

**REQUEST FOR INFORMATION FOR INTEGRATED BRIDGE SYSTEM**

1. The Ministry of Defence, Government of India, intends to revise NSQRs of Integrated Bridge System (IBS) based upon experience gained and to broaden the existing qualified vendor base. The MoD, Gol, intends to procure Integrated Bridge System (IBS) for fitment onboard *IN* ships (small ship and large ship configuration).
2. This Request for Information (RFI) for IBS consists of three parts as indicated below:-
  - (a) **Part I.** The first part of the RFI incorporates operational characteristics and features that should be met by the System. Important technical parameters of the proposed System are also mentioned.
  - (b) **Part II.** The second part of the RFI states the methodology of seeking response of vendors. Submission of incomplete response format will render the vendor liable for rejection.
  - (c) **Part III.** This part lays down the guidelines for framing Criteria for Vendor Selection/ Pre-Qualification in Buy Indian (IDDM), Buy (Indian) and Buy & Make (Indian) Cases.

**PART - I: OPERATIONAL AND TECHNICAL REQUIREMENTS**

3. **Intended Use of Equipment (Operational Requirements).**
  - (a) **Definition.** An Integrated Bridge System (IBS) is defined as a combination of navigation aids, equipment and sensors, which are interconnected in order to allow centralised access to sensor information and to enable effective Bridge Resources Management from workstations, with the aim of increasing the safety of the ship and her navigational efficiency.
  - (b) **Functionalities.**
    - (i) The IBS system should provide for the following key functionalities:-

- (aa) ECDIS.
- (ab) ARPA.
- (ac) Conning Display.

(ii) Integrated Bridge System (IBS) should facilitate effective and safe bridge resource management. It should enable expeditious, continuous and effective information processing and decision making by bridge team and enhance situational awareness of bridge team. Following additional benefits are to be accrued from optimal exploitation of IBS:-

(iii) IBS should integrate radar pictures, ECDIS, inputs from navigation aids like gyro, log, echo sounder, AIS, DGPS etc in a single Multi-Function Console (MFC) and present a comprehensive navigational situation to the Officer of the Watch (OOW).

(iv) IBS should automatically provide time stamped record of each field, thus helping in accurate record keeping.

(v) IBS should provide functionality of expeditious position fixing in pilotage waters with aid of OBD.

(vi) Fitment of IBS should standardise the displays on *IN* ships.

(vii) IBS should operate on a double redundant network, thus increasing navigational safety.

(viii) IBS should record the voice communications in the bridge and verbal instructions passed over the machinery, action and conning intercoms.

(ix) IBS should enhance bridge ergonomics which subsequently aids in optimisation of Bridge Resource Management (BRM).

(x) IBS should be hard wired to Gyro, Log, DGPS, AIS, Echo Sounder and Nav Radar(s) feed with one each MFC in the Bridge, Chart House/ Ops Room, in- addition to the IBS distribution units to prevent catastrophic failure.

(xi) A failure of one part should not affect other parts except for those functions directly dependent upon the information from the defective part.

(c) Other details as per Annexure.

5. **Important Technical Parameters.** The purpose of this Request for Information (RFI) is to obtain information on the envisaged Operational and Technical parameters placed at Annexure 'IV'.

6. Vendors should confirm that following conditions are acceptable:-

(a) The solicitation of offers will be as per 'Single Stage -Two Bid System'. It would imply that 'Request for Proposal' would be issued soliciting the technical and commercial offers together, but in two separate sealed envelopes. The validity of commercial offers would be at least 18 months from the last date of submission of offers.

(b) The technical offers would be evaluated by a Technical Evaluation Committee (TEC) to check its compliance with RFP.

(c) The equipment of all TEC cleared vendors would be put through a trial evaluation in India on a 'No Cost No Commitment' basis. A staff evaluation would be carried out by IHQ MoD (N) to analyse the result of field evaluation and shortlist the equipment for introduction into service.

(d) Amongst the vendors cleared by GS evaluation, a Contract Negotiations Committee would decide the lowest cost bidder (L1) and conclude the appropriate contract.

(e) Vendor would be bound to provide product support for time period specified in the RFP, which includes spares and maintenance tools/ Jigs/ fixtures for field and component level repairs.

(f) The vendor would be required to accept the general conditions of contract given in the Standard Contract Document at Chapter VI of DAP.

(g) **Offset (if applicable).** Not Applicable.

(h) **Integrity Pact (if applicable).** An Integrity pact along with appropriate Earnest Money Deposit (EMD) is a mandatory requirement in the instant case in accordance with provisions of Annexure I to Appendix O of Schedule I Chapter II of DAP -20.

(j) **Performance-cum-Warranty Bonds.** Performance-cum-Warranty Bond both equal to 3% value of the contract inclusive of taxes and duties is required to be submitted after signing of contract (PWBG of 3% of contract value is promulgated by MoD till 31 Dec 23). Confirmation of

submission of PWBG at the rate as promulgated by MoD at the time of tender submission is to be provided.

- (k) **ToT (if applicable)**. Not Applicable.
- (l) **Warranty**. The equipment shall be covered by warranty for replacement by the vendor for a period of two years.
- (m) **Delivery Period**. The equipment to be delivered within 24 months from the effective date of the contract.
- (n) **Spares**. List of Onboard (OB) and Base & Depot (B&D) spares required for supporting the equipment must be provided with cost. Quotations for spares should have a minimum validity of 18 months. Adequacy and continued availability of spares must be ensured prior to placement of orders for procurement of equipment .The list should be split in two parts as follows:-
  - (i) **Onboard (OB) Spares**. OB spares should cater for one-year exploitation needs of the equipment and comprise spares, which can be replaced by the ship's staff. OB spares normally comprised items like PCBs, modules, sub-assemblies etc.
  - (ii) **Base and Depot (B&D) Spares**. B&D spares are required to cater for at least five-year exploitation needs of the equipment. They must also comprise adequate quantities of all items included in the OB spares especially more PCB/ modules instead of discrete electronic components.
- (p) **Training**. The vendor shall be responsible for the training of operators and maintainers. Details of training schedule for operators and maintainers are to be indicated accordingly. The vendor must provide computer aided instruction packages in CD, instruction notes and special training aids to enable subsequent in-house training being conducted for following categories of personnel : -
  - (i) Operators.
  - (ii) First/ Second level maintenance personnel.
  - (iii) Third/ Fourth level depot maintenance personnel.
  - (iv) Training establishment staff.

(q) **Life Cycle Support.** Vendor would be bound to provide product support for time period specified in the RFP. This would include spares and maintenance tools/ jigs/ fixtures for field and component level repairs. The equipment is to be supported till the service life of the equipment. In the event of non-availability of the components/ sub-assemblies due to obsolescence, the sub-assemblies identical in the form, fit and function shall be provided. Overall life of the equipment should be at least 12 years from date of delivery to *IN*. Each set is to be provided with set of OBS and consolidated set for B&D spares to ensure maintainability of the equipment for 5 years post expiry of warranty.

(r) **Documentation.** Documentation for the equipment must be supplied as per the latest guidelines promulgated by Indian Navy meeting the requirements Reliability Action Plan. Technical and Operators manuals and other associated technical documents should include internal circuitry details that are required to undertake in-house repairs/ support by Indian Navy.

(s) **Upgrading of System.** The vendor shall give an undertaking to make available all future upgrades to the system software and hardware. As far as possible, such upgrades should be possible with minimal change of system configuration.

(t) **Relaxation.** Relaxation or review of any feature or parameters specified herein which could lead to major reduction in cost, complexity or development and production timeframe of the system shall be informed to the user for consideration.

(u) **CAMC.** CAMC for hardware and software as part of life cycle management is to be provided by the OEM.

**PART - II****7. Procedure for Response.**

(a) Vendor must fill the form of response as given in **Annexure II to Appendix A to Chapter II**. Apart from filling details about company, details about the exact product meeting other generic technical specifications should also be carefully filled. Additional literature on the product can also be attached with the form.

(b) The filled form should be dispatched at under mentioned address:-

**Directorate of Staff Requirements**

Room No 206, D Block

Africa Avenue

Integrated Headquarters

Ministry of Defence (Navy)

New Delhi 110026

Fax: 011-26771320

Email ID: [dsr.navy@nic.in](mailto:dsr.navy@nic.in)

PoC - CDR (SR) - ND, Contact details 011-26771343

(c) Last date of acceptance of filled form is **eight weeks** from the date of posting of this RFI on MoD website. The vendors short listed for issue of RFP would be intimated.

8. The Government of India invites responses to this request only from Original Equipment Manufacturers (OEM)/ Authorised Vendors/ Government Sponsored Export Agencies (applicable in the case of countries where domestic laws do not permit direct export by OEMs). The end user of the equipment is Indian Navy.

9. The information is being issued with no financial commitment and the Ministry of Defence reserves the right to change or vary any part thereof at any stage. The Government of India also reserves the right to withdraw it should it be so necessary at any stage. The acquisition process would be carried out under the provisions of DAP.

**PART - III****GUIDELINES FOR FRAMING CRITERIA FOR VENDOR SELECTION/  
PREQUALIFICATION IN 'BUY (INDIAN-IDDMM)' 'BY (INDIAN)'**

10. The guidelines prescribed for short-listing/pre-qualification of Indian vendors in Buy (Indian-IDDMM) and Buy (Indian) cases are enumerated in the succeeding paragraphs. **Paragraph 11** deals with the parameters that may be considered for short-listing of vendors, whereas **Paragraph 12** amplifies the process for applying selected parameters to the process of vendor short listing.

**11. Parameters.****(a) General Parameters.**

(i) Applicant Entity should be an Indian Vendor as defined at Paragraph 20 of Chapter 1 of DAP 2020.

(ii) Business dealing with applicant Entity or any of its allied entities should not have been suspended or banned, by MoD/ SHQ or any Government Department or organization(as defined in Guidelines for Penalties in Business Dealings with Entities issued vide Ministry of Defence, D (Vigilance) MoD ID No 31013/1/2006-D (Vig) Vol II dated 21 Nov 2016). None of the Promoters and Directors of applicant entity should be a wilful defaulter.

(iii) "Entities" will include companies, with whom the Ministry of Defence has entered into, or intends to enter into, or could enter into contracts or agreements.

(iv) Applicant entity" may be a company, subsidiary, an associate company (as defined in the Companies Act, 2013) a consortium or a Joint Venture (JV).

**(b) Technical Parameters.**

(i) Vendor shall be a manufacturing entity or a system integrator of defence equipment and not a trading company, except in case where the OEM participates only through its authorized Vendors.

(ii) **Minimum two Years' experience in broad areas like manufacturing/ electronics etc as applicable in the instant procurement case.** If not, then cumulative experience of **at least three years in above areas**, resulting in gaining of competence for manufacturing the proposed product. (In case the SHQ feels that for a particular equipment a lesser experience could be accepted, then the same should be got approved by the competent authority before including the same in the RFP).

(iii) Where product involves integration, previous experience of **not less than one year/one project** in integration of systems/equipment shall be required.

(iv) **ICT Cases.**

(aa) Certification to be included if linked to scope of work- Gartner Quadrant/ISO9001/CMMi3 or more (specifying development /service /acquisition models) /ISO27001. For information security and large value projects preferably CMMi5 may be specified.

(ab) Compliance with IEEE/ITU standards depending upon nature/type of project or solution required.

(c) **Financial Parameters.**

(i) **Average Annual Turnover.** Minimum average annual turnover for last three financial years, ending 31<sup>st</sup> March of the previous financial year, should not be less than 30% of estimated cost of the Buy (Indian-IDD) and Buy (Indian) project.

(ii) **Net Worth.** Net worth of entities, ending 31<sup>st</sup> March of the previous financial year, should not be less than 5% of the estimated cost of the Buy (Indian-IDD) and Buy (Indian) project.

(iii) **Insolvency.** The entity should not be under insolvency resolution as per Indian Bankruptcy Code at any stage of procurement process from the issuing of RFP to the signing of contract.

(iv) **Credit Rating (Desirable Financial Parameter).** Long term credit rating equivalent to CRISIL rating on Corporate Credit Scale as **CCR-BBB or better**, and **SME-04 or better for SMEs** issued by



credit rating agencies recognized by SEBI. Credit rating should be as on 31<sup>st</sup> March of the previous financial year.

(d) **Other Parameters.**

(i) **Industrial License (IL).** Vendors should be either holding a valid defence industrial license or should have applied for the same before responding to RFP. In any case the vendor must confirm holding of IL before commencement of FET. (Items requiring IL will be as per DIPP Press Note 3 of 2014 as amended from time to time).

(ii) **Registration.** Registered for a minimum of two years (one year for SMEs). Minimum number of years not applicable for JVs constituted specifically for a project.

12. **Stipulations for Applying Parameters.**

(a) Areas like manufacturing/electronics/.explosive etc. Referred to at Paragraph 2 (b) (ii) should be defined in each case of procurement.

(b) In case the Applicant Entity is unable to meet the Financial Parameters by itself, it may rely on its **holding Company**(as defined in the Companies Act, 2013 and amendments thereof) (“Companies Act”) for fulfilment of the Financial Parameters, in which case reliance must be placed on the Holding Company towards fulfilment of **ALL** the Financial Parameters.

(c) In case the Applicant Entity is unable to meet one or more of the Technical parameters by itself, it may rely on a Group Company (ies) for fulfilment of the Technical parameters. A Group Company in relation to the Applicant Entity may be:-

(i) A Company of which the Applicant Entity it is an Associate Company such company should have ownership, directly or indirectly, of at least 26% of the voting shares of the Applicant Entity.

(ii) A Company which is an Associate Company of the Applicant Entity. The Applicant Entity should have ownership directly or indirectly, of at least 26% of the voting shares of such Associate Company.

(iii) A Company with whom the Applicant Entity is commonly owned, directly or indirectly, for at least 26% of the voting shares

by another company. For example: An Applicant Company A is an Associate Company of Company B, in which B holds at least 26%. Further, C is also an Associate Company of B, in which B holds at least 26%. In this case the Applicant Company may use the credentials of C as well.

(iv) The Holding Company and Subsidiary companies (as defined under the Companies Act) of the Applicant Entity.

(d) The Applicant entity may be a single entity or a group of entities (the “consortium”), coming together to implement the project. In such case:-

(i) The credentials of only those members of their related entities may counted, who have at least 26% equity stake in the Consortium.

(ii) Each Consortium should have a designated **Lead Member**.

(iii) For Technical Parameters, **any of the consortium members of their Group Companies** may meet the criteria.

(iv) For Financial Parameters. The Turnover and Net Worth of the Consortium Member shall be reckoned **proportionate to Consortium Member’s equity stake** in the Consortium, and each Consortium member should meet the other criteria pertaining to Insolvency and Credit Rating. In case the Consortium Member relies on its Holding Company for any one of the above-mentioned Financial Parameters, then reliance must be placed on the Holding Company for meeting **all the financial Parameters**.

(e) Vendors should provide all necessary self-authenticated document in support of their achievement of criteria. Such documentation should inter-alia include:-

(i) Details of projects/supply orders successfully executed in the last two years.

(ii) Annual reports for three years of applicant entity, parent and associate companies, consortium and JV partners.

(iii) Details of shareholders, promoters, associated, allied and JV companies.

(iv) Details of vigilance action, viz ongoing investigation and suspension/ debarment/ blacklisting actions against the applicant entity or any of its allied entities, parent company or consortium and JV partners, if any by any Department/agency of Central Government.

(v) A Certificate from CA/ CS indicating the financial parameters for the last three years as per Paragraph 2(c).

(f) Any vendor furnishing false information will be liable for action as per existing guidelines.

**REQUEST FOR INFORMATION: PROCEDURE FOR RESPONSE****Request for Information for IBS**

1. The Ministry of Defence, Government of India, intends to revise NSQRs of Integrated Bridge System (IBS) based upon experience gained and to broaden the existing qualified vendor base. The MoD, GoI, intends to procure eight Integrated Bridge System (IBS) for fitment onboard *IN* ships. OEMs/ Authorised Vendors are requested to forward information on the product which they can offer. The parameters/ broad specifications of the item are mentioned in the questionnaire attached as per Annexure III to Appendix A. In addition the vendors are required to furnish details as per Proforma at Annexure II to Appendix A.

2. Apart from the information as per the Appendices the vendors may also forward technical details/ product brochures/ literature etc pertaining to the items in question.

3. The required information/ details may please be forwarded at the following address by **eight weeks from the date of posting of this RFI on MoD website:-**

(a) **User Directorate.**

**Directorate of Staff Requirements**  
Room No 206, D Block  
Africa Avenue  
Integrated Headquarters  
Ministry of Defence (Navy)  
New Delhi 110026  
Fax: 011-26771320  
Email ID: [dsr.navy@nic.in](mailto:dsr.navy@nic.in)

(b) **Procurement Directorate.**

**Directorate of Staff Requirements**  
Room No 206, D Block  
Africa Avenue  
Integrated Headquarters  
Ministry of Defence (Navy)  
New Delhi 110026  
Fax: 011-26771320  
Email ID: [dsr.navy@nic.in](mailto:dsr.navy@nic.in)

(c) **Planning Directorate.**

**Directorate of Staff Requirements**

Room No 206, D Block

Africa Avenue

Integrated Headquarters

Ministry of Defence (Navy)

New Delhi 110026

Fax: 011-26771320

Email ID: [dsr.navy@nic.in](mailto:dsr.navy@nic.in)

(d) **ADG Acquisition Technical.**

O/o Technical Manager (M & S)

Room No 5, D-2 Wing

Ground Floor, Sena Bhawan

Rajaji Marg

New Delhi 110011

Tel: 011-23011540,

Fax: 011-23017684

## Annexure II to Appendix A

**VENDOR INFORMATION PROFORMA**

1. Name of the Vendor/Company/Firm.

-----  
-----

(Company profile including Share Holding pattern, in brief, to be attached)

2. **Type (Tick the relevant category)**

Original Equipment Manufacturer (OEM)

Yes/No

Authorised Vendor of foreign Firm

Yes/No (attach details, if Yes)  
others (give specific details)

3. Contact Details.

Postal Address.....;

City: .....

State:-

Pin Code.....Tele.....

Fax.....URL/Web Site.....

Email.....

4. Local/ Branch/ Liaison Office/Agent (if any) at New Delhi.

Name & Address:.....

Pin Code:.....Tel:.....Fax:.....

Email:.....

5. Financial Details: Category of Industry (Large/Medium/Small-scale):.....

6. **Certification by Quality Assurance Organisation.**

<u>Name of Agency</u>	<u>Certification</u>	<u>Applicable from (Date &amp; Year)</u>	<u>Valid till (Date &amp; Year)</u>

--	--	--	--

7. **Details of Registration.**

<u>Agency</u>	<u>Registration No</u>	<u>Valid till (Date)</u>	<u>Equipment</u>
GeM			
DGQA/DGAQA/DGNAI			
OFB			
DRDO			
Any other Government Agency			

8. **Membership of FICCI/ ASSOCHAM/ CII or other Industrial Associations.**

Name of Organisation

Membership Number

9. **Equipment/Product Profile (to be submitted for each product separately)**

- (a) Name of Product:.....  
(IDDM Capability be indicated against the product)  
(Should be given category wise)
- (b) Description (attach technical literature):.....
- (c) Whether OEM or Integrator:.....
- (d) Name and address of Foreign collaborator (if any):.....
- (e) Industrial Licence Number:.....
- (f) Indigenous component of the product (in percentage):.....
- (g) Status(in service/design& development stage):
- (h) Production capacity per annum:
- (j) Countries/agencies where equipment supplied earlier (give details of quantity supplied):  
.....

- (k) Estimated price of the equipment.....
- 10. Alternatives for meeting the objectives of the equipment set forth in the RFI.
- 11. Any other relevant information:.....
- 12. **Declaration.** It is certified that the above information is true and any changes will be intimated at the earliest.

(Authorised Signatory)



## Annexure III to Appendix A

**REQUEST FOR INFORMATION: QUESTIONNAIRE**

Ser	Specifications/ Parameters	Reply
1.	Do you comply with complete QRs (operational and technical parameters) placed at Annexure IV? Please provide feature wise compliance?	
2.	Any new specifications/ features/ technology development not included in QRs and are being offered by the OEM?	
3.	Will you provide complete support for software and hardware issues?	
4.	Provisioning of IBS under Buy Indian (IDDM) (preferred) (Indigenous Design & IC content $\geq 50$ %) / Buy Indian categorisation (IC content $\geq 60\%$ , incase of indigenous design $\geq 50\%$ ) iaw DAP 20?	
5.	Have you supplied IBS to IN/ foreign navy/ Merchant Navy? Its performance and difference vis a vis QRs at Annexure IV?	
6.	What is the maximum time that you would take to deliver IBS post contract?	
7.	What is the status of IBS Technology Readiness Level (TRL) with your firm?	
8.	How would you ensure that operational requirements projected at Annexure IV vis a vis network requirements onboard ship are met in totality?	
9.	Does the software cater for easy de-bugging and follow the laid down industry standards? If yes, what standards are followed? Does the architecture of the software cater for easy re-loading of corrected embedded software / firmware by IN maintainer?	
10.	What is experience in integrating with associated Nav aids iaw QRs at Annexure IV?	

Ser	Specifications/ Parameters	Reply
11.	Give details of MFCs, MFDs and ICC specifications for small ship and large ship configuration?	
12.	Please provide details wrt IBS configuration for small ships (corvette and below) and large ship configuration?	
13.	Please provide if any AI technology is incorporated in IBS? Will it utilize hybrid AI algorithm?	
14.	In case of failure of one MFC/ MFD, will other MFCs and MFDs would be available for exploitation?	
15.	In case of network failure, will individual hardwired MFCs be available for exploitation as Nav Radar and ECDIS to ensure minimum navigation functionality at all time?	
16.	In case of more than one power amplifiers, is the power supply common or do the amplifiers have independent power supplies? Also, in case of failure of one amplifier, will the other amplifiers continue to stay in operation mode?	
17.	Does the system have a high visibility display providing brightness and contrast control? Give details of display viewing angles and limitations, if any. Also list the details of parameters/features available for viewing on the front panel display.	
18.	Provide detailed information of PDS and POU?	
19.	Functionality of MFDs that would be fixed on ICC?	
20.	MFDs that would be fitted on bridge top, wings needs to be weather proof? Please provide details?	
21.	What is the IP specification of OBD to ensure protection from weather/ marine environment?	
22.	Utilisation of Indigenous Military Material and Indigenous Software, indicating plan for material sourcing iaw Para 11 and 13 of Ch II of DAP 20 be indicated.	
23.	Cost estimate including taxes and duties is to be provided.	

Ser	Specifications/ Parameters	Reply
24.	Mode of FET (Physical trials/ documentation/ certification/simulation) and trial methodology as per parameters in QRs, including parameters for product evaluation is to be provided.	
25.	Vendor information and relevant documents wrt vendor being MSME and /or startup may be provided iaw Para 23, Chapter II of DAP 20.	
26.	Inputs on alternatives to meet the same/ better operational requirements is to be provided	
27.	Inputs on compliance and/or conformity to various industrial and military standards as applicable as per QRs, related to operations and safety be provided.	
28.	Undertaking is to be provided stating that “The vendors/ firms (name) have never been banned/ debarred from doing business dealing with MoD /Gol/or any other Govt organisation.	
29.	Confirmation is to be provided wrt submission of PWBG at the rate as promulgated by MoD at the time of tender submission.	

22. **After Sale Support.** The following details will be provided by the vendor:-

- (a) Repair methodology being proposed.
- (b) What kind of Engineering Support Package (ESP) and life time support can be provided alongwith financial implications?
- (c) How are similar kind of systems being maintained by the vendor?
- (d) Will the requisite spares, SMT/ STE be provide by the vendor for carrying out component level repairs?
- (e) What would be the training mechanism for operators and maintainers?
- (f) Proposal for CAMC/ RRC with cost implications.

23. **Product Support and Upgradability.** The vendor shall indicate and give details of the information sought listed below:-

- (a) All major repairs and overhaul facilities for major assemblies and component level owned by the vendor India.
- (b) Base overhaul facilities and availability of infrastructure in India.
- (c) Management of repairs and spares post warranty.
- (d) Upgrade for software (as applicable).
- (e) Upgradability of hardware for enhanced performance features or due to modifications required to obviate recurring defects.
- (f) Vendor shall indicate conformity to submission of Manufacturers Recommended List of Spares (MRLS), Illustrated Spare Part List and Technical Manuals including for STEs.
- (g) Vendor shall indicate compliance to Tangible Obsolescence Management Plan and plan for upward compatibility with latest modules.
- (h) Vendor shall provide details of vendors/ sub-vendors and readiness/ lead time towards provisioning of spares.

24. **Manufacturing and Production Aspects.**

- (a) Vendor shall provide details of all R&D and manufacturing infrastructure.
- (b) **Indigenization.** Vendor shall give out ability and willingness to supply the product to meet the requirements of **Buy (Indian-IDD) and/ or Buy (Indian)** to meet the aim of indigenization as per the provisions and spirit of DAP 2020.
- (c) **Production Capacity.** Vendor will give out his current and planned annual production capacity and proposed delivery schedule of the equipment. The timeline required to deliver required quantity of the equipment for trials and post contract, time required to deliver the equipment.
- (d) Vendor should indicate willingness to participate in trials as per DAP 2020 in India on NCNC basis.

- (e) Vendor should give details on use of indigenous military material and software indicating plan for sourcing material and cost implications vis-à-vis foreign sourcing of material.
25. **Test Standards.** Inputs on test standards adopted for similar equipment type be indicated. Equipment procured by Indian Navy has to undergo environmental test and other relevant checks by nominated CQAE, FATs as per Mil Std/ JSS 55555 requirements.
26. **Certification.** Parameters for which certifications can be made applicable and provided in lieu of trials evaluation. Details of parameters of the equipment which can be certified from NABL accredited labs will be indicated.
27. **Financial Aspects.** Vendor shall intimate the cost of one IBS system as mentioned at 'Annexure IV', inclusive of taxes and duties. Details of cost should also include product support package, training, additional details as deemed appropriate.
28. **Compliance with Provisions of DAP 20.** Vendor should indicate compliance with all provisions of DAP-20. If not, which Para/ clause of DAP-20 not agreed with reasons be indicated.
29. Vendor should also indicate willingness for option clause as per DAP 2020.
30. **Training.** Vendor shall indicate ability and willingness to offer following:-
- (a) Training aggregate for conduct of training like technical literature, slides, blow up diagrams, training work modules, brochures and Computer Based Training package.
  - (b) Vendor shall indicate the facilities available at Vendor's premises to conduct training. Vendor should also indicate training for user, maintainers, and QA personnel.
  - (c) Recommended training period for users, maintainers and QA personnel.
  - (d) Availability and cost of simulators if any.
  - (e) Availability of willingness of the vendor to provide hard and soft copies of the User Handbook, Design Specifications, Technical Manuals along with CBT for training.

31. If vendor is MSME and/ or Startup, relevant information and supporting documents are to be provided.
32. Vendors to specify the protocols/ security features being followed to maintain cyber security of the transmitter. Please indicate acceptability and implementation of provisions with respect to security/ malicious codes as per DAP-20.
33. **Undertaking on Debarment.** Vendor should provide an undertaking that it was never banned/ debarred from doing business dealing with MoD/ Gol/ or any other Govt organization.
34. Indicate if same or similar system has been supplied to any other customer along with details of deviation in capabilities and cost, if any.
35. **Miscellaneous.**
  - (a) Extract of relevant technology perspective, and capability roadmap to be included.
  - (b) Any futuristic plans for modification and or modernization plans for the equipment being offered.
  - (c) Vendor may consider RFI as advance information to obtain requisite government clearances.

## OPERATIONAL AND TECHNICAL PARAMETERS

### PART A - INTRODUCTION

1. **Definition.** An Integrated Bridge System (IBS) is defined as a combination of navigation aids, equipment and sensors, which are interconnected in order to allow centralised access to sensor information and to enable effective Bridge Resources Management from workstations, with the aim of increasing the safety of the ship and her navigational efficiency.

2. **Functionalities.**

(a) The IBS system should provide for the following key functionalities:-

- (i) ECDIS.
- (ii) ARPA.
- (iii) Conning Display.

(b) Integrated Bridge System (IBS) should facilitate effective and safe bridge resource management. It should enable expeditious, continuous and effective information processing and decision making by bridge team and enhance situational awareness of bridge team. Following additional benefits are to be accrued from optimal exploitation of IBS:-

- (i) IBS should integrate radar pictures, ECDIS, inputs from navigation aids like gyro, log, echo sounder, AIS, DGPS etc in a single Multi-Function Console (MFC) and present a comprehensive navigational situation to the Officer of the Watch (OOW).
- (ii) IBS should automatically provide time stamped record of each field, thus helping in accurate record keeping.
- (iii) IBS should provide functionality of expeditious position fixing in pilotage waters with aid of OBD.
- (iv) Fitment of IBS should standardise the displays on *IN* ships.

(v) IBS should operate on a double redundant network, thus increasing navigational safety.

(vi) IBS should record the voice communications in the bridge and verbal instructions passed over the machinery, action and conning intercoms.

(vii) IBS should enhance bridge ergonomics which subsequently aids in optimisation of Bridge Resource Management (BRM).

(viii) IBS should be hard wired to Gyro, Log, DGPS, AIS, Echo Sounder and Nav Radar(s) feed with one each MFC in the Bridge, Chart House/ Ops Room, in- addition to the IBS distribution units to prevent catastrophic failure.

(ix) A failure of one part should not affect other parts except for those functions directly dependent upon the information from the defective part.

**PART B - ESSENTIAL PARAMETERS A**



## SECTION I - OPERATIONAL PARAMETERS

1. **Configuration.** The IBS configuration should include the following components:-

- (a) Multi-Function Consoles (MFCs).
- (b) Multi-Function Displays (MFDs).
- (c) A dual redundant network, along with network switches and /or hubs and gateways.
- (d) Sensor Integration Units/ Sensor Concentrators, to interface with navigational aids and Ships Data Network.
- (e) Radar switching units or similar equipment, to enable control of the radar trans-receivers through the Multi-Function Consoles.
- (f) A 'Fixed Type' Voyage Data Recorder (VDR).
- (g) Optical Bearing Devices.
- (h) Integrated Captain's Consoles.
- (j) A gateway to exchange data with IPMS/ BDCS/ CMS network (if the ship being fitted with IBS is provided with IPMS/ BDCS).
- (k) Portable Operating Unit.
- (l) Portable Diagnostic Unit.

2. **Scope of Supply by OEM.** In-addition to the equipment listed at Para 1 above, the equipment that are required to be included within the vendor scope of supply of IBS and the related interfacing requirements are as follows:-

<u>Ser</u>	<u>Equipment</u>	<u>Scope of Supply &amp; Interfacing Requirements</u>
(a)	Compatible I and E/F band Nav Radars alongwith combiner units.	(i) Included in the scope of supply of the IBS from IHQ MoD (N) nominated vendor list or duly approved by IHQ MoD (N) prior induction iaw
(b)	AIS	

<u>Ser</u>	<u>Equipment</u>	<u>Scope of Supply &amp; Interfacing Requirements</u>
(c)	Transmitting Magnetic Compass.	approved NSQRs/ SOTRs promulgated by IN.
(d)	Automatic Weather Observation System (AWOS) for weather observation (Cloud Height, Temperature, Pressure Relative Humidity and Visibility).	(ii) The IBS vendor shall be responsible for the complete system integration.  (iii) IBS is to be interfaced with Wind Speed Direction Sensor (WSDS) and AWOS.
(e)	DGPS/ G3I Receiver	WSDS is to be interfaced with IBS for providing wind data for launch and recovery of aircraft. Cloud height, temperature, humidity, visibility data is to be provided to conning page of IBS by AWOS.  (iv) The sensors integrated with the IBS, other than the Nav radars namely AIS, AWOS, WSDS, DGPS and Transmitting Magnetic Compass should have their own dedicated displays.  (v) The equipment being included in the scope of supply of the IBS {(a) to (e)} should also be interfaced with the other ship's system viz CMS, ECDIS, radars etc. The same would be specified in the ship specific RFP.  (vi) SATs of all equipment being included in the scope of supply of the IBS {(a) to (e)} in addition to IBS would be offered by IBS vendor.

<u>Ser</u>	<u>Equipment</u>	<u>Scope of Supply &amp; Interfacing Requirements</u>
		(vii) The data from all equipment included in the scope of supply of IBS is to be available on IBS network to ensure feasibility of data exchange with other network or equipment.

3. **Scope of Supply by IN/ Shipyard.** The scope of supply by *IN/shipyard* which needs to be factored for interfacing with IBS are as follows:-

<u>Ser</u>	<u>Equipment</u>	<u>Scope of Supply &amp; Interfacing Requirements</u>
(a)	Steering System with Auto Pilot.	(i) These equipment would be Navy/ shipyard supply.
(b)	Gyros/ INS SA	(ii) IBS is to be interfaced with the equipment fitted on board.
(c)	Echo Sounder.	
(d)	Electro Magnetic Log.	(iii) In cases where the ship system do not provide data as required by IBS (viz syncro /proprietary protocols), the necessary conversion is to be undertaken at the IBS end.
(e)	Combat Management System -for output of data, as subsequently described in this document.	
(f)	Integrated Platform Management System (IPMS) - for input data, as subsequently described in this document.	
(g)	Wind Speed Direction System (WSDS) for providing Wind Speed and Direction for launch and recovery of aircraft.	(iv) The data from all equipment being interface with IBS is to be available on IBS network to ensure feasibility of data exchange with other network or equipment.
(h)	Time Reference Server	

4. **Bridge Design.** A two-dimensional isometric layout design of the bridge will be required to be provided to IHQ MoD (N) for approval. The design should be in compliance with IMO and class rules. In case of existing ships, this would also include fitment of IBS inside the Bridge, Ops room and any other compartment along with re-location of existing equipment.

### **Functionalities of IBS Sub Systems and Interfaced Nav aids**

#### 5. **Multi-Function Consoles.**

(a) **Type.** The Multi-Functional Consoles (MFCs) are to be identical (except where specified herein) and interchangeable, both functionally and physically. Each MFC is to comprise a Flat Panel Display (LED) display, a keyboard with associated tracker ball and processor (s). The display should be of, at least 23 inch (diagonal) size, with a minimum screen resolution of 1920 x 1080 pixels. There should be a provision on the MFCs to switch the displays to day or night mode, with a facility for dimming up to 'zero' level.

(b) **Locations of MFC.** The MFCs would be installed in the Chart House, Bridge, Ops Room, Flag Bridge, ECP and ADR (if applicable). Exact number and locations of MFCs would vary depending on the type/ class of the ship. The same would be specified in the ship/ class specific RFP.

(c) **Configuration.** The configuration of MFCs should be as indicated below:-

(i) **Introduction Page.** A custom designed page displaying a welcome message on the backdrop of the digital silhouette of the ship, the Naval Ensign and the National Flag. This would be the first page displayed on each MFC when the system is powered on.

(ii) MFCs should be configured using the Master-Master (also referred to as Multi-Master) concept. Each MFC should have the ability to fulfil all IBS functions.

(iii) Where control of sensor (like radar trans-receivers) is being exercised by the earmarked MFC fitted inside the bridge and Ops Room, that MFC would become the 'Station-in-Control' for the relevant sensor/ function. In such a case, no other MFC should be able to exercise control of that sensor. However, the information from that sensor should continue to be available for display on all

other MFCs. An indication that an MFC is the 'Station-in-Control' for a particular sensor should be available on the other MFCs.

(iv) Means should also be available to relinquish control of a sensor from the MFC, when desired, so that another MFC may assume the 'Station-in-Control' for that sensor. During change from Master to Master or Master to Slave the route data on ECDIS/ targets acquired on radar should not be lost.

(d) **Conning Display Mode.**

(i) One of the selectable modes/ menus of the MFC should include the 'Conning Display' mode. The purpose of the Conning Display Mode is to present the ship's configuration/ status in graphical manner and data collected from the ship's navigation, manoeuvring, propulsion and steering sensors, in groups.

(ii) The GUI of the Conning Display Pages should be customisable, depending upon the class of the ship on which the system is being fitted. The customisation is to be approved by IHQ MoD (N).

(iii) The list of Conning Display Pages should include, but not be limited to the following pages: -

(aa) **Met and Astro Page.** This page should display information received from met sensors and shall include, but not be limited to such as Wind Speed and Direction, Temperature, Pressure and Relative Humidity. In-addition, there should be software provided by OEM for carrying out astronomical and tidal predictions based on the date, time and position of the ship.

(ab) **Navigational Data Page.** This page should display information received from navigational sensors and shall include, but need not be limited to: -

(aaa) Date and Time.

(aab) Ship's position.

(aac) Speed over ground.

(aad) Heading.

(aae) Course over ground.

(aaf) Rudder angle.

(aag) Depth.

(aah) Drift.

(ac) **Machinery Status Page**. This page should display status of the following machinery (but not be limited to) received from IPMS:-

(aaa) Main Engines.

(aab) DAs.

(aac) ACs.

(aad) Steering Gears.

(aae) Ref Plants.

(aaf) Fuel and Water state of the ship.

(aag) Graphical display of propulsion machinery and bow thrusters (if fitted) is also to be available.

(iv) **Flying Operations (SHOL) Display**. This page should display SHOL data for each type of helo. The SHOL data fed by user is to be depicted diagrammatically. The flying operations page should display wind and met data relevant for flying operations. The Flying Operations page should have option to calculate Foxtrot Corpen.

(e) **Software Back Up**. The IBS Vendor will be required to provide Software Backup with each system, along with the necessary permissions to load on the MFCs. System software backup is to be provided with necessary software and drivers to read the back-up images and re-boot the system.

## 6. **Multi-Function Displays (MFDs)**

(a) **Purpose and Type**. In-addition to the MFCs, Multi-Function Displays (MFDs) are to be provided with the system. MFDs are to be TFT (LED) colour displays of 10-12 inch diagonal size. These are to serve as repeater indicators for navigational data and to display the information from Conning Display Pages. The MFDs located at Bridge top, MCR and on

Integrated Captains Chair should be able to display Nav Radar and ECDIS data in addition.

(b) **Location of MFDs.** MFDs would be installed in Bridge, Bridge Top, Chart House, Secondary Steering Position, Ops Room, ECP, Flag Bridge and Bridge Wings. Exact number and locations of MFDs would vary depending on the type/ class of the ship. The same would be specified in the ship/ class specific RFP.

(c) **MFD Readability.** There should be a provision on the MFDs to switch the displays to day or night mode, with a facility for dimming upto 'zero' level. Additionally, the data displayed should be readable during daytime (minimum 1000 Nits). MFDs fitted in exposed locations viz bridge wings, ECP, bridge top etc would need to be ruggedized to meet IP 66 standard. The MFDs should have touch screen functionality.

7. **Portable Operating Unit.** The Portable Operating Unit (PoU) would be a laptop and perform functions akin to MFC. They would provide redundancy in case of MFC failure and would provide MFC capability in compartments like ECP having space constraints. The POU should be capable of being plugged into LAN ports provided across the ship. The number and location of POU ports would be differ from ship to ship and would be provided in RFP.

8. **Portable Diagnostic System.** The Portable Diagnostic System (PDS) would be a laptop based utility for diagnosing the fault in IBS. The PDU should be capable of being plugged into LAN ports provided across the ship. The number and location of PDU ports would differ from ship to ship and would be provided in RFP.

9. **Integrated Captain's Console.** The IBS package will include the Integrated Captain's Console(s) (ICCs) for the integrated bridge. The Console(s) is to be in form of a chair with built-in internal communication suite (linked with the ship's intercom system), a collapsible front desk, overhead reading lamp, collapsible/ foldable LED touch screen providing IBS inputs built in the arm rest. The console should have a suitable foot-rest and the reclining features built in. The ICC would be fitted in Bridge and Flag Bridge. Exact number of the ICCs would be included in the ship/ class specific RFP.

10. **Optical Bearing Device (OBD).** The OBD should be capable of plotting visual position lines on the ECDIS, thereby providing a means of plotting a visual fix on the ECDIS directly. Additionally, it should be able to provide the target

identity feedback to the operator from the AIS. Three OBDs are to be fitted in bridge and on either wings.

#### 11. Voyage Data Recorder

(a) A Voyage Data Recorder (VDR) is to be provided as a part of the IBS, to record navigational information.

(b) The VDR should be able to record the voice communications in the bridge, bridge top and the verbal instructions passed over the machinery, action and conning intercoms. The number of microphones provided inside the Bridge, in Bridge wings, on Bridge top and in the MCR should ensure recording of all voice communication. In-addition, VDR should be able to integrate with at least one VHF channel. The number of channels to be provided for voice recording would be specified in the ship/ class specific RFP.

(c) The communication recorded should be reproducible in a 'time-event log' format.

(d) The 'protective capsule' for the VDR, as required by IMO regulations, needs to be provided. Access to VDR data should be restricted through password control.

(e) The VDR should conform to the contemporary Performance Standards promulgated by IMO and published in the contemporary edition of IEC.

(f) Provision should be made for long-term storage of information (atleast 90 days) on VDR. Facility for external storage of the old records is also to be provided.

(g) It should be possible to replay selected recorded data on a commercial PC. All data received at VDR should be parsed and all individual fields/ parameters must be recorded and presented in readable format with option of time correlation for each field. The PC and associated replay software should be included in the scope of supply of the IBS.



12. **ECDIS Functions.** The ECDIS functions should be in compliance of following in addition to Appendix 'A':-

- (a) Each MFC should be able to display the complete ECDIS functions.
- (b) The ECDIS functions provided should conform to the contemporary Performance Standards promulgated by International Maritime Organisation (IMO) and International Electro-technical Commission (IEC).
- (c) **ENC Loading Capability.** All MFCs should accept ENCs in all IMO approved formats. All MFCs should have the permissions for updating Electronic Navigation Charts (ENCs) for chart corrections. The chart correction undertaken on any one MFC should be automatically updated on other MFCs. In addition, it should meet following standards:-
  - (i) S-63 - IHO Data Protection Scheme Edition 1.1.1 / S100 or latest upgrade.
  - (ii) ECDIS display and presentation IHO S-52 PresLib Edition 3.4.or upgrade.
  - (iii) RNC S 61 (Product Specifications for Raster Navigation Charts) or an upgrade.
  - (iv) The system should be able to load and display the Additional Military Layers (AMLs) to function as WECDIS. The system should also be capable of integrating 'Edition 1 and 2' AML.
- (d) **Specific Requirements.** The ECDIS should provide the following facilities in-addition to those specified by the contemporary IMO standards:-
  - (i) Renaming and labelling of routes and waypoints.
  - (ii) Labelling of target tracks should be possible on ARPA. Labels of the targets labelled on ARPA should appear automatically on ECDIS.

(iii) Data of a tracked target is to be correlated, so as to show a single track on ECDIS display.

(e) **Pilotage Tools.**

- (i) Feature of drawing LDL and Clearing Bearing/Lines.
- (ii) Plotting of wheel over position by multiple methods as per BR 45.
- (iii) Facility for plotting manual fixes in a simplified manner with option of preselecting fixing objects & marks.
- (iv) Feature to enter True Bearing and Range for manual fixing.
- (v) Time stamped position line while undertaking terrestrial fixing.
- (vi) Geometric shapes to support pilotage plan.
- (vii) Facility of displaying predicted Tidal Stream or Current vector with effective time and strength.
- (viii) Capability to interface with Optical Bearing Device (OBD) and Voyage Data Recorder (VDR).

(f) **General Features.**

- (i) Password based access to various ECDIS functions.
- (ii) Capability to display and manage Additional Military Layers (AMLs).

(g) **Desirable Attributes.**

- (i) Water Space Management and Moving Havens.
- (ii) Provision of manual corrections to Tidal Stream.
- (iii) Facility to plot fixes using Running fix, HSA and VSA.
- (iv) Linking of LDL and Clearing Bearings/ Lines with Anti-grounding alarm.

(v) Voyage Data storage capacity of atleast 90 Days.

13. **Radar Functions**. The Radar functions should be in compliance of following in addition to Appendix 'B' & 'C':-

(a) The IBS should be interfaced with all the 'I' and E/F band navigation radar trans-receivers, installed on the ship. It should be possible to control the radar(s) from MFCs in control.

(b) Each MFC should also provide for radar functions as mandated by IMO regulations. It should be possible to manipulate the radar controls namely range scale, pulse length, PRF, anti-sea clutter, anti-rain clutter, interference suppression etc from the MFC which is the 'Station-in-Control'.

(c) The radar functionality on each MFC should conform to the contemporary Performance Standards promulgated by IMO and IEC document.

(d) Combiner units are to be provided so as to ensure all round picture for enhancing situational awareness. In case of tripping of one radar, the combiner unit should be able to automatically provide complete picture across all sector for other radar.

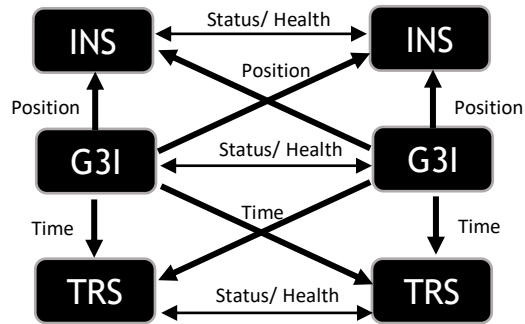
14. **DGPS/G3I**. The DGPS supplied by the OEM should comply relevant IMO regulations and NSQRs/ SOTRs promulgated by IHQ Mod (N). G3I receiver is to be provided by OEM instead of DGPS from IHQ MoD/ (N) nominated vendor as and when inducted by IN.

15. **AIS**. The DGPS supplied by the OEM should comply relevant IMO regulations, NSQRs/ SOTRs promulgated by IHQ Mod (N) and Appendix D.

16. **Transmitting Magnetic Compass**. The Transmitting Magnetic Compass supplied by the OEM should comply relevant IMO regulations and NSQRs/ SOTRs promulgated by IHQ Mod (N) and Appendix E.

17. **AWOS**. The AWOS supplied by the OEM should comply relevant IMO regulations and NSQRs/ SOTRs promulgated by IHQ Mod (N).

18. **Temporal Alignment.** Aligning set of systems with a designated time standard or reference would require each system's internal time to be transformed onto a common time axis. The IBS software should be able to accurately fuse time and position sensitive data from multiple sources based on accuracy and provide redundancy of sources with pre-determined sequence of graceful degradation. This should be iaw temporal and geospatial guidelines at Appendix F. Broad configuration shall be as follows:-



## SECTION II - TECHNICAL PARAMETERS

### 1. System Implementation.

(a) The reliability of the system is to be ensured by providing an open architecture dual redundant fibre optic network. The network load handling capacity would be ascertained during FATs, through testing actual numbers of MFCs and MFDs and through simulating maximum number of tracks that can be handled by the ARPA software.

(b) The IBS should comply with all applicable IMO requirements and recommendations. Parts executing multiple operations should meet the requirements specified for each individual function they control, monitor or perform.

(c) The Man Machine Interface (MMI) should be designed to be easily understood and in a consistent manner.

(d) The system management should ensure, that one user only has the focus of an input or function at the same time. If so, all other users should be informed about that by the IBS.

(e) It should always be clear, from where essential functions may be performed.

(f) Arrangement of consoles and equipment location should be user oriented and ergonomic. The consoles should be ergonomically designed to cater for operations whilst sitting and standing. The exact number of consoles requiring seated and standing operations would be specified in RFP.

(g) IBS OEM to provide carcass for fitment of IBS consoles and third party equipment in bridge. The carcass is to be optimised based on class of ship and available space in bridge. The dimensions, drawing and positioning of equipment on carcass would be approved by *IN*.

(h) The IBS would be fitted onboard *IN* ships in Small Ship or Large Ship configuration depending upon class of ship. The dimensions and number of MFCs and MFDs would vary depending upon type of configuration and available space. The same would be specified in RFP.

## 2. **Redundancy.**

(a) IBS shall be so arranged that failure of one sub-system is brought to immediate attention of the OOW of the navigational watch by audible and visual alarms, and does not cause failure to any other sub system. In case of failure in one part of an IBS, it shall be possible to operate each other individual item of equipment or part of the system separately.

(b) A failure of one part should not affect the functionality of other parts except for those functions directly dependent upon the information from the defective part (individual module, equipment or subsystem).

(c) Gyro, Log, DGPS, AIS, Echo Sounder, Nav Radar(s) and EM Log feed are to be hardwired with one each MFC in the Bridge and Ops Room, in-addition to the IBS distribution units. In case of network failure/ IBS failure individual hard wired MFCs should function as Nav Radar MFCs and ECDIS MFC providing basic navigational functionality. A failure in connectivity should not affect the individual functionality.

(d) Technical fault/breakdown/ software snag of any of the MFCs should not affect the function of other MFCs.

(e) The system architecture is to factor for redundancy so as to avoid single point failure attributable to one part/system.

(f) For actions which may cause unintended results, the IBS should request confirmation from the operator.

(g) The system should have graceful degradation and should be dual redundant.

## 3. **Integration.** The IBS should meet the following requirements:-

(a) The functionality of the IBS should ensure that its operation on one each MFC in the bridge, chart house and ops room is as effective as for the entire system put together.

(b) Gyro, Log, DGPS, AIS, Echo Sounder, Nav Radar(s) and EM Log feed are to be hardwired with one each MFC in the Bridge and Ops Room, in-addition to the IBS distribution units. The Nav radar with least blind arc is to be hardwired with bridge MFC and other to Ops room MFC. E/F radar is to be hardwired with bridge MFC. The system should cater for fully reliable, dual redundant data network for distribution of feed from gyro,

log DGPS, AIS, Echo sounder and Nav radars to all sub systems and MFCs. Redundancy in data and network needs to be worked out during formulation of system architecture and the same is to be finalised during system design review.

(c) Failure of a sensor/ feed from any sensor should not affect the functions of other sensors/ IBS. Status of such failed sensors is to be indicated as data not available on relevant pages with suitable alarm.

(d) The functionality of the IBS should ensure that it's operation is at least as effective as for stand-alone equipment.

(e) Where multifunction displays and controls are used to perform functions necessary for safe operations of the ship they should be duplicated and interchangeable.

(f) It should be possible to display complete system configuration, the available configuration and the configuration in use.

(g) Each part to be integrated should provide details of it's operational status and latency and validity of essential information. Means should be provided within the IBS to make use of this information.

(h) An alternative means of operation should be provided for essential function.

(j) An alternative source of essential information should be provided. The IBS should identify loss of either source.

(k) The source of information (sensor, result of calculation or manual input) should be displayed continuously or upon request.

4. **Software Back Up.** The IBS Vendor will be required to provide Software Backup with each system, along with the necessary permissions to load on the MFCs. System software backup is to be provided with necessary software and drivers to read the back-up images and re-boot the system.

5. **Network Monitoring Capability.** The system should have provision to integrate with other open architecture based systems. System design is to cater for 'Network Monitoring'. The dual redundant fibre optic network should be on master-master configuration and there should not be any time interval in change over in case of failure of one of the networks. Failure of the network should be notified to the operator through Audio/Visual alarm.

6. **Data Exchange.**

(a) Data exchange should ensure safe operation of the ship.

- (b) The integrity of data flowing on the network should be ensured.
- (c) A failure in the connectivity should not affect independent functionality.
- (d) The system should be able to carry out a failure analysis and also document it.

7. **Alarm Management.**

- (a) Alarm management on priority and functional groups should be provided within the IBS.
- (b) The number of alarm types and their releases should be kept low by providing information or indications.
- (c) Alarms should be displayed prominently indicating reasons for alarm.
- (d) **Muting of Alarms.** For the MFCs co-located in one compartment, eg the Enclosed Bridge, facility is to be provided for muting the audio alarm for all the MFCs from any one MFC.

8. **Power Supply, Interruptions and Shutdown.**

- (a) Power should be supplied to the IBS from both the main and alternate source of electrical power with automated changeover.
- (b) If subjected to an orderly shutdown, the IBS should, upon switching-on, come to an initial default state.
- (c) After a power interruption, full functionality of the IBS should be available after recovery of all sub-systems.
- (d) IBS should be supplied with online UPS with maintenance free lead acid sealed battery capable to provide backup power supply for at least 30 minutes. The batteries should be sourced indigenously.
- (e) The Nav Radar with least amount of blind arc is required to be provisioned with EED compliant UPS with atleast 30 min backup, iaw Roadmap for Electrical Change Management Policy letter EE/03/9712(safety audit) dated 31 May 19 or latest. UPS backup is to be available for all sub systems of radar (antenna, Tx/Rx and Combiner unit), so as to ensure that the radar picture is available in case of total power failure.



9. **Interoperability with CMS.** IBS should be able to provide the following outputs to the Combat Management System (CMS) (if fitted on board):-

(a) Signal conditioning of all analog signals for video/ blanking needs to be catered by the IBS as required.

(b) Navigational Radar ARPA tracks. In case of multiple Nav Radars fitted onboard, correlated track of all nav radar with respective radar identifiers are to be provided to CMS.

(c) MFC/MFD fitted in Ops room should be able to provide additional display output via HDMI/VGA to integrate the feed of IBS into Vertical Remote Display (VRD) of CMS.

10. **Power Supply.** IBS is to be supplied with suitable step down transformer 380/ 415 V to 230V 50 Hz 1 phase for input power supply to the system. Further, all other secondary supplies required for the system operation are to be derived from the main input power supply (230 V 50 Hz 1 phase).

11. **UPS.** The IBS should be supplied with online UPS with maintenance free **lead** acid sealed battery capable to provide backup power supply for at least 30 minutes. The batteries should be sourced indigenously. The UPS should meet MIL STD 461-F, as amended, for EMI/ EMC requirements.

12. **IEC Standards.** The environmental, shock and EMI/ EMC standards for the equipment supplied within the scope of IBS are to comply with IEC 60945 standards or contemporary amended versions. In-addition, the UPS supplied as part of IBS should also meet MIL STD 461-E applicable standard for EMI/EMC requirements.

13. **Built-in Test Equipment (BITE).** The BITE software should run automatically at power-up in any mode of operation and should have control over the sub-system hardware. The design of the system should cater for the following features:-

(a) Built-in Test (BIT) facility is to identify, locate and indicate to the operator any fault that has occurred in the system during operation in all modes. BIT messages shall be displayed at the bottom of the operator colour screens.

(b) The BIT shall isolate all detected faults to Line Replaceable Unit (LRU) level. The BITE shall be capable of identifying the faults of physical communication breaks also.

(c) It should be possible to display the results of built-in tests on any MFC.

14. **Software Standards.** The software used in the IBS should be 'type approved' meeting contemporary IMO and IEC standards.

### **SECTION III - MAINTAINABILITY AND ERGONOMICS PARAMETERS**

1. **Maintainability.** The maintenance philosophy of IBS would be through long term CAMC towards ensuring seamless product support (hardware and software) post induction.
2. **Ergonomic Criteria.**
  - (a) Integrated display and control functions should be standardised across various displays, controls and Human Machine Interface (HMI).
  - (b) The information displayed in the HMI is to follow a standard format amongst all displays.
  - (c) The HMI should accept manual inputs.
  - (d) For manual inputs that may cause unintended results, the IBS should request confirmation before acceptance, thus providing a plausibility check.
3. **IC Content.** Minimum Indigenous Content (IC) as specified in DAP 20 for Buy Indian (IDDM) is to be ensured.
4. **Trial Methodology.** The trial methodology is relevant for IBS and all associated equipment being supplied as part of IBS such as Radar, ECDIS, AIS etc. The trials would be conducted for all nav equipment along with IBS as per approved trial schedule. Following would constitute towards trial methodology:-
  - (a) **Validation Trials.** FET would be conducted where applicable, else validation trials would be undertaken.
  - (b) **FATs.** Integrated FATs would be undertaken iaw finalised ICDs wherein OEM would be required to develop own system simulators which is to be forwarded for validation. These would be undertaken at vendor's premises by services nominated team to check the equipment functional performance as per an approved test procedure prior dispatch. FATs to be conducted in a configuration as close to the actual layout onboard, before the equipment is cleared for dispatch for onboard use/ installation including the carcass.

(c) HATs/SATs. The methodology for the Acceptance Trials will be proposed by the OEM and approved by *IN*. The trials may be carried out in phases if required. The trials will be conducted onboard fitted platform.

**Appendix 'A'**  
**(Refers to Section II Para 12)**

**PERFORMANCE STANDARDS OF ECDIS**

**Electronic Chart Display and Information System (ECDIS)**

1. **Introduction.** Electronic Chart Display and Information System (ECDIS) is a navigation information system, which, with adequate backup arrangements, can be accepted as complying with the up-to-date chart required by Regulation V/19 and V/27 of the 1974 SOLAS Convention, as amended. It displays selected information from a System Electronic Navigation Chart (SENC) with positional information from navigation sensors to assist in route planning and route monitoring.

2. **Performance Standards.** The ECDIS should conform to the following contemporary Performance Standards promulgated by International Maritime Organisation (IMO), International Electro-technical Commission (IEC) and International Hydrographic Organisation (IHO) in addition to the requirements enumerated in the succeeding paragraphs. The ECDIS should form integral part of IBS MFC & MFDs. It should comply with following IMO and IEC standards:-

- (a) IMO Resolution MSC.232(82) 2009-Revised ECDIS Performance Standard, as amended from time to time.
- (b) IEC Standard 61174 (2015), as amended from time to time.
- (c) IHO Standards S-52 and S-64, as amended from time to time.

3. **Features.** ECDIS should have the capability to perform functions of Navigation, Planning and Conning Information besides having the following fundamental features :-

- (a) Colour vector chart presentation.
- (b) Multi-chart loading.
- (c) Zoom (in/out)

- (d) Display, update and manage fully digitised and/ or raster scan electronic charts in an IHO approved format.
- (e) Review (chart scrolling).
- (f) Information on any charted element and on the chart itself, including lists of lights, sailing directions etc.
- (g) North up/ True Motion mode presentation.
- (h) WGS-84 geodetic datum.
- (j) Automatic chart reset and generation of adjacent chart.
- (k) Chart auto load mode.
- (l) On screen help function.

4. **IBS MFCs with ECDIS Functionality.** ECDIS inducted as part IBS would be required to conform to requirements mentioned in this annexure in addition to those of IBS.

5. **Display.** The display should be a flat LED or TFT 'Multi-Function Console' (MFC) display as part of IBS. It should have user friendly man-machine interface and symbols and colours as per standards laid down by IMO for radar and ECDIS displays. MFC should provide the following features :-

- (a) It should be able to display all ECDIS functions.
- (b) **Electronic Navigation Charts (ENC) Loading Capability.** It should accept ENCs in all IMO approved formats and should have the necessary permissions for updating ENCs for chart corrections. Where more than one MFC is provided, the chart corrections undertaken on any one MFC should be automatically updated on other MFCs. In addition, it should meet following standards:-

- (i) S-63 - IHO Data Protection Scheme Edition 1.1.1/ S-100 or an upgrade.
- (ii) ECDIS display and presentation IHO S-52 PresLib Edition 3.4.or upgrade.
- (iii) RNC S 61 (Product Specifications for Raster Navigation Charts) or an upgrade.

6. **Additional Requirements.**

(a) The system should be able to load and display Additional Military Layers (AMLs) to function as WECDIS. The system should also be capable of integrating 'Edition 1 and 2' AMLs.

(b) **Specific Requirements.** The ECDIS should provide the following facilities in addition to those specified by contemporary IMO standards:-

(i) Renaming and labelling of routes and waypoints.

(ii) Labelling of target tracks on ARPA. Labels of targets labelled on ARPA should appear automatically on ECDIS.

(iii) Correlation of target track data from multiple sources, so as to present a single track on ECDIS display.

(c) **Pilotage Tools.**

(i) Feature of drawing LDL and Clearing Bearing/Lines.

(ii) Plotting of wheel over position by multiple methods as per BR 45.

(iii) Facility for plotting manual fixes in a simplified manner with option of preselecting fixing objects & marks.

(iv) Feature to enter True Bearing and Range for manual fixing.

(v) Time stamped position line while undertaking terrestrial fixing.

- (vi) Geometric shapes to support pilotage plan.
- (vii) Facility of displaying predicted Tidal Stream or Current vector with effective time and strength.
- (viii) Capability to interface with Optical Bearing Device (OBD) and Voyage Data Recorder (VDR).

(d) **General Features.**

- (i) Password based access to various ECDIS functions.
- (ii) Capability to display and manage Additional Military Layers (AMLs).

(e) **Desirable Attributes.**

- (i) Water Space Management and Moving Havens.
- (ii) Provision of manual corrections to Tidal Stream.
- (iii) Facility to plot fixes using Running fix, HSA and VSA.
- (iv) Linking of LDL and Clearing Bearings/ Lines with Anti-grounding alarm.
- (v) Voyage Data storage capacity of upto 90 Days.

7. **Interfacing.** ECDIS should not degrade the performance of any equipment providing sensor inputs. The connection of optional equipment should not degrade the performance of ECDIS below standards as specified by contemporary IMO and IEC regulations, updated from time to time. In-addition, ECDIS should be connected to systems providing continuous position fixing, heading and speed information. The ECDIS should be capable of following interfaces :-

- (a) GNSS, IRNSS Receiver(s) and G3I.
- (b) Gyro/ RLG.
- (c) Speed Log.



- (d) AIS.
- (e) ADS (B).
- (f) COTS Navigation Radar I and E/F band (both raw video for overlay and tracks).
- (g) Echo Sounder.
- (j) Autopilot.
- (k) NMEA messages.

8. **Redundancy**. The ECDIS should meet the functionality of “Standby ECDIS” as per contemporary IMO guidelines for paperless navigation.

### **Miscellaneous**

9. **Durability and Resistance to Environmental Conditions**. The equipment should be capable of continuous operation under the conditions of various sea states, ship’s motion, vibration, shock, humidity and temperatures to comply with IEC 60945 standards.

10. **Supplies**. The ECDIS should be capable of operating on 110 Volts and 230 Volts, 50/60 Hz power supplies, to cater for installation on all Indian Navy ships.

11. **Integration with COTS Radar**. The equipment should be capable of displaying raw radar video and ARPA track data received from ship’s COTS radars. Failure of radar on an MFC should not result in non-availability of ECDIS facility and vice versa.

12. **Built-in Test Equipment (BITE)**. The BITE software should run automatically at power-up in any mode of operation and should have control over the sub-system hardware. The design of the system should cater for the following features:-

(a) Built-in Test (BIT) facility is to identify, locate and indicate to the operator any fault that has occurred in the system during operation in all modes. BIT messages shall be displayed at the bottom of the operator colour screens.

(b) The BITE should isolate all detected faults to card level and be capable of identifying specific faults of physical communication breaks.

13. **Environmental Standards.** The equipment should comply with IEC 60945 standards or contemporary amended versions of environmental and EMI/ EMC standards. In-addition, the equipment should be provided with Shock Standards in accordance with IEC 68-2-27 or equivalent.

14. **Certification/ Compliance Certification.** The vendor should provide 'Type approved/ IMO Compliance' certification by a registered Classification Society with regards to ECDIS.

15. **Cyber Security Aspects.** The following cyber security aspects should be catered:-

(a) **Protection of Communication Interfaces.** All interfaces should be documented along with their purpose and communication protocol(s). All unused communication interfaces should be disabled through software/ hardware. Provision to enable/ disable these interfaces should be provided.

(b) **Update/ Patch Management.** The system should have a facility for updating/ patching the Operating System and application software. Mechanism for undertaking the same should be clearly outlined in system documentation.

(c) **Physical Security.** Access control mechanisms to prevent unauthorized access to the system must be provided.

## **PERFORMANCE STANDARDS OF I BAND RADAR**

### **I Band COTS Radar**

1. **Purpose.** To serve as the primary navigational radar for the presentation of navigational situation and to assist in ensuring ship's/ vessel's navigational safety in harbours, other restricted sea areas and in open seas. The system should, inter-alia, perform the following functions: -

- (a) Display clear raw video of all moving and stationary contacts, coastline, creeks, navigational buoys and marks, harbour installations, jetties etc.
- (b) Determine coordinates of detected contacts.
- (c) Track the detected contacts.
- (d) Solve relative velocity problems, for collision avoidance.
- (e) Assist in the ship's pilotage and manoeuvring in restricted waters.
- (f) Surface surveillance.
- (g) Provide for manual alphanumeric labelling of targets, including AIS tracks, when AIS is interfaced with radar.
- (h) Provide Trial Manoeuvre simulation, with facilities for trial course computation, with variable trial speed and time.
- (j) Provide a set of parallel index lines iaw BR 45, fully adjustable in range and azimuth for facilitating blind pilotage.

2. **Type.** 'I'-Band Band COTS high definition surface warning and navigational radar systems, with Automatic Radar Plotting Aid (ARPA), built within an IBS Multifunction Display.

3. **IMO Compliance.** The radar should meet performance standards prescribed in IMO Resolution MSC.192 (79), as amended from time to time as well as contemporary IMO standards for ARPA and Displays. The system should be 'Type Certified' by a Class society. The radar should conform to these standards in addition to the requirements enumerated in the succeeding paragraphs.

4. **System Configuration.** The system should have the following configuration:

- (a) Antenna and turning mechanism.
- (b) Man-aloft switch.
- (c) Trans-receiver (Down mast or Up-mast version).
- (d) Processor unit.
- (e) Modularity in design.
- (f) Radar display to be provided within IBS MFC and MFD.
- (g) Built in System Redundancy provided through backup and fall back arrangements as per extant IMO specifications.

5. **Antenna System.** The vendor should be able to supply antenna in 4 feet and 6 feet configuration. Requirement to be finalised as per ship requirements.

(a) **Beam Width.**

<u>Bands</u>	<u>Horizontal</u>	<u>Vertical</u>
I Band	Better than 1.4° for 6 feet antenna	Between 20° to 30°

	Better than 2° for 4 feet antenna	
--	-----------------------------------	--

(b) **Side lobes**. Better than -28 dB within 10° of beam and -34 dB outside 10° of beam.

(c) **Gain**. 28 dB or better.

(d) **Polarisation**. Horizontal.

(e) **ARR**. Between 20 to 50 rpm.

(h) **Wind Speed Limitations**. To start and operate satisfactorily in relative wind speeds of up to 100 knots.

(j) **Peak Power**. At least 25 KW for 6 feet antenna and 10 KW for 4 feet antenna for magnetron based and 300 W for solid state trans-receivers.

## 6. **Transmitter/ Receiver**.

(a) **Frequency**. Between 9200 MHz to 9500 MHz.

(b) **PRF/ Pulse Length**. Multiple PRFs and Pulse lengths (LP/ MP/ SP), as required, for long range detection and short range discrimination.

(c) **Receiver Noise**. Better than 6 dB.

(d) **Wave Guide Run (if applicable)**. Should provide for at least 30 m waveguide run between antenna and trans-receiver unit, without degradation in performance of the radar.

7. **System Performance**. The system performance should be in accordance with IMO regulations in force. The maximum instrumented range of the radar should be at least 48 nm.

**Multi Function Console (MFC)**

8. The display should be a 'Multi Function Console (MFC) as part of IBS and should conform to requirements as per contemporary IMO and IEC standards for Radar, ECDIS and IBS displays. The display and transceiver unit, as per ship's requirements. MFC should provide the following features :-

(a) **Type of Display.**

(i) Flat LED or TFT display with user friendly man-machine interface and symbols and colours as per standards laid down by IMO. It should be capable of working as a Multifunction Console providing full functionality of the following selections:-

(aa) Standard Radar PPI.

(ab) Chart Radar.

(ac) ECDIS Radar.

(ad) ECDIS with Radar Interlay.

(ae) Dual PPI.

(b) **Screen Size.** The display area would vary as per ship's GRT. It should meet the following minimum requirements specified by IMO:-

(i) < 500T GRT - 195 x 195 mm.

(ii) 500 to <10,000 T GRT and High Speed Craft - 270 x 270 mm.

(iii) >10,000 T GRT - 340 x 340 mm.

(c) **Screen Resolution.** At least 1920 x 1080 pixels.

- (d) **Graphics**. Ability to display graphic symbols (vectors, lines and special symbols) and alphanumeric symbols.
- (e) **Range Scales/ Rings**. Range scales from 0.5 to 48 nm, with appropriate range rings.
- (f) **Anti-Clutter Devices**. The equipment should have facilities for suppression of unwanted echoes from sea clutter, rain and other forms of precipitation, clouds, sand storms and from other radars. It should incorporate both, manual and automatic anti-clutter controls.
- (g) **PPI Modes/ Presentation**. Relative Motion, True Motion and True Motion Centred modes, with 'Head-up', 'North-up' and 'Course-up' presentations of the radar picture, with a facility for off-centring.
- (h) **Mapping**.
- (i) Facilities for manually creating, storing and editing at least 100 maps referenced to own ship or a geographical position.
  - (ii) Facility to transfer maps to other MFCs online or through portable magnetic media.
  - (iii) Internal non-volatile memory or external memory cards option for transferring saved maps and routes between MFC and PC.
- (j) **Target Data Readout**. Target data readout of range, bearing, speed, course, CPA and TCPA. Facility to select true or relative vector irrespective of selected PPI mode (True Motion or Relative Motion).
- (k) **Guard Zones**. Facilities for setting variable guard zones and CPA/TCPA.
- (l) **Parallel Index Lines**. A set of electronically generated parallel index lines, fully adjustable in range and azimuth.
- (m) **Trial Manoeuvre**. Own ship's manoeuvre simulation, with facilities for trial course computation, with variable trials speed and time.

(n) **Anchor Watch**. Detection of the ship dragging her anchor, with an associated alarm.

(p) **Variable Range Marker (VRM)/ Electronic Bearing Line (EBL)/ Tracker Ball**. One each, with data readout over full azimuth and range, with off centring facility. Additional floating EBL and VRM.

(q) **Tracking**. Manual and automatic acquisition and tracking of at least 40 targets with relative speeds of upto 100 knots till at least 24 nm range.

(r) **Alarms**. Acoustic and visual alarms for navigational and system failures along with facility for muting from MFCs.

(s) **Electronic Navigation Charts (ENCs)**. All MFCs should accept ENCs in all IMO approved formats and should have the necessary permissions for updating ENCs for chart corrections.

(p) **360° Coverage**. The MFC should be capable of providing 360° coverage, by combining pictures of two radars of the same make, through a suitable combiner unit. In case of tripping of one COTS radar, the combiner Unit should be able to automatically provide complete picture across all sector for the other radar.

(p) **Interfaces**. The radar should be capable of being interfaced with both analog and digital shipboard systems and navigational aids of different origins and manufacturers. Details of ship specific requirements for number and type of outputs are to be provided in the RFP. The responsibility of providing suitable interface units(s) and carrying out integration is to be with the IBS vendor (as incorporated in the RFP). The interfacing should be carried out such that the following functionalities are provided:-

(i) Reception and presentation of parameters from ship's SHHD and 3<sup>rd</sup> party equipment, where interface protocols are available from equipment OEM or provided by *IN*.

(ii) Display the video of up to two more COTS radars fitted onboard the ship.



(iii) Display video and provide corresponding radar controls for other radars of same make on a single MFC.

(iv) Provide 360<sup>0</sup> picture of two radars of the same make, through a suitable combiner unit, to ships systems.

9. **Time Stamping.** The Time Stamp on all tracks displayed on the MFC and log files archived by the system should be the GPS time provided through the GPS/ GNSS/G3I interface.

### **Miscellaneous Requirements**

10. **Durability and Resistance to Environmental Conditions.** The equipment should be capable of continuous operation under the conditions of various sea states, ship's motion, vibration, shock, humidity and temperatures to comply with IEC 60945 standards.

11. **Power Supplies.** The system should be capable of operating on 110 Volts and 230 Volts, 50/60 Hz power supplies, to cater for installation on all Indian Navy ships.

12. **UPS.** The system should be supplied with online UPS with maintenance free battery capable of providing backup power supply for at least 30 minutes. The batteries should be sourced indigenously. The UPS should meet MIL STD 461-E as amended, for EMI/ EMC requirements.

13. **Additional Requirements.** The radar will be installed as the primary navigational radar on ships. Additional requirements based on respective class of ships would be as follows:-

(a) **Fan Out Unit.** The radar should have a fan out unit or a similar facility, so as to be able to give the raw radar video feed and track data, to up to three displays, as well as to the onboard CAAIO/ CMS.

(b) **Multi Radar Installation.** Where two or more radars are fitted, they should be so installed that each radar can be operated individually and all of them can be operated simultaneously without being dependent upon one another. They should be so installed that failure of one radar would not cause the other radar(s) to be adversely

affected. In-addition, the radars should be installed to minimise the dead zones and accordingly combiner units {radars fitted on single ship (one IBS system) are to be sourced from same OEM for seamless integration}, should be provided for radars.

(c) **Integration with ECDIS**. Failure of ECDIS on an MFC should not result in non-availability of radar facility and vice versa.

(d) **Pre-Trigger Pulse for ESM Blanking**. There should be a provision of providing pre-trigger pulse for blanking ESM system.

14. **Built-in Test Equipment (BITE)**. The system should have a Built-in Test (BIT) facility to identify, locate and indicate to the operator any fault that has occurred in the system during operation in all modes. The BITE software should run automatically at power-up and should have control over the sub-system hardware. The BITE should isolate all detected faults to card level and be capable of identifying specific faults of physical communication breaks.

15. **Environmental Standards**. The equipment should comply with IEC 60945 standards or contemporary amended versions of environmental and EMI/ EMC standards. In-addition, the equipment should comply with Shock Standards in accordance with IEC 68-2-27 or equivalent.

16. **Certification/ Compliance Certification**. The vendor should provide 'Type approved/ IMO Compliance' certification by a registered Classification Society with regards to Navigation Radar.

17. **Cyber Security Aspects**. The following cyber security aspects should be catered:-

(a) **Protection of Communication Interfaces**. All interfaces should be documented along with their purpose and communication protocol(s). All unused communication interfaces should be disabled through software/ hardware. Provision to enable/ disable these interfaces should be provided.

(b) **Update/ Patch Management**. The system should have a facility for updating/ patching the Operating System and application software.

Mechanism for undertaking the same should be clearly outlined in system documentation.

(c) **Physical Security**. Access control mechanisms to prevent unauthorized access to the system must be provided.

PERFORMANCE STANDARDS OF E/F BAND RADAR

E/F Band COTS Radar

1. **Purpose.** To serve as a navigational and surface surveillance radar for the presentation of navigational situation and provision of long range surface scanning to assist in ensuring the vessel's navigational safety in harbours, restricted sea areas and in open seas. The system should perform the following functions:-

- (a) Display clear raw video of all moving and stationary contacts, coastline, creeks, navigational buoys and marks, harbour installations, jetties etc.
- (b) Determine coordinates of detected contacts.
- (c) Track the detected contacts.
- (d) Solve relative velocity problems, for collision avoidance.
- (e) Assist in the ship's pilotage and manoeuvring in restricted waters.
- (f) Surface surveillance.
- (g) Provide for manual alphanumeric labelling of targets, including AIS tracks, when AIS is interfaced with radar.
- (h) Provide Trial Manoeuvre simulation, with facilities for trial course computation, with variable trial speed and time.
- (k) Provide a set of parallel index lines iaw BR 45, fully adjustable in range and azimuth for facilitating blind pilotage.

2. **Type.** 'E/F' Band COTS high definition surface warning and navigational radar systems, with Automatic Radar Plotting Aid (ARPA), built within a IBS Multifunction Consoles.

3. **IMO Compliance.** The System should meet performance standards prescribed in IMO Resolution MSC.192 (79), as amended from time to time as well as contemporary IMO Standards for ARPA and Displays. In addition, the radar should conform to the requirements enumerated in the succeeding paragraphs.

4. **System Configuration.** The System should have the following configuration:-

- (a) Antenna and Turning Mechanism.
- (b) Man-aloft Switch.
- (c) Trans-receiver.
- (d) Processor Unit.
- (e) Modularity in design.
- (f) Radar display to be provided within IBS MFC and MFD.
- (g) Built in system redundancy provided through backup and fall-back arrangements as per extant IMO specifications.

5. **Antenna System.**

- (a) **Beam Width.**
  - (i) **Horizontal.** 2° or lesser.
  - (ii) **Vertical.** Between 20° to 30°.

(b) **Side Lobes.** Lesser than -28 dB within 10° of beam and lesser than -34 dB outside 10° of beam.

(c) **Gain.** 26 dB or better.

(d) **Polarisation.** Horizontal.

(e) **ARR.** 20 to 50 rpm or better.

(f) **Wind Speed Limitations.** To start and operate satisfactorily in relative wind speeds of upto 100 knots.

## 6. **Transmitter/ Receiver.**

(a) **Frequency.** 2900 MHz to 3100 MHz.

(b) **PRF/ Pulse Length.** Multiple PRFs and Pulse Lengths (LP/ MP/ SP), as required, for long range detection and short range discrimination.

(c) **Range Accuracy.** Within 30 m or 1% of range scale, whichever is greater.

(d) **Bearing Accuracy.** Within 1 degree.

(e) **Range Discrimination.** As per extant IMO Specifications.

(f) **Bearing Discrimination.** As per extant IMO Specifications.

(g) **Receiver Noise.** Lesser than 6 dB.

(h) **Wave Guide Run (if applicable).** Should provide for atleast 30 m, waveguide run between antenna and trans-receiver unit, without degradation in performance of the radar.

7. **System Performance.** The system performance should be in accordance with extant IMO Regulations in force. In addition, the following performances parameters are required to be met:-

(a) **Maximum Instrumented Range.** Atleast 48 nm.

(b) **Minimum Detection Range.** The following minimum detection ranges in clutter free conditions should be obtained by the E/F Band Radar, under standard atmospheric conditions over sea, with a 12-15 m radar antenna height and 95% probability of detection:-

Ser	Target Description	Detection Range (nm)
(i)	Shorelines (rising to 60 m)	20
(ii)	Shorelines (rising to 6 m)	8
(iii)	Shorelines (rising to 3 m)	6
(iv)	Ships more than 5000 GRT	11
(v)	Ships more than 500 GRT	8
(vi)	Small Vessels with Radar Reflectors	3.7
(vii)	Navigation Buoy with Corner Reflector	3.6
(viii)	Typical Navigation Buoy	3.0
(ix)	Small vessel of 10 m length with no reflector	3.0

### **Multi-Function Console (MFC)**

8. The display should be a 'Multi-Function Console (MFC) as part of IBS and should conform to requirements as per contemporary IMO and IEC Standards for Radar, ECDIS and IBS displays. The display and transceiver unit, as per ship's requirements. MFC should provide the following features :-

(a) **Type of Display.** Flat LED / TFT/ contemporary display, with user friendly man-machine interface and symbols and colours as per standards laid down by IMO. It should be capable of working as a Multi-function Console providing full functionality of the following selections:-

- (i) Standard Radar PPI.

(ii) Chart Radar.

(iii) ECDIS Radar.

(iv) ECDIS with Radar Interlay.

(b) **Screen Size**. The display area diameter would vary as per ship's GRT. It should meet the following requirements specified by IMO:-

(i) **Less than 500 GRT**. Minimum 195 x 195 mm.

(ii) **500 GRT to Less than 10,000 GRT and High Speed Craft**. Minimum 270 x 270 mm.

(iii) **More than 10,000 GRT**. Minimum 340 x 340 mm.

(c) **Screen Resolution**. Screen resolution should be 1920 X 1080 or better

(d) **Graphics**. Ability to display graphic symbols (vectors, lines and special symbols) and alphanumeric symbols.

(e) **Range Scales/ Rings**. Range scales from 0.5 to 48 nm, with appropriate range rings.

(f) **Anti-Clutter Devices**. The System should have facilities for suppression of unwanted echoes, including sea clutter, rain and other forms of precipitation, clouds, sand storms and interference from other radars. It should incorporate manual and automatic anti-clutter functions.

(g) **PPI Modes/ Presentation**. Relative Motion, True Motion and True Motion Centred modes, with 'Head-up', 'North-up' and 'Course-up' presentations of the radar picture, with a facility for off-centring.

(h) **Mapping**.



- (i) Facilities for manually creating, storing and editing at least 100 maps referenced to own ship or a geographical position.
- (ii) Facility to transfer maps to other MFCs online or through portable storage media.
- (iii) External memory cards option for transferring saved maps and routes between MFC and PC.
- (j) **Target Data Readout.** Target data readout of range, bearing, Lat and Long, speed, course, CPA and TCPA. Facility to select true or relative vector irrespective of selected PPI Mode (True Motion or Relative Motion).
- (k) **Guard Zones.** Facilities for setting variable guard zones and CPA/TCPA.
- (l) **Parallel Index Lines.** A set of electronically generated parallel index lines, fully adjustable in range and azimuth.
- (m) **Trial Manoeuvre.** Own ship's manoeuvre simulation, with facilities for trial course computation, with variable trials speed and time.
- (n) **Anchor Watch.** Detection of the ship dragging her anchor, with an associated alarm.
- (p) **Variable Range Marker (VRM)/ Electronic Bearing Line (EBL)/ Tracker Ball.** One each, with data readout over full azimuth and range, with off centring facility. Additional floating EBL and VRM.
- (q) **Tracking.** Manual and automatic acquisition and tracking of at least 40 targets with relative speeds of upto 100 knots till at least 24 nm.
- (r) **Alarms.** Acoustic and visual alarms for navigational and system failures along with facility for muting from MFCs.

(s) **Electronic Navigation Charts (ENCs)**. All MFCs should accept ENCs in all IMO approved formats and should have the necessary permissions for updating ENCs for chart corrections.

(t) **360<sup>0</sup> Coverage**. The MFCs should be capable of providing 360<sup>0</sup> coverage, by combining pictures of two radars, through a suitable combiner unit.

(p) **Interfaces**. The radar should be capable of being interfaced with both analog and digital shipboard systems and navigational aids of different origins and manufacturers. Details of ship specific requirements for number and type of outputs will be provided in the RFP. The responsibility of providing suitable interface/ fan out units and carrying out integration is to be with the IBS vendor (as incorporated in the RFP). The generic, indicative list of interfaces required to be carried out are enumerated below:-

(i) **Input to the Radar.**

(aa) IRNSS/ SBAS enabled GPS for positional data (Serial RS 422 NMEA).

(ab) Log for ship's speed data (Synchro/ Pulse/ Serial RS 422 NMEA).

(ac) AIS for identification data (Serial RS 422/ NMEA Fast NMEA).

(ad) Ship's Data Network (SDN) (Synchro/ Serial RS 422 NMEA).

(ae) Gyro for heading data (Synchro/ Serial RS 422 NMEA).

(ii) **Output from Radar.** Information provided by the radar output should be in accordance with International Standard (IEC 61162), to the following:-

(aa) CMS.

(ab) Radar Data Distribution Units, Gun FCS, CTD, ECDIS and IBS, if fitted.

(ac) Radar tracks and status information to SDN.

9. **Time Stamping**. The Time Stamp on all tracks displayed on the MFC and log files archived by the system should be provided through the GPS/ GNSS/ IRNSS interface.

### **Miscellaneous Requirements**

10. **Durability and Resistance to Environmental Conditions**. The System should be capable of continued operation under the conditions of various sea states, ship's motion, vibration, shock, humidity and temperatures. It should comply with IEC 60945 Standards or contemporary amended versions of environmental and EMI/ EMC Standards.

11. **Power Supplies**. The System should be capable of operating on 110 Volts and 230 Volts, 50/60 Hz power supplies, to cater for installation on all Indian Navy ships.

12. **UPS**. The system should be supplied with online UPS with battery capable of providing backup power supply for at least 30 minutes. The UPS should meet MIL STD 461-E as amended, for EMI/ EMC requirements.

13. **Additional Requirements**. Additional requirements based on respective class of ship would be as follows:-

(a) **Fan Out Unit**. The radar should have a fan out unit or a similar facility, so as to be able to provide raw radar video feed and track data, to upto three displays, as well as to the onboard CAAIO/ CMS, SDN, ECDIS, IBS, RDU, SDN etc.

(b) **Multi-Radar Installation**. Where two or more navigation radars are fitted, they should be so installed that each radar can be operated individually and all of them can be operated simultaneously without being dependent upon one another. They should be so installed that failure of one radar would not cause the other radar(s) to be

adversely affected. In-addition, the radars should be installed to minimise the dead zones and accordingly combiner units as required, should be provided for the radars.

(c) **Integration with ECDIS.** Failure of ECDIS on an MFC should not result in non-availability of radar facility and vice versa.

(d) **Pre-Trigger Pulse for ESM Blanking.** There should be a provision of pre-trigger pulse for blanking ESM, SSR and other relevant systems onboard.

14. **Built-in Test Equipment (BITE).** The System should have a Built-in-Test (BIT) facility to identify, locate and indicate to the operator any fault that has occurred in the System during operation in all modes. BITE software should run automatically at power-up and should have control over the sub-system hardware. BITE should isolate all detected faults to card level and be capable of identifying specific faults of physical communication breaks.

15. **Certification/ Compliance Certification.** The vendor should provide 'Type approved/ IMO Compliance' certification by a registered Classification Society with regards to Navigation Radar, ECDIS and MFC.

16. **Cyber Security Aspects.** The following cyber security aspects should be catered:-

(a) **Protection of Communication Interfaces.** All interfaces should be documented along with their purpose and communication protocol(s). All unused communication interfaces should be disabled through software/ hardware. Provision to enable/ disable these interfaces should be provided.

(b) **Update/ Patch Management.** The System should have a facility for updating/ patching the Operating System and application software. Mechanism for undertaking the same should be clearly outlined in system documentation.

17. **Access Control.** Access control mechanisms to prevent unauthorised access to the System must be provided.

**Appendix 'D'**  
**(Refers to Section II Para 16)**

**AIS**

1. **Purpose.**

(a) Automatic Identification System (AIS) is a navigational aid, which provides information about a merchant ship (length, beam, draught etc), its cargo and also gives vital inputs for collision avoidance (like positional information, course, speed, whether it is a NUC vessel or at anchor, rate of turn etc).

(b) AIS should be capable of providing to ships / submarines and to competent authorities, information from merchant ship (s), automatically and with the required accuracy and frequency, to facilitate their accurate tracking. Transmission of the data should be with the minimum involvement of the ship's personnel and with a high level of availability of the system.

(c) The AIS enhances the maritime situational awareness of our ships / submarines operating at sea, considerably reduce the need for interrogation of the merchant ships to obtain / verify their particulars / passage details.

2. **Regulations / Standards.** AIS (Class A) should comply / meet the following current international Standards: -

(a) Current IMO performance standards and in any case the performance standards are not to be inferior to those set out in the Annexure 3 to the IMO Resolution MSC 74 (69).

(b) General requirements for GMDSS and Electronic Navigation Aids as set out in resolution A.694 (17).

(c) Latest edition of IEC 61993-2 - Part 2: Class A ship borne equipment of the Universal AIS - Operational and Performance Requirements and Methods of Test and required Test Results.

(d) General Requirements / Methods of Testing and Required Test Results laid down for Maritime Navigation and Radio Communication Equipment and Systems laid down in IEC 60945.

(e) The requirements of the current Radio Regulations and applicable ITU-R Recommendations M.1371.1.

### 3. Functionality.

(a) The system should be capable of operating in an “Autonomous and Continuous” mode for operation in all areas.

(b) AIS (Class A) should also have a ‘Listen Only Mode, ie, Passive Mode’, which disables the automatic transmission of AIS information. ‘Listen Only Mode, i.e., Passive Mode’ is to be provided as the ‘Default Mode’ of operation. However it should be feasible to activate the ‘Active Mode’, when required.

### 4. System Configuration. The AIS (Class A) should comprise the following: -

(a) A communication processor, capable of operating over a range of maritime frequencies, with an appropriate channel selecting and switching method, in support of both short and long range applications;

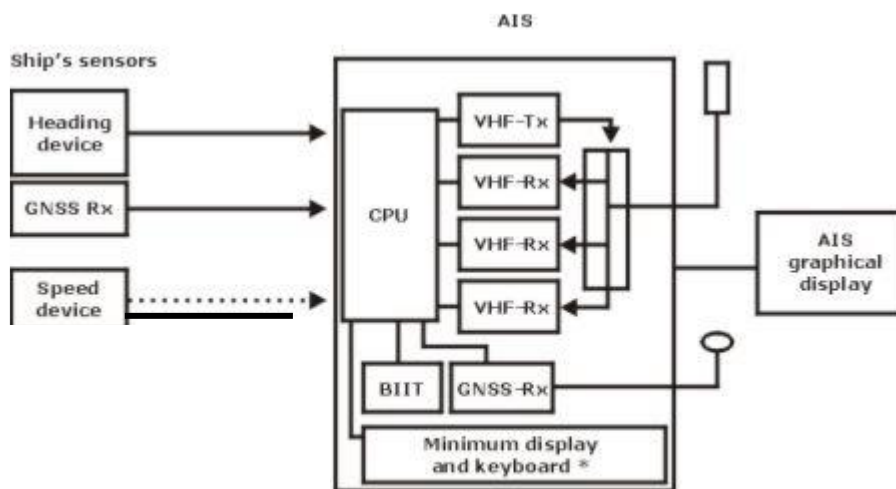
(b) A means of processing data from an electronic position-fixing system, which provides a resolution of one ten thousandth of a minute of arc and uses the WGS-84 datum;

(c) A means to automatically input data from other sensors meeting the provisions as specified in paragraph 21 below;

(d) A means to input and retrieve data manually;

(e) A means of error checking the transmitted and received data; and

- (f) Built in Test Equipment (BITE).
- (g) In general, an onboard AIS consists of: -
- (i) Antennas;
  - (ii) One VHF transmitter;
  - (iii) Two multi-channel VHF receivers;
  - (iv) One channel 70 VHF receiver for channel management;
  - (v) A central processing unit (CPU);
  - (vi) An electronic position fixing system, global navigation satellite system (GNSS) receiver for timing purposes and position redundancy;
  - (vii) Interfaces to heading and speed devices and to other ship borne sensors;
  - (viii) BIIT (Built in Integrity Test); and Separate display with integrated alphanumeric keyboard to input and retrieve data.



2 - AIS Components

5. **Capabilities.** The AIS equipment should be capable of following: -

- (a) Providing information automatically and continuously to a competent authority and other ships, without involvement of ship's personnel.

- (b) Receiving and processing information from other sources, including that from a competent authority and from other ships.
  - (c) Responding to high priority and safety related call with a minimum of delay.
  - (d) Providing positional and maneuvering information at a data rate adequate to facilitate accurate tracking by competent authority and other ships.
6. **Technical Characteristics.** The technical characteristics of the AIS such as variable transmitter output power, operating frequencies (dedicated internationally and selected regionally), modulation, and antenna system should comply with the appropriate and current ITU-R Recommendations.
7. **Power Supplies.** The AIS and associated sensors should be powered from the ship's main source of electrical energy. In addition, it should be possible to operate the AIS and associated sensors from an alternative source of electrical energy. The AIS system should be capable of operating on 110 Volts or 230 Volts, 50 / 60 Hz power supplies, to cater for installation on all Indian Navy ships / submarines. The AIS should also operate on power supply of 24 V DC.
8. **Information.** The information provided by the AIS should include the following: -
- (a) **Static.**
    - (i) IMO number (where available).
    - (ii) Call sign and name.
    - (iii) Length and beam.
    - (iv) Type of ship.
    - (v) Location of position-fixing antenna on the ship (aft of bow and port or starboard of centerline).



(b) **Dynamic.**

- (i) Ship's position with accuracy indication and integrity status.
- (ii) Time in UTC (Date to be established by the receiving equipment).
- (iii) Course over ground.
- (iv) Speed over ground.
- (v) Heading.
- (vi) Navigational status (NUC, at anchor etc through manual input).
- (vii) Rate of turn (where available).
- (viii) Optional - Angle of heel (where available).
- (ix) Optional - Pitch and roll (where available).

(c) **Voyage Related.**

- (i) Ship's draught.
- (ii) Hazardous cargo (type) (as required by the competent authority).
- (iii) Destination and ETA (at Master's discretion).
- (iv) Optional -Route plan (waypoints).

(d) Short safety related messages.

9. **Information Update Rates for Autonomous Mode.** The different information types are valid for a different time period and thus needs a different update rate and are as follows: -

- (a) Static information - Every 6 min and on request.
- (b) Dynamic information - Dependant on speed and course alteration according to the under mentioned table.

Type of ship	Reporting Interval
Ship at anchor	03 min
Ship 0-14 knots	12 sec
Ship 0-14 knots and changing course	04 sec
Ship 14-23 knots	06 sec
Ship 14-23 knots and changing course	02 sec
Ship > 23 knots	03 sec
Ship > 23 knots and changing course	02 sec

- (c) Voyage related information - Every 6 min, when data has been amended and on request.
- (d) Safety-related messages on as required basis.
10. **Ship Reporting Capacity.** The system should be able to handle a minimum of 2000 reports per minute to adequately provide for all operational scenarios envisioned.
11. **Security.** A security mechanism should be provided to detect disabling and to prevent unauthorized alteration of input or transmitted data. To protect the unauthorized dissemination of data, the IMO Guidelines (MSC.43 {64}) Guidelines and Criteria for Ship Reporting Systems) should be followed.
12. **Permissible Initialisation Period.** The installation should be operational within 02 minutes of switching on.
13. **Interfaces.**

(a) To enable a user to access, select and display the information on a separate system, the AIS should be provided with an interface conforming to an appropriate international marine interface standard.

(b) Should be capable of flexible interfaces with analog and digital navigational systems and aids like GPS, Gyro, and Log, navigational radar, ECDIS, Integrated Bridge System (IBS) and CTD / CAIO System / Combat management System (CMS) to cater to shipboard systems of different origins / manufacturers and vintages.

(c) The vendor / OEM will be completely responsible for interfacing AIS with GPS, Gyro, Log, and Navigational radar, ECDIS, IBS and CTD / CAIO Systems / CMS. In case the systems to be interfaced with AIS do not have additional ports for providing output to AIS, the OEM of AIS should provide adequate number of buffer boxes for splitting the output of those system(s) to provide feed to the already interfaced existing system(s) and also the AIS.

(d) **Fan Out Unit.** The AIS should have an option for a fan out unit or a similar facility, so as to be able to give the AIS data, to upto three displays, as well as to the onboard computerised Action information Organisation / Combat Management System.

14. **Durability and Resistance to Environmental Conditions.** The equipment should be capable of continuous operation under the conditions of various sea states, ship's motion, vibration, humidity and temperatures to comply with IEC 60945 standards.

15. **Induced Environment.** The equipment shall be tested to commercial standards in vogue for ship borne systems for shock, vibration and electromagnetic interference (IEC 60945).

### **Maintenance and Product Support**

16. **On Board Maintenance.** The system should afford easy on-board maintenance, by replacement of cards with Built-In Self-Test (BIST) menu analysis. The OEM / supplier is also required to recommend a list on onboard spares. Extensive BITE facilities should be provided to monitor the health of the system upto Least Replaceable Unit (LRU).

17. **Mean Time To Repair (MTTR)**. The basic system should have a MTTR of one hour or less.

18. **Performance Monitoring**. The facility to determine a significant drop in system performance relative to the calibrated standard established at the time of installation should be provided.

19. **Product Support**. The AIS should be supported by the OEM / supplier, for a period of at least 10 years. Likely obsolescence of any component / module, should be intimated by the firm, well in time, to enable stocking of spares by the Indian Navy. The firm should also recommend / offer suitable substitutes for such components. In addition, up-gradation/modifications to the system, resulting in enhancements to the systems performance should be intimated and offered to the Indian Navy. The firm should also be willing to undertake AMC (which would be contracted on expiry of the warranty period) either directly or through their authorised reps in India.

**Appendix 'E'**  
**(Refers to Section II Para17)**

**Transmitting Type - Magnetic Compass**

**Purpose.**

1. Transmitting magnetic compass is an electronic device which uses the geometric field to obtain and transmit information about the ship's heading.
2. In addition to general requirements contained in resolution A.694(17)/ or latest all marine Transmitting Magnetic Compass.

**Composition.**

3. Transmitting magnetic compass may comprise of:-
4. (a) A standard magnetic compass equipped with a magnetic sensor and electronics for generating a suitable output signal for other devices. The compass used should be the standard magnetic compass provided under SOLAS Chapter V; or
5. (b) An electromagnetic compass consisting of the sensor part and electronics for generating a suitable output signal for other devices; or
6. (c) Any type as defined under (a) and (b) additionally equipped with a rate gyro to improve dynamic performance.

7. **Construction.**

(a) **Fore and Aft Mark.**

- (i) A fore and aft mark should be inscribed on the magnetic sensor housing, which should be installed in parallel to the ships fore and aft line.

(ii) The accuracy of the fore and aft mark should be within  $\pm 0.5$  deg to the fore and aft direction of the housing.

(iii) If a rate gyro is installed it should be marked in the same way and additionally be marked with top or bottom.

(b) **Fitting.**

(i) Provision should be made, in the mounting arrangements of the magnetic sensor, for correction of any misalignment upto + 0.5 deg with respect to the fore and aft line.

(ii) The fitting of the sensor arrangement to the compass in paragraph 3.1 above should still enable the compass to comply with resolution A.382 (X) with particular reference to accuracy, gimbaling and use of the azimuth reading device.

(iii) Compensation of Deviation and Heeling error.

(iv) Provision should be made to correct the deviation and heeling error and it should be possible to correct the following values.

(c) Vertical component of the ship's magnetic field (producing the heeling error)

(b) Coefficient A B C D and E.

8. **Indication of Compensation.** The values used for electronic compensation should be indicated by adequate means and should be stored such that values are automatically recovered on switch on.

9. **Protection of Compensation.** The compensating devices should be protected against inadvertent operation.

10. **Heading Output.** All displays and outputs of heading should indicate true heading. An indication of any deviation and variation applied to compensate the heading should be capable of being displayed or included in the output.

11. **Interfaces.** The transmitting magnetic compass should be so designed to transmit heading information to other equipment. At least one output should be in accordance with the relevant international marine interface standards.

**Performance.** The following performance standards are required to be achieved under the conditions of value of  $18 \mu\text{ T}$  of the horizontal component of the geomagnetic field and the environmental conditions experienced onboard ships.

12. **Accuracy of Heading.**

(a) **Static.** The static accuracy of the heading indication should be within  $\pm 1.0$  deg

(b) **Dynamic.** The dynamic accuracy of the heading indication or output should be within  $+ 1.5$  deg in addition to the static accuracy as defined. Periods of oscillation of the error should not be shorter than 30s under the conditions of various sea states and ship's motion likely to be experienced in ships.

13. **Follow up Accuracy of the Transmission Systems.** The follow up accuracy of the transmission system should be within  $+ 1.5$  deg, when the sensor is rotated at the rate of  $20 \text{ deg/ sec}$ .

## **TEMPORAL AND GEO-SPATIAL ALIGNMENT**

1. **Overview.** Operations at sea are under transition from net-enabled to net-centric in accordance with the Navy's NCO Vision. A pre-requisite for this is accurate correlation of data between geographically displaced entities, which in turn is dependent on the quality of temporal and geo-spatial alignment. This framework is to achieve temporal and geospatial alignment.

### **Theoretical Framework**

2. **Reference Terms.**

(a) **Temporal Alignment.** Temporal alignment is the process of aligning a set of systems with a designated time standard or reference. It would require each system's internal time to be transformed onto a common time axis.

(b) **Geo-spatial Alignment.** Geospatial alignment is the process of aligning a set of systems to a common geographical reference. Systems involved would require to use a common source of positional information, based on a common datum, and charts from a common source.

(c) **Synchronisation.** Synchronisation is the process of precisely coordinating or matching two or more activities, devices, or processes in time and space.

(d) **Time Reference Server.** A Time Reference Server (TRS) is a central provider of temporal information. It acquires time from multiple satellite-based sources, determines the source to be used, and thereafter disseminates a single time to all users. TRS are equipped with atomic clocks that provide accurate time even when satellite based sources are not available.

(e) **Platform Time.** Time maintained by the TRS on each platform is known as the Platform Time.



- (f) **System Internal Time.** TRS disseminates time to various systems fitted on a ship, based on which each system's internal clock is synchronised. The time thus available with the system is called the System Internal Time.
- (g) **Network Time.** For the purpose of this document, a network pertains to all platforms and shore stations that require to be temporally aligned in order to cooperate with each other towards execution of a mission(s). Network Time is the common time reference that is maintained by all nodes of the network.
3. **Necessity.** Geo-spatial and temporal alignment is required in networked operations for:-
- (a) Accurate fusion of time and position sensitive data from multiple sources on information aggregators such as CMS, Trigun etc.
  - (b) Synchronisation of communication network nodes for supporting datalinks using waveforms such as MANET and TDMA.
4. **Enablers.** Key enablers of geo-spatial and temporal alignment are:-
- (a) Commonality of source of temporal and positional information.
  - (b) Accuracy of temporal and positional information.
  - (c) Common protocol for transfer of time and positional information over the network.
  - (d) Use of common reference system for time (UTC) and positional coordinates (WGS 84).
  - (e) Redundancy of sources that may provide time and positional information, with pre-determined sequence of graceful degradation.
5. **Capabilities Required.** The following capabilities are required at nodes of a network:-
- (a) Multiple and redundant sources of GNSS information.

- (b) Ability to detect and mitigate loss or spoofing of GNSS data.
- (c) Directional antennae to reject signals from direction of jamming source.
- (d) Fallback options for position and time information in case of non-availability of GNSS.
- (e) Compliance of all onboard systems with the Platform Time.
- (f) Ability of sensors connected to ship's network to time-stamp their tracks and other time-sensitive information.
- (g) Ability to detect difference in the Platform Time and the System Internal Time and apply corrections while carrying out correlation.
- (h) Use of common datum and reference systems for time and position.
- (j) Use of common time synchronisation protocols for transfer of time reference.

6. **Equipment Fit.** The following is the equipment fit that is required to deliver the above capabilities:-

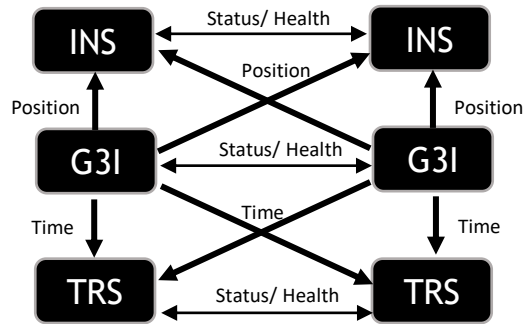
- (a) **G3I Receivers.** Two G3I1 receivers, each with the following characteristics:-
  - (i) Ability to detect jamming or spoofing through comparison of time and position information received from different constellations.
  - (ii) Automatic switchover to an alternate constellation in case of jamming or spoofing of one.
  - (iii) Operator alert in case of jamming or spoofing of information from a single constellation or complete loss of signal.
  - (iv) Two antennae, each with 360 deg coverage, capable of functioning even during jamming from a particular sector.

---

1 G3I pertains to SatNav receivers capable of receiving positional information from GPS, GLONASS, GALILEO, and IRNSS

- (v) Output information only to the platform's TRS and INS.
  - (vi) On platforms not fitted with INS, the G3I receiver is to provide Positional Reference to all systems on the platform.
- (b) **TRS**. Two TRS, each with the following characteristics:-
- (i) The TRS should comprise a G3I disciplined rubidium clock capable of serving time on the ship's network in the prescribed Network Time Protocol (NTP) format.
  - (ii) The TRS should be able to detect drift in G3I time. This will ensure fail-safe operation against spoofing, in case G3I receiver is not able to detect drift. Warning is to be provided to the operator to initiate manual changeover to rubidium clock, in case of such detection by TRS.
- (c) **Inertial Navigation System**. Two Inertial Navigation Systems (INS), each with the following characteristics:-
- (i) Each INS shall be capable of computing positional information on basis of inertial parameters. This shall be corrected by G3I information when available.
  - (ii) Each INS should be able to detect drift in G3I position. This would be a failsafe against spoofing, in case it is not detected by the G3I receiver. Warning shall be provided to the operator to initiate manual changeover to inertial data.
  - (iii) Facility to use positional inputs from an external or central G3I receiver other than a receiver integral to the INS.

7. **Location and Architecture**. The location and architecture of the above systems would be dependent on the network fitted on the platform and is to be determined on a case to case basis. Broad configuration shall be as follows:-



8. **Actions on Degradation.** The G3I shall automatically switch over to another constellation in case of degradation in information from a particular satellite constellation. No actions would require to be taken by other platforms on the network.

9. **Systems on the Network.** Following standards shall be adhered to by systems connected to the platform's network:-

(a) All systems that require position and time information shall source it from the platform's network, as served by INS and TRS. Independent satellite based sources shall not be provisioned with each system, unless absolutely necessary.

(b) Stamping of time and position shall be done at the system, when it initiates a track or any other time or position-sensitive data-point. System Internal Time shall be used for time stamping. In case this is not feasible, stamping shall be carried out at the next hierarchical level defined in the platform's architecture.

(c) Following shall be used by each system, for commonality in time across the network:-

(i) Network Time and Platform Time - UTC.

(ii) System Internal Time - Local time or UTC.

(iii) Protocols for time synchronisation - Network Time Protocol<sup>2</sup> or Precision Time Protocol<sup>3</sup>.

<sup>2</sup> NTP - As defined in IETF RFC5905 and updated from time to time.

<sup>3</sup> PTP - As defined in IEEE 1588-2019 and updated from time to time

(d) All systems shall use the following for commonality in positional reference:-

- (i) Datum WGS 84.
- (ii) Charts from the designated Chart Server.