Acoustic Sensor Module Level-3
- 3.5 Acoustic Sensor Module Level-4
- 3.6 Isolation Module Level-2

Each module has an average length of 30 meters and diameter of 80 mm. The modules are interconnected using pressure balanced multi-pin under water marine grade connectors to

form and operate as a single receiver array. The receiver array is designed to operate at depths of 200 meters and has a breaking strength of 2 tons.

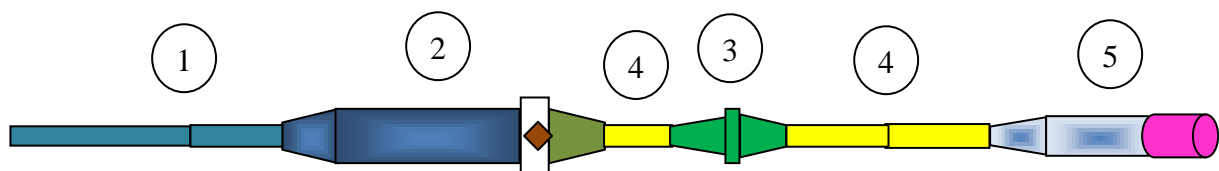
4. Tow Cable assembly

Tow Cable assembly act as the life line of Towed Array Sonar, transferring the drag force to the winch, acting as the medium for transferring power supply to the arrays and providing a data telemetry link. Tow cable assembly consists of a light tow cable, heavy tow cable, Electro-opto-Mechanical-Interface Connector and a Cable Interface Module.

Both the Light Tow cable and Heavy tow cable have signal lines, power lines and FO lines. The light tow cable is designed to be neutrally buoyant in water and can operate at water depths off 200 meter and has a breaking strength of 15 tons. The heavy tow cable is positively buoyant and can operate at water depths of 200 meters with a breaking strength of 20 tons. Both Heavy tow cable and Light tow cable are torque balanced.

Electro-opto-Mechanical-Interface Connector is a sealed unit designed to operate under 200 meters of water and couples the light tow cable and heavy tow cable electrically, optically and mechanically for a breaking strength of 15 tons. The Electro-opto-Mechanical-Interface Connector is also designed to couple the Towed Projector Array electrically and mechanically on the tow cable assembly.

The free end of the HTC is provided with a winch end mechanical termination and optical conectorisation. The free end of the LTC is to be assembled with Cable Interface Module (CIM) which converts the electrical signal from Receiver Array into optical signal. A schematic block diagram of Tow Cable assembly is shown below.



Schematic block diagram of Tow Cable Assembly

1. Heavy Tow Cable (HTC)
2. Electro-opto-Mechanical-Interface Connector (EOMIC)
3. Intermediate anchoring
4. Light Tow Cable (LTC)
5. Cable Interface Module

5. Array Data Interface Box

The data from the towed array is available over optical link in the tow cable. The optical data from the array is received by converted to electrical format before taking the data through the winch slip ring. The data is again converted to optical before sending it to the Sonar control room. The former conversion happens in the rotor box while the latter happens in the stator box. Both these units use Ethernet Fiber Media converters for the conversions. Along with these converters, the units also house the required power supplies and Ethernet switches. The Array interface unit (AIU) houses the electronics required for converting the optical data coming to the Sonar Control Room back to Ethernet form. It also houses the electronics required for the built in test Insonifier for the towed array. The AIU forms the interface between Towed Array data and signal processing electronics at SCR. AIU accommodates Ethernet Fiber media converters, Ethernet switches, DC-DC converters and Built in test insonifier electronics.

6. Skill Set requirement

6.1 Assembly, integration & Testing of Towed Projector Unit (TPU)

- 6.1.1 Competence to identify Transducer shell resonance and assembly of respective PZT stack to obtain required “Transmitting Voltage Response (TVR)”
- 6.1.2 Competence for Impedance matching of transducer with Tuning Coils for specified Delivery of power.
- 6.1.3 Competence for Assembly of TPU without affecting overall set TVR and Source Level
- 6.1.4 Expertise in Underwater testing of Transducers with Standard Hydrophones
- 6.1.5 Expertise in acoustic measurements with matching system power amplifier and Transducer array fine tuning till final proving of SL
- 6.1.6 Experience in handling PV/Epoxy resins for potting underwater connectors and Axially water-blocked multicore cables.

6.2 Assembly, Integration & Testing of Electro-opto-Mechanical-Interface Connector

- 6.2.1 Competence in splicing of fibre optic cables of Multimode Fibre optic lines.
- 6.2.2 Competence in safe securing of spliced fibre optic joints.
- 6.2.3 Competence in steel armoured cable termination.
- 6.2.4 Competence in aramid fiber strength member cable termination.
- 6.2.5 Competence in polyurethane potting of cable termination to achieve high pressure sealing of cable termination.

- 6.2.6 Competence in epoxy potting of aramid strength member.
- 6.2.7 Competence in swage button termination of Steel wire ropes.
- 6.2.8 Competence in handling and pressure filling of Silicon gel.
- 6.2.9 Competence in crimping of Stainless steel rings on flexible tubes.

7. General

The manufacturer shall carry out Qualifications tests as per DQAN guidelines. Environmental Stress Screening (ESS) Tests include Thermal cycling, Random vibration and Endurance/burn-in for 100% Electronic Components. The Environmental Tests (ET) includes High temperature storage test and Vibration test as per MIL-STD-167-I(Ships).

8. Facility Requirement

The manufacturer should have their own facility for manufacturing, assembly, and testing of receiver arrays. The following facilities are required for carrying out the production work.

- a) An air-conditioned hall with dimensions not less than 40 m long x 8 m wide x 6 m high.
- b) Environmental stress screening facility with not less than 150 liter capacity for carrying out screening of electronic components.
- c) Vibration facility to carry out random vibration and variable frequency test.
- d) Sophisticated Electronics Laboratory with facilities for precision electronics works such as wiring, soldering and testing.
- e) Load testing facility for tensile testing of the modules of Towed Receiver Array.
- f) Tube insertion facility with a provision of inserting 35 m long modules with high capacity vacuum pumps.
- g) Oil filling facility with a height of 12 m.
- h) Dehumidified air-conditioned room for assembly of Sound Projectors.
- i) Pressure Test facility for 30 bar.
- j) Underwater measurement facility for deep water (40 meters) acoustic measurements
- k) Hydraulic press
- l) Rubber Molding facility
- m) Deployment/Retrieval simulations test setup

9. Equipment Requirement

The following testing equipment are necessary

- a) 100 MHz Digital storage oscilloscope
- b) Computer/ Laptop with 100 Mbps Ethernet port loaded with Lab view software
- c) Stellar is Evaluation Kit (EKK – L M 3S 9 B 92)
- d) PL-USB Blaster (RCN, Make : Altera)
- e) Function (Arbitrary Waveform) generator (10 MHz)
- f) Impedance analyzer
- g) High Voltage (300V/2 k W) DC power supply, with UPS back up
- h) Regulated DC power supply 0-30V, 5 A
- i) 1000 V Megger
- j) RMS Multimeter
- k) Insonification Unit – for generating acoustic noise of required frequency