

**QUESTIONNAIRE FOR HIGH ENDURANCE AUTONOMOUS UNDERWATER VEHICLE - ANTI SUBMARINE WARFARE (HEAUV-ASW)**

1. **Introduction.** *IN* is examining the feasibility of inducting a High Endurance Autonomous Underwater Vehicle (HEAUV) for Anti Submarine Warfare (ASW) operations. The HEAUV would be an autonomous self-propelled Underwater Vehicle with an endurance more than 15 days. It is envisaged to be used for the following missions:-

- (a) Track submarines using a Thin Line Array, Flank Array, Active Sonar or Synthetic Aperture Sonar.
- (b) Undertake Surface Surveillance by radar fitted on periscope type mast.
- (c) Recording CTD, Bathymetric data and Bottom Profiling.

2. **Questionnaire.** In order to assess capability of vendors to develop HEAUV-ASW, questionnaire is enumerated below.

Q.1. Vendor to specify the following:-

Ser	Requirements	Vendor to Specify	Limiting Parameters
(a)	<b>Capabilities</b>	(i) Modular Design. (ii) Endurance and Manoeuvrability. (iii) Speed vs Endurance table. (iv) Low Acoustic, Magnetic, Visual and IR signatures. (v) Capability for autonomous operations and pre-programmed operations. (vi) Autonomous Navigation, Collision avoidance and Communication suite. (vii) Adequate redundancies in terms of navigation equipment, power supply, propulsion options and communication.	Should be a Containerised Solution.  More than 15 days underwater endurance at Economical Speed.

Ser	Requirements	Vendor to Specify	Limiting Parameters
		(viii) Conformity of vehicle/equipment fit to latest International regulations, wherever applicable.	
(b)	<b>General</b>	(i) Service Life. (ii) Displacement. (iii) Dimensions (Length overall, Beam and Draught). (iv) Speed (Max Speed, Economical Speed, etc). (v) Endurance and Range (at various speeds). (vi) Sea Worthiness. (vii) Proposed hull form and design. (viii) Reserve Buoyancy. (ix) Preliminary stability, intact and Damage stability calculations. (x) Stealth features.	Not more than 6000 kg (inclusive of payloads) Length not greater than 12 m Sea worthy upto Sea State 5. Restriction for launch/recovery be specified.
(c)	<b>Operational Characteristics</b>	(i) Mission Duration in various options. (ii) Operations Cycle. (iii) Depth Restriction.	Max Speed – NLT 08 Kn. Economical Speed – NLT 03 Kn.
(d)	<b>ASW Module</b>	(i) Type of Sonar. (ii) Details of Sonar. (iii) Details of Sonar Deploying Mechanism. (iv) Details of sensor Performance Prediction Sub Module.	Minimum detection on active sonar 3000 m (on either sides) in all bathy conditions

Ser	Requirements	Vendor to Specify	Limiting Parameters
		(v) Any other Sub Module.  (vi) Details of Active Towed Array and/or Hull Mounted Sonar be provided.	
(e)	<b>Bathymetric, Oceanographic Data and Bottom Profiling Module</b>	(i) Operational and Technical details of Module.  (ii) Capabilities and limitations.	
(f)	<b>Navigation System</b>	(i) Detailed list of Nav equipment along with technical parameters of each.  (ii) Type of Gyro(s).  (iii) Details of Data Recorders.  (iv) Details on Degree of Autonomy for safe navigation.	-
(g)	<b>Communication Systems</b>	(i) Details of types of Communication options available along with technical details for each.  (ii) Details of connectivity with Control Station.  (iii) Details of communication redundancy in all modes of operations.	-
(h)	<b>Propulsion</b>	(i) Type of Propulsion.  (ii) Type of Propeller and Rudders (if applicable).  (iii) Options in propulsion, if any.  (iv) Equipment operating Conditions (Ambient air temp, water temp, max relative humidity, roll/pitch)	-

Ser	Requirements	Vendor to Specify	Limiting Parameters
		<p>restrictions, etc).</p> <p>(v) Details of power redundancy in all modes of operations. And, vehicle operations in case of total power failure or all fuel exhausted.</p>	
(j)	<b>Power Generation and Distribution</b>	<p>(i) Details of propulsion power.</p> <p>(ii) Type and capacity of Power Generation system onboard.</p> <p>(iii) General power requirements onboard.</p> <p>(iv) Type of Power Management System onboard.</p> <p>(v) Type and rating of equipment fitted onboard.</p> <p>(vi) EMI/EMC issues.</p> <p>(vii) Specifications/Standards of all equipment/systems.</p> <p>(viii) Payload vs Endurance power load table.</p>	-
(k)	<b>Cyber Security</b>	<p>(i) Details of cyber security measures to prevent cyber-attack.</p> <p>(ii) Details of anti-jamming, anti-hacking and anti-spoofing features incorporated.</p> <p>(iii) Any other feature incorporated.</p>	
(l)	<b>Manpower Requirement</b>	Details of manpower required for Operations, transportation and Maintenance to be provided.	-

Q.2. What is the concept of operation of the HEAUV, to enable it to undertake missions mentioned at Para 1 above?

Q.3. What is the expected time late for transmitting target data from HEAUV to the Control Station?

Q.4. Being an Autonomous Vessel, collision avoidance (both underwater and on surface) is a critical aspect to be incorporated in the vessel. Description of the collision avoidance system, algorithm used and details of testing undertaken/planned be elaborated.

Q.5. What would be the means of target classification and how this data would be available to the Control Station? Specify for both underwater target and surface target. Capability of the periscope mast to undertake surface surveillance may also be indicated?

Q.6. Provide identification aids available on the HEAUV like flash light, acoustic noise maker, etc?

Q.7. How and in which format would the data about the target/mission be communicated to the control station? The suitability of the system to be compatible with the Combat Management System (CMS) (for analysis ashore/onboard ships) in *IN* inventory be ascertained?

Q.8. Provide following details wrt Satcom: -

- (a) Type of Satcom Link required to be established (forward control link, return link or both).
- (b) The data rates and type of data on the forward and return links.
- (c) Latency acceptable in the forward link.
- (d) Duration and frequency of requirement of Satcom link during operations.
- (e) Band of operations.
- (f) Feasibility of compatibility with *IN* Satcom network.
- (g) Security overlay if any.
- (h) Feasibility of incorporating *IN* security solutions in to the Satcom.

Q.9. What are the core autonomous functionalities (like navigation, collision avoidance, power management, etc) and what is the expected reliability?

Q.10. Whether the system has AI capability? If yes, provide details?

Q.11. What is the method by which the HEAUV would be controlled? It is requested that, the following details be provided in this regard:-

- (a) When being controlled:-
  - (i) What is the mechanism to control it; Underwater Acoustic, V/UHF and Satellite link?
  - (ii) What is the range upto which it can be controlled (mention for all mechanisms)?
  - (iii) What is the composition of the Control Station? Further, as a Control Station, what is the nature of the equipment required to control the HEAUV onboard a ship and/or ashore?
  - (iv) What are the limitations that would be imposed when it is being controlled?
  - (v) In case of data-link failure, how is the HEAUV directed/controlled?
- (b) When being operated by Pre-Fed Data/Autonomous operation:-
  - (i) What is the maneuvering capability and limitations when the HEAUV is being controlled by Pre-Fed Data/undertake autonomous operations?
  - (ii) What are the various limitations that would be faced when feeding data? Eg, time required to feed data, max and min time before launch the data needs to be fed, etc?
  - (iii) What would be the equipment required to feed data into the HEAUV?
  - (iv) What are the limitations that would be imposed when it is undertaking independent programmed missions?
  - (v) Once launched, can the mission profile be changed through communication link? If yes, any limitation imposed by means of communication being used to provide new mission profile to the HEAUV?
  - (vi) Comments on shifting to autonomous mode of operation from remote mode and vice-versa?

Q.12. Would the HEAUV be capable of operating in multiple regimes (combination of speed and endurance)? If yes please provide the details.

Q.13. Would the HEAUV be capable of upgradation during the product life? Also provide details of envisaged maintenance routine?

Q.14. What would be the mechanism for lowering/ hoisting/ deploying the HEAUV? Can the mechanism be fitted on any vessel like OSV, warship, etc? If yes what would be the requirements and associated timelines?

Q.15. What would be the accessories provided with the HEAUV for its deployment from ashore and from a ship at sea? Indicate the power source required for the routines, charging/recharging and other activities to facilitate operations from ship? Compatibility with onboard supply also be mentioned.

Q.16. What are the type of containers in which the HEAUV would be carried and what requirements are to be met for transportation (sea and land)? Also indicate dimensions, weight, power supply and Air Conditioning requirements of the container?

Q.17. What is the envisaged infrastructure required for stowage and maintenance of the HEAUV onboard a ship and ashore?

Q.18. Does the HEAUV has a feature of data protection/destruction when unauthorized data retrieval is attempted? Details of self-destruction mode if available be indicated?

Q.19. Is the design of HEAUV indigenized (IPR of the design would be required on a later date)? Which all components of the HEAUV (including the payloads) would be imported and from where? Also mention the expected IC percentage? Also mention the details of the associated software (indigenous or not, etc)?

Q.20. Give details wrt indigenization of the enabling technologies like autonomous navigation, endurance, command and control, sensors, etc associated with the development of HEAUV for ASW missions?

Q.21. What are the envisaged timelines for development of prototype post award of Project Sanction Order? Indicate willingness to progress the prototype development under Make II and subsequent development under Buy Indian IDDM Scheme?

Q.22. Indicate willingness to offer comprehensive AMC and/or Rate Repair Contract. Brief scope and cost of the AMC/RRC to be indicated.

Q.23. An estimated Budgetary Quote be provided for the following:-

- (a) 01 HEAUV-ASW and 01 simulator (mention both costs separately).
- (b) Cost of other sub-systems (Control Station, associated equipment etc).
- (c) Manufacturer Recommended List of Spares (OBS and B&D spares) for five years.

- (d) Training of personnel including operator and maintainer training, training aids and packages. The number of personnel proposed should also be indicated.
- (e) Special Tools and Test Equipment.
- (f) Documentation.
- (g) Cost of AMC/RRC.
- (h) Any other costs envisaged.
- (j) Details of costing as per **Annexure**.

Q.24. What are the technical expertise of the manufacturer to design and develop HEAUV? In case, some payload is sourced from global/Indian firm details may be provided along with details of ToT plan?

Q.25. How and where are the prototype trials proposed to be undertaken?

Q.26. What is the envisaged Mean Time Between Failure (MTBF) for the vehicle and the payloads?

Q. 27. What type of battery would be used and what would be envisaged battery charging cycle? Further, the shelf life of the battery used for main propulsion (if used) be indicated?

Q.28. Provide the specifications of the simulator with special reference to its capability to aid training of crew?

Q.29. In case of defect, can HEAUV communicate to the control station regarding health status? Does it have an option of remote health check and remote system recovery?

Q.30. What is the proposed scope and duration of training that would be provided to *IN* personnel to enable optimum exploitation of the vessel?

Q.31. What Quality Assurance (QA) methodologies are proposed to be deployed by the vendor during design, development, production and trial phases to ensure delivery of a completely reliable and fail safe underwater combat ready platform?

Q.32. What 'Testing' strategy is proposed to be deployed by the vendor to check the reliable operations of the HEAUV-ASW for the complete endurance of the vehicle in the developmental stage?

Q.33. What are the global best practices in QA methodology for design and development of Autonomous vehicle and Robotic systems and how are these being incorporated?

Q.34. Details of various emergency modes of operation that HEAUV addresses may be provided?

Q.35. Levels of autonomy provided in the system modes of operations and navigation mode?

Q.36. Level of AI with self-learning capabilities and sensor fusion incorporated in platform to undertake autonomous operations may be indicated?

### **VENDOR INFORMATION**

Q.37. Indicate Name, Address and Unique ID (if any) of the Vendor/Company/Firm.

Q.38. Furnish complete postal address, details of local office/liaison office in Delhi area (if any) in New Delhi/in vicinity.

Q.39. The following details to be provided (relevant documents to be forwarded):-

- (a) Category of Industry (Large/Medium/Small Scale).
- (b) Annual Turnover in INR for last 03 financial years.
- (c) Profit/Loss Statement of the last 03 financial years.
- (d) Number of employees in firm.
- (e) Details of manufacturing infrastructure that would be useful for manufacturing the HEAUV-ASW and its subsystems.
- (f) Production capacity per annum.
- (g) Details of earlier contracts with Indian Ministry of Defence/Government agencies:-

Contract Number	Equipment	Quantity	Cost

**LAST DATE OF RESPONSES TO BE SUBMITTED IS 14 SEP 20**

PROJECT- HEAUV  
DTE OF STAFF REQUIREMENTS  
IHQ MoD(N)  
A BLOCK DARA SIKOH ROAD  
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KA: Cdr S Makkar  
Tel: 011-23010579

[This undertaking would be required at EOI and RFP stage](#)  
[\(Refer para 19 \)](#)

**UNDERTAKING TO COMPLY WITH INDIGENOUS DESIGN**

We, \_\_\_\_\_ (“Name of Vendor”), do hereby certify, undertake and confirm that:

1. The Design of \_\_\_\_\_ (“Named Product”), as claimed by us in response to the EOI No is owned wholly by us/by an Indian entity.

2. Further, we confirm that the Design of the Named Product, as claimed by us, has not been licensed from a foreign third party except for standard software licences such as, but not limited to OS / Database / \_\_\_\_\_(Strikeout / Specify as applicable).

3. The ownership of the Design, as claimed by us, enables us to manufacture, realise, sell, provide Through Life Support, modify and upgrade the Named Product without any encumbrances, except as specified below: (If any form of encumbrances exist on the product or any of its subsystems these should be elaborated here)

\_\_\_\_\_  
\_\_\_\_\_

4. We further claim that we own the following IP Rights in relation to the design of the Named Product: (Specify any Patents, Registration of Designs, if any, held by the Vendor)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. We also undertake to permit MoD/MoD appointed Specialists Committee, to inspect/ carry out technical audit at our premises of the applicable documents, such as Design Reports, Drawings, Specifications, Software Documents & Codes, Gerber files, etc, as may be reasonably necessary and required to prove the above claim of ownership of the Design of the Named Product. (Examination on site at company’s premises only. Documents, in any form, are not be sought nor required to be submitted for examination outside the Company’s premises)

6. Failure on our part to prove the ownership of the Design of the Named Product by us/by an Indian entity or submission of any false undertaking or claim as indicated in the response at any post contract stage of the intended procurement may make us liable to forfeiture of the PWBG to the extent of any direct losses or damages suffered by the MoD as a consequence of such false undertaking or failure to prove the ownership of the Design.

## Annexure (refer para 23 j of the Questionnaire)

## Statement Of Estimated Cost

Ser No	Items	Qty	Basic Unit Cost	Total Basic Cost	Basic Custom Duty	GST /IGS T	Total Cost (including BCD & GST/IGST)	Remarks
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
A.	<b>Cost of Basic Equipment.</b> Full break-up details may be given in separate Annexure.							
	Imported							
	Indigenous							
B.	<b>Cost of Installation / Commissioning/ Integration</b> (Where Applicable)							
	<b>Direct Labour Cost</b> ( Details of Mandays Bookings, Rate etc may be given in separte Annexure.)							
	<b>Overhead (Basis of Allocation):</b>							
	1.Project Monitoring Cost 2.Other Administrative Cost etc							
C.	<b>Cost of Transfer of Technology</b> (If any)							
D.	<b>Cost of Special Maintenance Tools and Special Test Equipment</b> may be given in separate Annexure.							
	Imported							
	Indigenous							
E	<b>Any other cost</b> (to be specified seperately):							
	1 .....							
	2.....							
F	<b>Freight and Transit Insurance Cost</b> (where applicable)							
	On Imported Material							
	On Indigenous Material							
G	Expected AMC cost giving year-wise break up (Basis)							
H	<b>Total Cost (Total of Serial No.A to G)</b>							