INVITATION FOR EXPRESSION OF INTEREST (EOI) FOR DESIGN, DEVELOPMENT AND PROCUREMENT OF INDIGENOUS PRECISION RANGE EXTENSION KIT (IPREK) UNDER MAKE-II PROCEDURE OF DAP-2020

Reference:-	**Defence Acquisition Procedure 2020 (DAP - 2020)**	
Appendices:-		
	A	Format for EoI Response
	B	Commercial and Technical Evaluation Criteria
	C	Confidentiality Agreement
	D	Correctness Certificate
	E	Draft Airworthiness Directive issued by CEMILAC

Layout

1. The EoI comprises the following parts:-

1.1. **Part-I** : General Information

1.2. **Part-II** : Scope of Project

1.3. **Part-III** : Evaluation Criteria

1.4. **Part-IV** : Procedure for submission of Response to the EOI

1.5. **Part-V** : Miscellaneous

2. The nodal officer for this project for all queries/ clarifications/ coordination will be Chairman, Project Facilitation Team (PFT), “Indigenous Precision Range Extension Kit (IPREK)”. Address and contact details of the nodal officer are given at Para 26 of the EoI.

PART I: GENERAL INFORMATION

3. The brief on the equipment is as follows:

3.1. A precision range extension kit helps in converting normal general purpose bombs into a weapon for accurate delivery and extended range. Such kit support conversion of existing General Purpose (GP) bombs into Long Range Glide Weapon at much lesser cost. It is proposed to indigenously design, develop and manufacture an "Indigenous Precision Range Extension Kit (IPREK)" for use on existing GP 500 Kg bombs of IAF under Make-II procedure of DAP-2020. Indigenous Precision Range Extension Kit (IPREK) for GP 500 Kg Bombs is intended to be used for accurate bombing against targets viz industries, fortifications and armoured vehicles etc. It should be adaptable on the existing aircraft as well as aircraft in the process of being inducted into IAF.

3.2. The IPREK is a precision guidance and control kit with un-foldable high aspect ratio wings and control surfaces designed to be retrofitted onto the existing 500 Kg GP bomb. It transforms the dumb bomb into a precision-guided munition, enabling longer-range strikes with enhanced accuracy.

Objective

4. The objective of this EoI is to seek responses from eligible Indian Entities to indigenously Design & Develop, maximum Qty-20 prototype "IPREK" under the '**Make II**' sub-category of **'Make**' and to procure 500 "Indigenous Precision Range Extension Kit (IPREK)" with IN-GPS/IRNSS (fitted with NavIC chip) + EO+IIR/ DSMAC capability along with associated equipment for GP-500 Kg/ PB-500 bomb under the ' **Buy (Indian-IDDM)**' category as per Chapter- III of DAP 2020, after successful development of prototype.

PART II: SCOPE OF THE PROJECT

5. **Phases**. The project involves following two phases:-

5.1. **Design and Development Phase**. This phase involves indigenous Design and Development of prototype “IPREK”, Single Stage Composite Trial (SSCT) and conversion of Preliminary staff quality requirement (PSQR) to Air Staff Qualitative Requirements (ASQR). This phase will end upon approval of the trial report by the appropriate authority within the Air HQs as per **para 54, 55 of Chapter-III of DAP 2020** under the ‘Make-II (Industry Funded)’ sub-category with minimum 50% IC content.

5.2. **Procurement Phase**. The procurement phase commences with issue of commercial RFP in accordance with Para 55A of Chapter-III of DAP 2020 to the qualifying DAs and subsequent acquisition of the MOQ through the ‘Buy (Indian-IDDM)’ category as per the provisions of DAP 2020.

6. **Categorisation**.

6.1. **Design and Development Phase**. Procurement under ‘Make-II (Industry Funded)’ Sub Category of Make Category in accordance with Chapter-III of DAP-2020.

6.2. **Procurement Phase**. Procurement under ‘Buy (Indian-IDDM)’ in accordance with Para 6(d) of Chapter III of DAP-2020 from qualifying Development Agency (DA) with minimum 50% IC.

7. **Quantities**.

7.1. **Design and Development Phase**. Maximum quantity 20 prototype IPREK along with associated equipment for SSCT on LCA.

7.2. **Procurement Phase**. Qty-500 “Indigenous Precision Range Extension Kit (IPREK)” with IN-GPS/IRNSS (fitted with NavIC chip) + EO + IIR /DSMAC Terminal Guidance along with associated equipment for GP-500 Kg/ PB-500 bomb.

8. **Make-II Procedure**. Detailed guidelines on Make II Procedure (Chapter III of DAP 2020) may be downloaded from MoD website for reference.

9. **Preliminary Service Qualitative Requirements (PSQR)**. The PSQRs for indigenous Design and Development of the prototype of “IPREK” will be shared with the companies who intend to participate in the Make-II Project. The PSQRs sharing from IAF will take place only if the participating industries meets the eligibility conditions as per financial eligibility criteria mentioned in EoI **Appendix B** of Chapter-III of DAP 2020 and after signing of Non-Disclosure Agreement inclusive of OSA

Timelines & Milestones

10. **Single Stage Composite Trials**. SSCT will be conducted in accordance with Para 55 of Chapter III of DAP 2020. Trials will be undertaken within India at IAF units.

11. **Milestones**. The IPREK are planned to be inducted as per timeline brought out below. The estimated timeline for induction/ delivery is as follows (Appendix-L to Chap-III of DAP 2020):-

Sl No	Activity	Remarks	Timeline (Weeks)	Cumulative Timelines (Weeks)
11.1.	Issue of EoI	By PFT	--	T_0
11.2.	EoI Response Submission	By EoI Respondents	08	T_0+ 8
11.3.	EoI Response Evaluation	By PFT	06	T_0+ 14
11.4.	Issue of Project Sanction Order (PSO) for Prototype Development	To selected DAs	02	T_0+ 16
11.5.	Prototype development	By DAs	30-48	T_0+ 46 to T_0+ 64
11.6.	Single Stage Composite User Trials (SSCT) & Acceptance of Trial Report	--	07	T_0+ 53 to T_0+ 71
11.7.	Conversion of broad technical requirements to ASQRs	--	02	T_0+ 55 to T_0+ 73
11.8.	Issue of Commercial RFP	--	02	T_0+ 57 to T_0+ 75
11.9.	Solicitation of Commercial Offer	--	04	T_0+ 61 to T_0+ 79
11.10.	Finalisation of Cost Negotiation Committee (CNC)	--	04	T_0+ 65 to T_0+ 83
11.11.	Signing of Contract	--	02	T_0+ 67 to T_0+ 85

Development of Prototype and Trials

12. IPREK should be developed as per PSQRs. Any clarification related to functional or operational aspects of development as sought by the DAs will be provided by the Project Facilitation Team (PFT).

13. After the prototype of IPREK has been developed as per the PSQRs and confirmed by the PFT in a collegiate manner, the PFT with requisite empowered members, would carry out the SSCT of the prototype. If the prototype is assessed as meeting the standards, the PSQRs would be converted to ASQRs. Once the ASQRs are finalised, the vendor shall submit the certificate as per Appendix A to Chap-I and Annexure I & II to Appendix B of

Chapter I of DAP-2020. Necessary technical literature pertaining to the design, material and verification of IC will be provided by the DAs prior to the conduct of SSCT of the prototype IPREK. All process for airborne certification as indicated in the relevant Chapters of IMAP-2023 will be followed. Quarterly updates on the progress of the project need to be forwarded by the DA to the PFT. Periodic review of the D&D progress shall be carried out by the PFT with each DA and towards the culmination of the D&D (i.e last 3 months) fortnightly feedback need to be provided.

14. DAs may be required to produce the following documents for vetting and approval by IAF, QA agencies and Design Certification Agency as per PSQRs. The documents will be provided to the PFT during prototype development stage and documents will be finalized prior to conduct of SSCT.

14.1. Environmental Qualification Test Procedure (EQTP).

14.2. Detailed Specification Sheet.

14.3. Detailed drawings.

14.4. Manufacturing Process Document.

14.5. Quality Assurance Plan (QAP).

14.6. Acceptance Test Procedure (ATP).

14.7. **User manual/ Brochure containing the following**:-

14.7.1. Detailed drawings, specifications, standards & capabilities of Indigenous Precision Range Extension Kit (IPREK) & its accessories.

14.7.2. Detailed guidelines/ procedure for installation & removal, data acquisition and downloading, operating instructions and storage facility.

14.7.3. Training documents.

14.8. Design for manufacturability(DFM) analysis.

14.9. System Safety Assessment studies to be carried out

14.10. Air wortiness Certification Plan(ACP) in accordance with IMTAR-21

14.11. Weapon operational requirement needs to be captured in concept of utilisation document

14.12. Reliability analysis as per MIL STD 217 or equivalent standard.

14.13. Documentation for certification of weapon and its systems/subsystems/LRUs/SRUs/Software/Firmware as per IMAP 23/IMTAR-21.

14.14. Documentation for certification of test rigs/tools as per IMTAR-21.

14.15. Repair Maintenance philosophy along with manufacturers recommended list of spares(MRLS), List of special maintenance tools (SMP)/ Special test equipment(STE), Jigs, fixtures, technical literature and training aggregates

14.16. Certificate of Malicious code.

15. Design & Development (including developmental testing/ trials) of the Indigenous Precision Range Extension Kit (IPREK) is to be undertaken by the DAs. In case any IAF facility is required during trials, the DAs may provide a list of such requirements in his response (Para 36 of Appendix A of EoI refers). Each participating vendor will be provided three trials or trials as mutually agreed between Vendor and PFT to prove the system meets the desired standards as specified in the broad technical requirements.

Solicitation of Commercial Offers

16. A commercial Request for Proposal (RFP) for 'Buy (Indian-IDDM)' phase would be issued to all DAs who have cleared the 'single stage composite trials' of prototype to solicit their commercial offers and additional technical information/ documentation, as may be necessary(Airworthiness Directive issued by CEMILAC attached as Appendix E may be referrred may be referred).

17. The project is envisaged to have the following deliverables and the details of procurement phase will be further amplified in the Commercial Request for Proposal (RFP):-

17.1. **Prototype Development Phase**. Maximum Qty 20 Indigenous Precision Range Extension Kit (IPREK) along with associated equipment for SSCT on LCA.

17.2. **Procurement Phase**.

17.2.1. A total of Qty-500 "Indigenous Precision Range Extension Kit (IPREK)" with IN-GPS/IRNSS (fitted with NavIC chip) + EO/IIR/DSMAC terminal guidance)} along with associated equipment for GP-500 Kg/ PB-500 bomb.

17.2.2. Tools, Testers and Ground Equipment (TTGE), requisite training, Technical literature including user handbook, operations & technical documents and manuals.

Intellectual Property Rights (IPRs)

18. Policy on IPRs is mentioned at Para 59 of the Chapter III of DAP-2020 for Make-II Procedure.

PART III : EVALUATION CRITERIA

Commercial and Technical Evaluation Criteria

19. **Eligibility**. Indian Entity satisfying criteria given at Para 20 of Chap 1 to DAP 2020 is considered as an eligible “Indian Entity” for the project.

20. EoI respondents will be evaluated by the PFT for compliance to financial and technical criteria as **Appendix B.**

Indigenous Content (IC)

21. Indigenous Content of minimum 50% is to be ensured at prototype stage and during procurement stage. After successful development of IPREK, further procurement will be as per the ‘Buy (Indian-IDDM)’ procedure in accordance with DAP-2020. IC content will be assessed as per guidelines at Para 21 of Chapter I of DAP 2020. All relevant deliveries made under contract shall be accompanied by a certificate of IC issued by the Chief Financial Officer (CFO) of the prime/ main contractor. All final deliveries under contract shall be accompanied, in addition to the certificate issued by the CFO of the prime (main) contractor as aforesaid, by its Company Auditor’s certificate. Break down of IC in terms of components, materials and software “for the entire system” is to be provided.

22. The DA shall certify compliance w.r.t Ministry of Finance (MoF), Department of Expenditure (DoE) order (Public Procurement No. 4) No.F.7/10/2021-PPD (1) dated 23 February 2023 (available on Department of Expenditure website with link https:// doe.gov.in/procurement-policy-divisions) and submit an undertaking that *“I have read the clause regarding restrictions on procurement from a vendor of a country which shares a land border with India; I certify that the vendor is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this vendor fulfils all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]”.* Vendor from a country which shares a land border with India for the purpose of this EoI means the following:-

22.1. An entity incorporated, established or registered in such a country sharing a land border with India

OR

22.2. A subsidiary of an entity incorporated, established or registered in such a country

OR

22.3. An entity substantially controlled through entities incorporated, established or registered in such a country

OR

22.4. An entity whose beneficial owner is situated in such a country

OR

22.5. An Indian (or other) agent of such an entity

OR

22.6. A natural person who is a citizen of such a country

OR

22.7. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

23. **Foreign Collaboration**. If the EoI Respondent is collaborating / plans to collaborate with a foreign technology provider, the nature of such collaboration and the technology areas being transferred must be stated in the response. response (please refer Para 14, 31.3., 35 of **Appendix A**). Also, with such collaboration, EoI Respondent must justify compliance to IDDM requirement for the D&D and subsequent manufacturing of IPREK .

PART IV: PROCEDURE FOR SUBMISSION OF RESPONSE TO THE EoI

24. **Guidelines for Submitting EoI Responses**.

24.1. The responses should be submitted as per format placed at **Appendix A**. Should a vendor need to mention any other information, a separate column/ row/ additional pages may be added.

24.2. All responses as per Appendices should be submitted in a single file/ folder. Supporting documents/ additional references should be submitted in a separate folder with proper reference mentioned against each parameter/ sub parameter in respective appendices.

24.3. Any supporting document/ evidence without any reference to specific parameter of criteria will not form part of assessment. Such document may be used only at discretion of PFT

25. **Rejection Criteria for Selection as EoI Respondent**. The following may lead to rejection of EoI response:-

25.1. Failure to meet the Commercial and Technical Evaluation Criteria given at **Appendix B**.

25.2. Failure to offer compliance to any of the terms and conditions given in the EoI.

25.3. Failure to agree with the project timelines.

25.4. Failure to offer desired indigenous content.

25.5. Any other parameter of the response considered inadequate.

26. The envelopes shall be addressed as under:-

Chairman, Project Facilitation Team
Design, Development and Procurement of
Indigenous Precision Range Extension Kit (IPREK)
Gp Capt Ops Wpn(T) (Room No. 563)
Air HQ (Vayu Bhawan)
Rafi Marg, New Delhi-110011
Telephone/ Fax: 011- 23060630/ 011-23015104
E-Mail ID: procfive-75@gov.in

27. The response to this EoI must be submitted by **…….** PM on **…….** at the address mentioned above.

28. The Company will be required to sign and honour the ‘Confidentiality Agreement’ with MoD, Govt of India. The ‘Confidentiality Agreement’ will be furnished by each EoI respondent at the time of submission of EoI responses as per format given at **Appendix C**.

PART V: MISCELLANEOUS

29. **Pre-EoI Response Meeting**. Companies may submit written queries/ clarifications/ amplifications on specific issues within **15 days** of the issue of EoI. A pre-response meeting will be held in **about four (04) weeks** after the issue of EoI to clarify issues/ queries raised by the participating firms to facilitate submission of response. Date of pre-response meeting will be promulgated by the PFT.

30. Guidelines for penalties in business dealings with entities as promulgated by Government from time to time will be applicable on procurement process & bidders.

31. The Pre-Contract Integrity Pact (PCIP), listed as detailed in Para 119 of Chapter II of DAP 2020, shall apply mutatis mutandis to 'Buy (Indian-IDDM) phase of the project.

32. Respondents would be subject to disqualification if they make false, incorrect, or misleading claims in their response to this EoI. A 'Correctness Certificate' as per the format at **Appendix D** will be furnished as part of the response.

33. Please acknowledge the receipt of this invitation for EoI.

File No: **AIR HQ/S 17272/24/OPSWPNT(T3)**

Date: **Jan 26**

(A Bhatia)
Air Cmde
Chairman, PFT

Appendix A
(Refers to Para 23.1 of EoI)

FORMAT FOR EOI RESPONSE

PART I – VENDOR DETAILS

(Include details related to name(s) of the entity, work share planned during design, development, as well as manufacture):

Note: ***In case of foreign collaboration, compliance to Para-3 of Chapter-III of DAP 2020 to be clearly established***.

15. Have you supplied any product/services to MoD, Indian Army / Indian Air Force / Indian Navy / Indian Coast Guard / DPSUs / DRDO labs / Ordnance Factories, any other defence organisation, etc.? (Provide indicative list, if applicable)

16. Details of ISO, Quality Assurance and other Certification.

Financial Information.

17. Average Turn Over of the last three financial years:

18. Net worth of the company, as on 31 Mar of last FY (year 2025) (should be positive).

Technical Information.

19. Availability of area for factory (including covered, uncovered and bonded space).

19.1 Covered area (Sq M):

19.2. Uncovered area (Sq M):

19.3. Any other space available (Sq M):

20. Details of Developmental Facilities:-

20.1 Strength of permanent manpower:-

20.1.1. Technical:

20.1.2. Administrative:

20.2 Inspection and Quality Control.

20.3 Laboratory and Drawing Office Facility.

21. Integration capabilities for system-of-systems projects.

22. Is the factory space adequate to undertake design, development and manufacture of the IPREK?

23. Have you ever developed or manufactured any equipment/sub-assemblies/ parts for any project of similar capability of IPREK? If yes, then the product details to be provided.

24. Have you ever developed and supplied any Electronic Warfare Equipment (Electronic Surveillance equipment or Jammer) to IA/IN/IAF/any other organisation? If yes, the details of equipment & Contract to be furnished.

25. Have you ever developed and supplied any Drones to IA/IN/IAF/any other organisation? If yes, the details of equipment airborne certification & Contract to be furnished.

26. Have you ever developed any ground control station for drones? If yes, the details to be furnished.

27. Any other information, relevant to the case.

PART II: PROJECT SPECIFIC INFORMATION

28. Outline the proposal to undertake prototype development for IPREK.

29. Stages/phases of development, with indicative time schedules.

30. Critical and Niche technologies planned to be developed as a part of this project..

31. Identify Sub-systems, LRUs and Software as per the following headings:

31.1 To be indigenously designed & developed by the company.

31.2 To be sourced from other companies who have indigenously designed & developed.

31.3 To be sourced from FOEM under JV/ToT/COTS. Indigenisation status and plan for the same also to be provided.

34. Life cycle support and obsolescence management aspects on the product need to be provided.

35. Milestones that can be demonstrated to facilitate project monitoring.

36. Role, responsibility and expertise details of the firm, if any, and if applicable.

37. Role of foreign technology provider, if any. In case of foreign collaboration, along with scope, depth & range of ToT, details of formal acceptance by foreign partner’s government (i.e. country of origin) that any license required to transfer the technology will be granted in case selected. If any inter-governmental agreement is required, same also needs to be stated.

38. Requirement of specialised testing assistance, where such facilities are available only with Armed Forces / DRDO / DGAQA / DGQA / DGNAI or any other Govt facility. (Please provide a list of such facilities, with time period for which required).

39. Information to prove design/developmental capability for the project of IPREK:-

39.1. Past examples of indigenous design and development

39.2. R&D facilities available in house, if any;

39.3. Technical/ R&D manpower/expertise available,

39.4. Institutional tie-ups, MoU, laboratory and drawing office facility, CAD / CAM facility

39.5. Percentage of total turnover spent on R&D during last three years etc)

40. Details of important facilities:

40.1. *Production facilities,*

40.2. CAD/CAM/Robotics, other advanced technology tools, environmental testing facilities, tool room, metrology and test eqpt facilities, instrumentation etc.

41. Please furnish an undertaking that design and development will be as per provisions and guidelines of Chap III of DAP 2020, especially related to Indigenous Design, Indigenous Content and IPR.

42. Documents to be submitted along with this appendix, by the EoI respondent:-

42.1. Copy of latest certificate of incorporation by the Registrar of Companies.

42.2. Audited Financial Statements (Profit & Loss Account and Balance Sheet) with Auditors Report for last three financial years.

42.3. Acceptance Certificate, clause wise of all terms and conditions given in the EoI.

42.4. Confidentiality Agreement (As per format at **Appendix C**).

42.5. Correctness Certificate (As per format at **Appendix D**).

42.6. Undertaking as per **Para 33** of this Appendix.

42.7. Self-certification for adequacy of engineering and technical ability for undertaking the D&D of IPREK.

42.8. Certificate for broad technical requirements compliance.

Note:-

1. All submissions must be supported by referenced documents duly authenticated.

2. Any input with incorrect or missing reference will not be assessed.
3. No separate financial, commercial criteria will be applied for start-ups.
4. Attach additional pages, as necessary.

Appendix B
(Refers to para 24.1 of EoI)

FINANCIAL AND TECHNICAL EVALUATION CRITERIA

(a) Financial Evaluation Criteria

Ser No	Information	Pass Criteria
1.	Annual Turnover	Average annual turnover of the applicant company for the last three financial years ending 31st March of the previous financial year should **not be less than 5%** of the estimated cost of the project. In case of JV, the average annual turnover of the lead partner shall be considered.
2.	Net Worth	Net worth of the entities ending 31st March of the previous financial year should be "**Positive**".

(b) Technical Evaluation Criteria

Ser No	Criteria and Sub Criteria	Pass Criteria
1	Engineering and technical ability	Self-certification by EoI respondent
	Integration Capability.	Statement of firm for adequacy
2	Proposed indigenous content in percentage of total cost at prototype stage and final stage	As per Chapter III of DAP 2020
3	Total Land area of company	Statement of firm for adequacy
4	PSQRs Compliance	Self-certificate of compliance by EoI respondent (this step will be completed, post issue of PSQRs to the EoI respondent, once it is found complaint to other requirements as specified in the EoI)
5	Intellectual Property Rights (IPR)	Vendor to confirm IPR as per **Para 18 of EoI**
6.	Project Proposal for D&D of IPREK	Evaluation by PFT for technical feasibility for realisation of the project.

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Appendix C
(Refers Para 20 & 27 of EoI)

CONFIDENTIALITY AGREEMENT

1. It is certified that Expression of Interest (EoI) document for the project of Design, Development and Procurement of Indigenous Precision Range Extension Kit (IPREK) will not be shared with any agency in part or in full. Only relevant details, as applicable, will be shared with technology partners including foreign technology partners. However, the EoI document itself will not be shared with any technology partners.

2. The company understands the security sensitivity of such operational system and any information pertaining to deployment and usage of the system including system scaling will not be discussed with third party without a written permission from the Project Facilitation Team. The company understands that failure to observe this agreement will lead to disqualification from the project without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

Signature with Company Seal

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Appendix D
(Refers to Para 32 of EoI)

CORRECTNESS CERTIFICATE

It is certified that information submitted in the documents as part of the response to Expression of Interest (EoI) for the project of Design, Development and Procurement of IPREK is correct and complete in all respects. It is acknowledged that the company will be disqualified from further participation if any information provided is found to be incorrect.

Signature with Company Seal

Appendix E
(Refers para 16 of EoI)

AIRWORTHINESS DIRECTIVE ON INCLUSION OF CERTIFICATION REQUIREMENTS IN REQUEST FOR PROPOSAL (RFP)

ACD/ XX /2023

Issue No. XX Date of Issue: DD MMM YYYY

(Part of 'Manuals' layer of Indian Military Airworthiness Framework')

CENTRE FOR MILITARY AIRWORHTINESS AND CERTIFICATION (CEMILAC)
DRDO, MOD
MARATHAHALLI COLONY POST
BENGALURU-560037

Documentation Page

Document Classification	Unclassified
Document No.	ACD/ /2023
Issue	0.1
Date of Issue	---- May 23
Number Pages	**36** (including the cover page)
Document Title	Directive on Inclusion of certification requirements in request for proposal (RFP)
Key Words	DDPMAS, IMTAR-21, Request for Proposal
Abstract	Main Contractors acquire subsystems, LRUs, Components and aero-materials themselves or from lower tier suppliers. During the acquisition process, the Main Contractors float Request for Proposals (RFPs or equivalent) to solicit potential D&D /Design-cum-Production-Partners. Based on techno-commercial evaluation, one or more suppliers are selected. It is important that the RFP includes the applicable Certification Requirements. This will help the prospective suppliers to include the technical, commercial, effort, timelines and resources in their bids. This document brings out the various aspects to be included in the RFP.
Organization	CEMILAC, DRDO
Distribution	No Restriction
Prepared By	Shri J Krishna Kumar Sc ‘G’, Gp Capt S Stephen, Shri G Senthil Kumar Sc ‘F’
Corrected By	Dr AK Bakare, Sc ‘G’
Review by	Committee of Directors, CEMILAC
Approved by	**(APVS Prasad), Outstanding Scientist** **Chief Executive (Airworthiness)** **& Chairman Joint Airworthiness Committee**

Revision History

Document Title	:	Airworthiness Directive on Inclusion of certification requirements in request for proposal (RFP)
Document Number	:	ACD/ /2023

Revision Number	Date	Approval	Remarks
Ver – 0.1	---- 2023	--	Draft for internal review

Executive Summary
Airworthiness Directive
Inclusion of certification requirements in Request for Proposal (RFP)

Aircraft and their sub-system development involve highly integrated system engineering and supply chain management. In the traditional Aerospace ecosystem, OEMs and Tier-1/Tier-2/Tier-3 suppliers form the complete hierarchical supply chain.

During development phase of an airsystem or airborne store, a Main Contractor (*the organization in the supply chain which is the applicant for airworthiness certification*) acquire subsystems, sub-assemblies, LRUs, components from suppliers. Conventionally, the acquisition process commences with, the Main Contractors floating Request for Proposal (RFPs) to solicit potential D&D /Design-cum-Production-Partners. Based on detailed and multi-stage techno-commercial evaluation, one or more suppliers may be selected for the prototype development and subsequent series production.

The main contractor would be the primary applicant for the certification of the product and is responsible to meet the certification requirements laid down by CEMILAC. Hence, it is important that the Main Contractor, includes the applicable Certification Requirements upfront in the Request for Proposal (RFP). This will help the prospective suppliers to be cognizant of the certification requirements at the time of bidding. The supplier can ensure that the submitted proposal complies with the certification norms, estimate the cost, effort, resources and timelines in a realistic manner. Once the supplier clearly understands the certification requirements during the bidding/contract finalization stage, the risks of time/cost overruns due to certification can be largely alleviated.

DDPMAS V1.0 and IMTAR-21 has stressed the importance of including the airworthiness certification requirements in the RFP in multiple sections of the document. This document gives more details of how certification requirements are to be incorporated during RFP stage.

This document can be used by DRDO, DPSUs and other private industries that plan to outsource development of products that need to certified by CEMILAC. This document can also be used by Indigenization Agencies (like BRDs, NAYs, SHQs) which take up indigenous substitutions for the existing fleet.

Contents

1 Introduction

1.1 Purpose

Main Contractors outsource development of subsystems, assemblies, components to suppliers. The outsourcing process beings with requesting for proposals from prospective suppliers. It has been noticed that the Main Contractors either totally fail or inadequately capture the airworthiness certification requirements in the Request for Proposals (RFPs). This has led to technical non-compliances, cost deficiency and time overrun issues. In order to avoid such risks, it is imperative to incorporate the certification requirements during the RFP stage so that the prospective suppliers can incorporate the technical and commercial aspects in their bids.

This document supplements DDPMAS 2.0 and various regulations given in various sections of IMTAR – 21.

1.2 Scope

The scope of the document is to bring out the means through which the Main Contractors can include airworthiness requirements in the RFP. Since the nature for airsystems/airborne stores cover a wide variety of domains and applications, it is not possible to enumerate product specific certification requirements. Since various procurement agencies follow organisation led approach and guidelines for raising an RFP, this document will attempt to outline the overall requirements for RFPs. Detailed certification requirements are tailored for specific items and captured as a part of ACC, TCB, TAB, ARD, Technical Specifications and Certification Plans. This document is ***NOT*** a substitute to ACC/TCB/TAB/ACP documents which form the basis for airworthiness certification. This documents essentially gives the generic and top-level details of what to be include in RFP to comply with certification requirements laid out in IMTAR-21.

1.3 Structure of the Document

The document is arranged in the form of Airworthiness Certification Requirements, codified as, ***ACR-RFP***. Each ACR-RFP comprises of the Requirement Statement, Acceptable Means of Compliance (AMC) and Guidance Material (GM).

1.4 Applying the Document

RFP is a proprietary document of the Main Contractor and RFP is not a certification related artefact. Hence, the main contractor may include any material towards acquiring the product or service. If the main contractor intends to obtain certification of a military airborne products, the main contractor can use this document as a ***guidance material*** while preparing the RFP. ***CEMILAC would neither review or approve RFPs***. If any project has detailed TCB/TAB/ACP then, those requirements take precedence over the content in this document.

1.5 Applicable Documents

1. DDPMAS Ver 1.0 Framework and Procedure for Design, Development and Production of Military Air systems and Airborne Stores dated Feb 2021.
2. IMTAR-21, Version 1.0 Indian Military Technical Airworthiness Requirements dated Feb 2021.

1.6 Definitions

a. **Design Organisation (DO)**

Design Organisations are organisations involved in the design & development and modification of Airborne Stores used in an Air System. DO shall be responsible for the through-life configuration management of the designed Air borne Stores. In context to this document, Airborne Store refers to the Avionics items / Ground Operational System (GOS) of UAS.

Ref : IMTAR - 21

b. **Design Organization Exposition (DOE)**

DOE is a document that the Design Organisation shall furnish to CEMILAC describing, directly or by cross-reference with the organisation manual, the relevant procedures required for design, modifications or repair of Air Systems & Airborne Stores.

Ref : IMTAR - 21

c. **FRACAS (Failure Reporting Analysis & Corrective Action System)**

FRACAS is a tool established to identify and correct deficiencies in equipment and thus prevent further occurrence of these deficiencies. It is

based upon the systematic approach of reporting and analysis of failures during manufacturing, inspection, test and operational use. The closed-loop feature of FRACAS requires that the information obtained during the failure analysis be disseminated to all of the stakeholders.

Ref : Mil-HDBK-338B

d. **Hazard**

A condition resulting from failures, external events, errors, or combinations thereof where safety is affected.

Ref : SAE ARP 4754A

e. **Product**

A general term used to denote any item, system, material, part, subassembly, set, accessory, Shop Replaceable Unit (SRU), Line Replaceable Unit (LRU.

Ref : Mil-Std-338B

f. **Main Contractor**

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

Ref : IMTAR - 21

g. **Original Equipment Manufacturer (OEM)**

The original equipment manufacturer is the original and the only firm manufacturing the specified COTS Item, as distinguished from the stockist/ distributors or suppliers of such items/equipment. In case of components, the term OCM (Original Component Manufacturer) may be used.

Ref : SAE AS6081

h. **Supplier**

An agency/person in the supply chain who provides a COTS items / service that is used or consumed in the design or production of Avionics. In the context of this document, supplier refers of all sources of supply of a COTS Item. Suppliers include Authorized Distributor, Independent Distributor, Stocking Distributor, Aftermarket Manufacturer, Government Supply Depot, and third party logistic provider.

1.7 Abbreviations

1.	ACBS	:	Approved Component Build Standard
2.	ACC	:	Airworthiness Certification Criteria
3.	ACP	:	Airworthiness Certification Plan
4.	ACR	:	Airworthiness Certification Requirements
5.	AFQMS	:	Approved Firm Quality Management System
6.	AHSP	:	Approved Holders of Sealed Particulars
7.	AMC	:	Acceptable Means of Compliance
8.	ARP	:	Aeronautical Recommended Practises
9.	ATE	:	Automatic Test Equipment
10.	ATP	:	Acceptance Test Procedure
11.	BoM	:	Bill of Material
12.	CCCB	:	Central Configuration Control Board
13.	CDR	:	Critical Design Review
14.	CEH	:	Complex Electronics Hardware
15.	CEMILAC	:	Centre for Military Airworthiness and Certification
16.	CFD	:	Computational Fluid Dynamics
17.	CoC	:	Certificate of Conformance
18.	CONOPS	:	Concept of Operations
19.	COTS	:	Commercially Off The Shelf
20.	CTAH	:	Combined Temperature, Altitude and Humidity
21.	D&D	:	Design & Development
22.	DDP	:	Declaration of Design and Performance
23.	DDPMAS	:	Design, Development and Production of Military Air Systems and Airborne Stores
24.	DDR	:	Detailed Design Review

25.	DGAQA	:	Directorate General of Aeronautical Quality Assurance
26.	DO	:	Design Organization
27.	DOAS	:	Design Organization Approval Scheme
28.	DOE	:	Design Organization Exposition
29.	DCPP	:	Design Cum Production Partner
30.	DPFM	:	DRDO Project Formulation and Monitoring
31.	DRDO	:	Defence Research & Development Organization
32.	EASA	:	European Union Aviation Safety Agency
33.	EM	:	Electro Magnetic
34.	EMC	:	Electro Magnetic Conditions
35.	EMI	:	Electro Magnetic Interference
36.	ESS	:	Environmental Stress Screening
37.	FAI	:	First Article Inspection
38.	FMECA	:	Failure Mode Effect and Criticality Analysis
39.	FPGA	:	Field Programmable Gate Array
40.	FRACAS	:	Failure Reporting Analysis & Corrective Action System
41.	FTA	:	Fault Tree Analysis
42.	FTB	:	Flying Test Beds
43.	GM	:	Guidance Material
44.	GOS	:	Ground Operational Systems
45.	HAS	:	Hardware Accomplishment Summary
46.	HASS	:	Highly Accelerated Stress Screening
47.	IC	:	Integrated Circuits
48.	ICAO	:	International Civil Aviation Organisation
49.	IMTAR	:	Indian Military Technical Airworthiness Requirements
50.	IP	:	Intellectual Property
51.	JAC	:	Joint Airworthiness Committee
52.	JSG	:	Joint Services Guidelines
53.	LCCB	:	Local Configuration Control Board
54.	LMC	:	Local Modification Committee
55.	LRU	:	Line Replaceable Unit
56.	LSP	:	Limited Series Production
57.	LTCC	:	Local Type Certification Comitee

58.	MDDO	:	Multi-Disciplinary Design Optimization
59.	MDI	:	Master Drawing Index
60.	Mil	:	Military
61.	MOPS	:	Minimum Operational Performance Specifications
62.	MoU	:	Memorandum Of Understanding
63.	MTBF	:	Mean Time Between Failure
64.	MTTR	:	Mean Time to Repair
65.	NDT	:	Non Destructive Test
66.	OCM	:	Original Component Manufacturer
67.	OEM	:	Original Equipment Manufacturer
68.	OEM	:	Original Equipment Manufacturer
69.	PBS	:	Product Breakdown Structure
70.	PDM	:	Project Data Management
71.	PDR	:	Preliminary Design Review
72.	PLM	:	Project Lifecycle Management
73.	PLOA	:	Probability of Loss of Aircraft
74.	PLOC	:	Probability of Loss of Control
75.	QA	:	Quality Assurance
76.	QAP	:	Quality Assurance Plan
77.	QMS	:	Quality Management System
78.	QT	:	Qualification Testing
79.	RBD	:	Reliability Block Diagram
80.	RFP	:	Request for Proposal
81.	RSC	:	Reusable Software Component
82.	SAE	:	*Society of Automotive Engineers*
83.	SAS	:	Software Accomplishment Summary
84.	SCRB	:	System Certification Review Board
85.	SCT	:	Supply Chain Traceability
86.	SEB	:	System Engineering Board
87.	SGRP	:	Single Ground Reference Point
88.	SQR	:	Staff Qualitative Requirement
89.	SRU	:	Shop Replaceable Unit
90.	TAA	:	Technical Airworthiness Authorities

91.	TAB	:	Type Approval Basis
92.	TARB	:	Test Adequacy Review Board
93.	TCB	:	Type Certification Basis
94.	TRR	:	Test Readiness Reviews
95.	UAS	:	Unmanned Aircraft Systems
96.	V&V	:	Verification & Validation
97.	WBS	:	Work Breakdown Structure

2 Subpart – A1 : Airworthiness Certification Requirements

2.1 List of requirements

Requirement ID	Title
ACR-RFP-A01	Certification Authority and Certification Basis
ACR-RFP- A02	Pre RFP Certification Activities
ACR-RFP- A03	Data Access to CEMILAC
ACR-RFP- A04	Review and Audit by CEMILAC
ACR-RFP- A05	Inclusion of Certification Requirement in derived RFPs
ACR-RFP- A06	Inclusion of QA Agency
ACR-RFP- A07	Quality Management System
ACR-RFP-A08	System Engineering approach to product development
ACR-RFP-A09	Safety Assessment
ACR-RFP-A10	Inclusion of detailed Requirement Specification
ACR-RFP-A11	Design Adequacy
ACR-RFP-A12	Fabrication of the Product
ACR-RFP-A13	Software/CEH Development and IV&V
ACR-RFP-A14	Test Adequacy
ACR-RFP-A15	Continued Airworthiness
ACR-RFP-A16	Documentation
ACR-RFP-A17	Authorised Holder of Sealed Particulars (AHSP)

ACR-RFP-A18	Tools, Testers and Ground Equipment

2.2 Details Certification Requirements

01	**Requirement ID :** ACR-RFP- A01	**Title :** Certification Authority and Certification Basis
	Requirement: The Main Contractor shall declare in the RFP that CEMILAC is the National Military Airworthiness Certification Authority in India and DDPMAS is the basis document for certification.	
	Acceptable Means of Compliance: (i) Military Airworthiness Certification in India is governed by DDPMAS, IMTAR-21 along with various Level-3 Manuals. Hence, the RFP shall clearly state that certification shall be carried out as per the provisions in these documents. (ii) CEMILAC and its Regional Centres for Military Airworthiness (RCMAs) are the Military Airworthiness Certification Authorities in India.	
	Guidance Material (i) DDPMAS and IMTAR-21 undergo revisions and amendments. Hence, the latest version of these documents should be referred in the RFP. (ii) If previous versions of these document are to used, then consent from CEMILAC shall be obtained.	

02	**Requirement ID :** ACR-RFP- A02	**Title :** Pre RFP Certification Activities
	Requirement:	

	The Main Contractor shall interact with CEMILAC for understanding the certification requirements before floating of the RFP.
	Acceptable Means of Compliance: (i) In case of ab-initio development, the main contractor can approach CEMILAC with the requirement specification or draft SQR document for seeking the necessary certification requirements. (ii) In case of Indigenous substitution, the certification requirements evolved during LTCC may be taken as the basis. (iii) In case of modification/upgrades, the main contractor can approach CEMILAC with the details of modification scheme and seek the necessary certification requirements.
	Guidance Material (i) The main contractor should note that RFP is a preliminary stage of the product development and the extent of details of the product may be limited. Hence, the certification requirements from RCMAs may also be generic and high level only.

03	**Requirement ID :** ACR-RFP- A03	**Title :** Data Access to CEMILAC
	Requirement: The Main Contractor shall mention in the RFP that Indian Military Airworthiness Certification authority i.e. CEMILAC has the right to access all the system related data and documents.	
	Acceptable Means of Compliance: (i) RFP shall contain a para describing the modalities of sharing the documents and data for certification.	
	Guidance Material (ii) Nil	

04	**Requirement ID :** ACR-RFP- A04	**Title :** Review and Audit by CEMILAC

	Requirement: The Main Contractor shall mention in the RFP that Indian Military Airworthiness Certification authority i.e. CEMILAC can constitute any airworthiness review and audit either independently or in association with the Main contractor towards certification of the product
	Acceptable Means of Compliance: (i) CEMILAC may constitute Test Adequacy Review Board (TARB) to ensure that all the testing requirements are captured. (ii) Chief Executive(Airworthiness), CEMILAC may constitute System Certification Review Board (SCRB) to evolve/review certification requirements and tailoring of standards.
	Guidance Material (i) Nil

05	**Requirement ID :** ACR-RFP- A05	**Title :** Inclusion of Certification Requirement in derived RFPs
	Requirement: The Main Contractor shall mention in the RFP, in case the supplier is outsourcing to sub-suppliers, the applicable certification requirements to be flowed down in the RFPs issued by the supplier	
	Acceptable Means of Compliance: (i) The main contract shall include a para describing the modalities of preparing/translating the certification requirements to subsequent RFPs generated.	
	Guidance Material (i) Nil	

06	**Requirement ID :** ACR-RFP- A06	**Title :** Inclusion of QA Agency
	Requirement:	

	The Main Contractor shall explicitly bring out in the RFP, the Govt. QA agency.
	Acceptable Means of Compliance: (i) DGAQA is the Govt. QA agency for Military Aeronautical Products. Hence, DGAQA shall be included as the QA agency. (ii) In case User Services opt to nominate their QA organization, then the name of the User Service QA organization shall be included in the RFP. (iii) In either case, the main contractor shall discuss the QA requirements and include them as a part of the RFP.
	Guidance Material (i) Nil.

07	**Requirement ID :** ACR-RFP- A07	**Title :** Quality Management System
	Requirement: The Main Contractor shall ensure in the RFP that the supplier shall have a Quality Management System (QMS).	
	Acceptable Means of Compliance: (ii) The Main Contractor shall have a Supplier Selection System that ensures the supplier has matured quality management process either by carrying out a Supplier Audit or using industry standards.	
	Guidance Material (iii) The industry standards QMS are AFQMS issued by DGAQA, AS9100 by ASQ.	

08	**Requirement ID :** ACR-RFP- A08	**Title :** System Engineering approach to product development
	Requirement:	

	The Main Contractor shall ensure in the RFP, that the supplier follows system engineering process throughout the product lifecycle.
	Acceptable Means of Compliance: (i) The RFP shall emphasis that the supplier needs to follow System Engineering approach inter-alia development of ConOps, Requirement analysis, design analysis, modelling & simulation, configuration management, risk management, independent reviews, quality assurance. (ii) The supplier shall also be expected to constituted failure analysis boards, test readiness review boards, results analysis teams, safety review boards, flight readiness review boards. The RFP shall have provisions that CEMILAC and DGAQA/User QA along with main contractors are members of these boards.
	Guidance Material (i) ISO/IEC/IEEE 15288: 2015 – Systems and software engineering

09	**Requirement ID :** ACR-RFP- A09	**Title :** Safety Assessment
	Requirement: The Main Contractor shall mention in the RFP, the criticality of the system based on Safety Assessment.	
	Acceptable Means of Compliance: (i) The main contractor shall carry out preliminary Safety Assessment and include the criticality of the system. (ii) The criticality of the systems shall be evolved both from flight functional hazards and Mission hazards that can impact survivability. (iii) The criticality shall be concurred by all the stakeholders like Users, Main contractor, CEMILAC and DGAQA/User QA. (iv) The RFP shall state that detailed the Supplier shall carry out detailed System Safety Assessment like FMEA, FMECA, Zonal Analysis.	

	Guidance Material (i) The safety assessment can be carried out based on SAE ARP 4761 or/and Mil-Std-882.	

10	**Requirement ID :** ACR-RFP- A10	**Title :** Inclusion of detailed Requirement Specification
	Requirement: The Main Contractor shall bring out detailed requirement specification of the product in the RFP.	
	Acceptable Means of Compliance: (i) The requirement specification shall include, but not restricted to functional, performance, safety, reliability & maintainability, interface, physical aspects, environmental aspects, self-test. (ii) A details requirements analysis shall be carried out which shall be reviewed by subject matter experts to ensure all the requirements are correct, complete, consistent and verifiable	
	Guidance Material (i) A generic list of specification parameters for LRUs are listed in Appendix- A. (ii) The specification may include performance standards like RTCA MOPS, SAE documents, Mil Standards and interface standards like ARINC. (iii) The Main contractor may discuss the requirements specifications with CEMILAC prior to inclusion in the RFP	

11	**Requirement ID :** ACR-RFP- A11	**Title:** Design Adequacy
	Requirement: The main contractor shall include necessary provisions to ensure that all the processes, activities and artifacts to ensure design adequacy are generated by the Supplier.	

	Acceptable Means of Compliance: (i) The RFP shall include the scope and schedule of PDRs, CDRs and other reviews. (ii) The RFP shall include the applicable modelling, simulation, analysis to ensure that the design would meet the both the requirement specifications and certification requirements. (iii) The RFP shall clearly state the criteria for use COTS items (hardware/software) in the design.
	Guidance Material (i) List of Criteria for PDR and CDR of Airborne Projects as Appendix - B. (ii) A generic list of analysis for avionics is listed Appendix – C1 and Mechanical system as Appendix - C2

12	**Requirement ID :** ACR-RFP- A12	**Title:** Fabrication of the Product
	Requirement: The main contractor shall ensure in the RFP the guidelines for procurement, fabrication, assembly and inspection processes.	
	Acceptable Means of Compliance: (i) The RFP shall include the requirements to ensure control on the source of supply traceability to OEMs, proper storage and handling of components/materials. (ii) The RFP shall include the need for tooling, jigs etc needed for manufacturing and assemblies. (iii) The RFP shall include provisions for Kit-of-parts inspection, process audit, stage inspection by the DGAQA/User QA and main contractor QA. (iv) The RFP shall include provisions for trained and approved/certified personal carrying out fabrication, inspection and testing. (v) The RFP shall include the need of first article inspection (FAI).	

	(vi) The RFP shall state that all the artefacts and data generated (like CoCs, Route cards, inspection and test reports) need to be preserved.	
	Guidance Material (i)	

13	**Requirement ID :** ACR-RFP- A13	**Title:** Software/CEH Development and IV&V
	Requirement: The main contractor shall include necessary provisions in the RFP to ensure the supplier follows systematic Software/CEH development and Independent Verification & Validation.	
	Acceptable Means of Compliance: (i) The RFP shall include the Software/CEH development lifecycle standards. (ii) The RFP shall include the necessary Software/CEH documentation requirements. (iii) The RFP shall include the extent of Independent Verification & Validation (IV&V) to be followed by the supplier for software certification.	
	Guidance Material (i) NIL	

14	**Requirement ID :** ACR-RFP- A14	**Title:** Test Adequacy
	Requirement: The main contractor shall include necessary provisions in the RFP to ensure the supplier carries out applicable test and evaluation.	
	Acceptable Means of Compliance:	

	(i) The RFP shall include the requirements for test facilities like rigs, ATEs. The RFP shall bring out that such facilities shall be approved by TAA based on the type and nature of the test facility. (ii) The RFP shall include the all the type of tests including functional, environmental, integration, aircraft ground integration and flight trials. (iii) The RFP shall state that the supplier shall plan to fabricate sufficient samples to ensure the adequate testing. Test samples may have be quarantined and preserved. (iv) The RFP shall include the need to conduct Test Readiness Reviews (TRRs).
	Guidance Material (i) A generic list of environmental tests is listed Appendix – D

15	**Requirement ID :** ACR-RFP- A15	**Title :** Continued Airworthiness
	Requirement: The Main Contractor shall mention in the RFP, that the supplier has to meet the certification requirements during production and in-service phase (operational lifecycle)	
	Acceptable Means of Compliance: (i) The main contractor to ensure that supplier establishes a FRACAS system for failure analysis (ii) The main contractor to ensure that the supplier has a robust configuration management system to track the changes to the product configuration throughout the lifecycle	
	Guidance Material (i) The main contract may follow the Local Modification Committee (LMC) approach for modification. (ii) All the defects and failures are to be collected, analysis and root cause established.	

16	**Requirement ID:** ACR-RFP- A16	**Title :** Documentation
	Requirement: The Main Contractor shall mention in the RFP, that list of documents/document types that need to be generated throughout the lifecycle of the product, during D&D, Production and in-service phases.	
	Acceptable Means of Compliance: (i) The documents include design documents, analysis, review reports, inspection records, QA audits records, test reports, sub-supplier data/documents. (ii) All the documents and data shall be properly managed through proper change/configuration management procedures. (iii) The Main Contractor shall mention in the RFP, the certification requirements towards publications pertaining to operational and maintenance aspects. (iv) The RFP shall state the period for which the documents need to be archived.	
	Guidance Material (i) A list of documents for Avionics and Aero-Mechanical/armament is attached as Appendix – E1 and Appendix – E2 respectively	

17	**Requirement ID:** ACR-RFP- A17	**Title :** Authorised Holder of Sealed Particulars
	Requirement: The Main Contractor shall mention in the RFP, the nominated Approved Holders of Sealed Particulars (AHSP).	
	Acceptable Means of Compliance: (i) AHSP are the authorized holders of design, fabrication and test data at the end of the D&D process. Hence, the RFP shall clearly state the AHSP.	

	(ii) The list of documents that shall part of ‘Sealed Particulars’ shall also be mentioned in the RFP.	
	Guidance Material Nil	

18	**Requirement ID:** ACR-RFP- A18	**Title :** Tools, Testers and Ground Equipment
	Requirement: The Main Contractor shall mention in the RFP, the list of tools, testers and ground equipment required for maintenance of the Product.	
	Acceptable Means of Compliance: (i) The RFP shall state the O-Level, I-Level and D-Level tools and testers. (ii) The Tools, testers and ground equipment shall be approved by the competent QA agency.	
	Guidance Material Acceptance of TTGEs may be as per IMTAR 21 Subpart T2	

3 Review, Promulgation and Feedback

3.1 Review

This document was prepared internally within CEMILAC and reviewed by the Council of Director of CEMILAC.

3.2 Promulgation

This document is a part of manuals of Technical Airworthiness Framework released by CEMILAC. The document would be available in CEMILAC's official website after release.

3.3 Feedback

Any feedback on the document may please be forwarded to the undersigned:

The Director (TC & PI)
CEMILAC, D R&D Organization,
Ministry of Defense,
Bengaluru, Karnataka, India
PIN Code – 560 037
Email : gd.tcs@cemilac.drdo.in

4 References

(i) DDPMAS Ver 1.0 Framework and Procedure for Design, Development and Production of Military Air systems and airborne stores

(ii) IMTAR-21, Version 1.0 Indian Military Technical Airworthiness Requirements

Appendix – A1: List of Parameters to be included in Specification

1. Physical and interface specification

1.1. Dimension:

[**LRU-PY** -01]Outer Dimension (including Connectors, handle & locating pin): (Note : give details with and without mounting tray)
…. (L) x … (W) x … (H) (in mm) Tolerance: ±… mm.

1.2. Weight:

[**LRU-PY** -02] LRU Weight shall be < …. Kgs or … ±… Kgs
(Note : give details with and without mounting tray)

1.3. Mounting :

[LRU-PY-03] : (Note : give details of mounting mechanism, like tray, interface plates etc)

1.4. Chassis cooling :

[**LRU-PY** -04] The Chassis of LRU shall be conduction/forced/liquid cooled. <Give Cooling specification>

1.5. Chassis connections:

[**LRU-PY** -05] LRU chassis power and signal input and output connections shall be made through D38999 series connector. There is provision of SGRP (Single Ground Reference Point) coming to the connector. <Any other schemes>

1.6. Accessibility :

[**LRU-PY**-06] LRU shall be designed to access all the SRUs by opening one of bottom cover. <Any other schemes>

1.7. Mechanical design & construction:

[**LRU-PY**-07] The LRU Chassis shall be designed using milled construction. The material used shall be HE30. For ease carrying, it shall be provided with handle. The Chassis shall have mounting lugs.

Colour: Black Finish: MATT Finish

<Any other schemes>

1.8. Marking:

[**LRU-PY**-08] The entire connectors shall be engraved onto the unit to ease the identification. The Name plate of LRU shall have Nodal Establishment name, LRU Name, Sl. No. and Hardware versions/Software versions engraved on it.

<Any other schemes>

1.9. Interfaces:

<Mil-Std-1553, ARINC, RS422 etc>

2. Electrical specifications

2.1. Input power supplies:

[LRU-EL -01] : Power Supplies shall be complaint to Mil-Std-704E. <Any other schemes>

2.2. Power consumption:

[LRU-EL -02] **:** Not exceeding TBD W under worst case conditions

2.3. Grounding requirement:

[LRU-EL -03]:Input Power ground, Signal ground and Chassis ground shall be Isolated. Chassis ground shall be connected to cable shield and filter pin ground <Any other schemes>

2.4. Insulation & Bonding:

[**LRU-EL** -04]: Insulation resistance measured between connector pins & chassis: >10MΩ

[**LRU-EL** -05]: Bonding resistance measured between any two contacts in the Chassis < 100mΩ <Any other schemes>

3. Reliability and Maintainability Requirements

3.1. [LRU-R&M-01]: Total Calendar Life: <TBD> Years

3.2. [LRU-R&M-02]: Total Operating Hours: <TBD> Hours

3.3. [LRU-R&M-03]: Mean Time Between Failures (MTBF): <TBD> Hours

3.4. [LRU-R&M-04]: Time Between Overhaul (TBO): <TBD> Year

3.5. [LRU-R&M-05]: Mean Time To Repair (MTTR): <TBD> Hour
(SRU level Replacement)

4. Safety and Redundancy Requirement

4.1. [LRU-SAF-01]: Criticality Classification

5. Functional & Performance Requirement of LRU system

<All the functional requirements properly tagged. >
<Start up time to provide full functionality >
<All the Performance requirements properly tagged. >
<If the functionality has to meet any ICAO/Mil/RTCA standards ensure that all the applicable functional/performance requirements are included >

6. APPLICABLE QUALIFICATION TESTS ON LRU

LRU unit shall be subjected to all the below QT Tests.
Category: External / Internal Mounted
Critical/Non Critical
Sample is given below

1	**Vibration Test (Final Resonance Test)**	At 1.0g from 5 Hz to 500 Hz, Equipment to be OFF	**[LRU-QT 010]**
2	**High Temperature Storage cum Operational Test**	From 35 °C to 70 °C , Duration 7 cycles, 24 Hrs each cycles as per Mil-Std-810F Method-, Procedure-	[**LRU-QT- 011**]
3	**……**		
4	**……**		

The complete list of tests for avionics is given in Annexure-1

7.0 EMI/EMC SPECIFICATION OF LRU

For LRU system MIL STD 461E shall be followed.
Category: External / Internal Mounted (with Respect to Electro Magnetic Conditions and not as per climatic)
Classification : Critical/Non Critical
Sample is given below

REQUIRED TEST	**DESCRIPTION**	**Applicability**	**Requirement Index no**
CE101	Conducted Emissions, Power and interconnecting leads (30Hz to 10KHz)	Curve #2 Figure CE101-4	[LRU-QT-050]
CE102	Conducted Emissions, Power and interconnecting leads (10 KHz to 10MHz)	Basic Curve CE102-1	[LRU-QT-051]
….			

Appendix – B : Criteria for PDR and CDR of Airborne Projects

(i) Criteria for PDR

Sl. No.	Criteria	Complied/ Not Complied/ Not Applicable	Proof of Compliance (if the criterion is applicable)	Remarks
A. Project Management Aspects				
1	System Engineering Plan document is generated. System Engineering Board (SEB) constitution is decided.			
2	Project management plans like System Development Plan, System Configuration Management Plan are available.			
3	Project Lifecycle Management (PLM) Plan and Project Data Management (PDM) Plans are available.			
4	Outsourcing plan and selection criteria for DCPP are identified.			
B. Requirements Aspects				
1	CONOPS has been prepared and consulted with User Services. The CONOPS shall cover all the aspects like Operational, Maintenance, training etc.			
2	Requirements analysis carried out based on CONOPS and System Requirement Document finalized.			
3	The external interface requirements are clearly identified.			
C. Design Aspects				
1	One or more feasible preliminary designs have been identified.			

2	Analysis of candidate designs have been carried out and the reports are available.			
3	Quantitative Multi-Disciplinary Design Optimization (MDDO) has been performed.			
4	The system architecture is finalized. The PBS and WBS are generated.			
D. Safety and Survivability Aspects				
1	Safety and Reliability Management Plan with detailed objectives, tools are identified.			
2	Functional Hazard analysis and Preliminary System Safety Analysis, Functional FMECA are performed.			
3	Mission Hazard Analysis is performed.			
4	The criticality levels (Design Assurance Levels) are assigned to each subsystem.			
5	Probability of Loss of Control (PLOC) and Probability of Loss of Aircraft (PLOA) are identified.			
6	Human Factors that impact Safety and Performance are identified.			
E. Verification and Validation				
1	A detailed system level verification and validation plan is generated.			
2	A test requirement traceability matrix covering a detailed means of testing is generated.			
3	Life Cycle Environmental Profile of the project is understood and the environmental requirements (climatic, Mechanical, Electro Magnetic) are identified as a part of Master Environmental Test & Evaluation Plan			

4	All test rigs and test facilities for design validation (component, subsystem and system level) are identified. The acceptance methodology for these facilities are broadly outlined.			
5	Flight Test requirements are identified.			
6	All tools required for testing are identified.			
7	Test Adequacy Review Boards are identified.			
F. Reliability and Maintainability Aspects				
1	Reliability analysis is carried out and the reliability figures are assigned.			
2	Redundant Management is identified.			
3	Maintenance Philosophy is understood and documented.			
4	O-Level, I-Level and D-Level testing requirements are captured.			
G. Quality Assurance Aspects				
1	Quality Assurance Objectives for the project are identified.			
2	Quality Assurance Plan document is generated.			
3	QA Teams are identified and training requirements are planned.			
4	Component, Subsystem and System level inspection and screening are clearly identified.			
5	The QMS requirements for the outsourcing agencies are identified.			
H. Manufacturing and Production ToT Planning				
1	The technologies for manufacturing for components and subsystems are understood.			

2	Series Production Facilities (ATE, production rigs) are planned.			
3	The proposed architecture is reviewed for Manufacturing and assembly.			
4	The training needs for the Manufacturing / Production / ToT Partner is identified.			
I. Risk Management				
1	Technical Risks (Development & Testing/Valuation), Procurement Risks are identified and quantified.			
2	Risk Mitigation Plans (Plan – B) are analyzed and suitable options are identified.			
J. Certification				
1	Preliminary discussion with Certification Agencies (CEMILAC, DGAQA) conducted and Certification Criteria are identified.			
2	Airworthiness Certification Plan & Quality Assurance Plan (QAP) have been prepared and reviewed by the certification agencies.			

(i) Criteria for DDR (for subsystem) / CDR (System Level)

Sl. No.	Criteria	Complied/ Not Complied/ Not Applicable	Proof of Compliance (if the criterion is applicable)	Remarks
A. Project Management Aspects				
1	All the applicable sections of DPFM are met (applicable for DRDO Projects). Other D&D organization may follow the provisions given in Mil Std 1521.			
2	PDR suggestions have been incorporated.			

3	All the Subsystem design review committee (DDR) have been incorporated.			
4	The constitution of DDR/CDR is in accordance with Section 2.5.2 of DPFM-2021. (applicable for DRDO Projects).			
5	All changes carried out in the conceptual design between PDR to DDR/CDR has reviewed and approved by Local Configuration Control Board (LCCB)/Central Configuration Board (CCCB)/System Engineering Board (SEB).			
6	All the data generated at various work centres that forms the basis of CDR are uploaded in the PLM Server.			
B. Requirements Aspects				
1	The System Architecture has been finalized and System Requirement allocation has been carried out to subsystems and modules.			
2	Subsystem Technical Specification requirements (from system requirements and derived requirements) have been generated and reviewed. The specifications covers not only functional, and performance, but also environmental, life related, reliability & maintainability, testability.			
2	All inter Subsystems/LRUs/SRUs interfaces are identified.			
3	It is ensured that all technical specification parameters are ensured to be ‘quantifiable’, ‘Correct’, ‘Complete’, ‘Consistent’ and ‘Verifiable’.			
4	The documentation and publications requirements are identified. The documentation includes the design documents (hardware & software), production documents, testing documents. The publication includes user manuals, maintenance manuals, fault diagnosis and repair etc.			
C. Design & Development Aspects				
1	Component level design are finalized and the drawings are baselined.			
2.	Standard and special processes involved in the development of the products are identified.			

3	Engineering models / prototypes are realized as per the component / system build standards and assembled.			
4	Applicable analysis for Structural systems, mechanical systems, Electronics and software/FPGA are carried out.			
5	The analysis results are reviewed and found to meet requirements. All the analysis which are not meeting the requirements are listed and mitigation are planned. The negative connotations of the limitations brought out by the analysis are studied for their impact on the user requirements.			
D. Safety and Survivability Aspects				
1	Detailed System Safety Analysis including Fault Tree Analysis, Dependence Diagrams, Particular Risk Analysis, Zonal Analysis, Common Cause Analysis, Markov analysis are carried out .			
2	Sub-system / software criticality levels are finalized.			
3	Derived requirements (Hardware, software and CEH) are analyzed for their impact on safety.			
4	Impact of software failures on the overall safety is analyzed.			
5	The design features for detection and annunciation of various failures are studied.			
E. Verification and Validation				
1	Component Level, Sub-system Level test plans for safety Functionality and performance are carried out.			
2	Functional Testing on Prototype/Engineering Models are carried out and results are reviewed.			
3	The test systems have been developed and accepted by Test System Adequacy Review Boards.			
4	Environmental, power compatibility and EMI/EMC tests are performed to the extent possible/planned on the prototypes.			
5	Component level fatigue tests are performed.			

6	Component level lifing tests are performed.			
7	The test results are reviewed and found to meet requirements. All the test results which are not meeting the requirements are listed and mitigation are planned. The negative connotations of the limitations brought out by the testing are studied for their impact on the user requirements.			
8	The human aspects of system are evaluated with User representatives.			
9	Component level/Sub-system level have been flight tested in Flying Test Beds (FTB).			
F. Reliability and Maintainability Aspects				
1	Reliability Block Diagram (RBD) is generated.			
2	Component Level FMECA is carried out.			
3	Detailed Reliability analysis (Parts Stress Method) is carried out. Derating Analysis are carried out.			
4	Availability and Dependability estimates are developed.			
5	MTBF/MTTR are estimated.			
6	Failure Reporting Analysis and Corrective Action System (FRACAS) is established and all the failures, corrective action and preventive actions are tracked.			
7	If software is present, the software reliability is established.			
G. Quality Assurance Aspects				
1	All the physical attributes (eg dimensions, finish etc) and processes (eg welding, soldering, assembly etc) have been found to meet the specifications.			
2	Non-compliances have been recorded and subject to non-compliance review processes. Corrective and Preventive actions have been recorded.			
3	Failure Analysis Review Boards have been constituted and all the defect investigations have been carried out meticulously.			
4	Oversight audits have been carried out on suppliers as planned in the QAP and			

	the supplier quality meet the overall quality objectives.			
5	Inward goods inspection processes have been established and component / material traceability aspects are available.			
6	All quality related matrices are identified.			
H. Manufacturing and Production ToT Planning				
1	All manufacturing jigs are fabricated and used in the realization of prototypes. Limitations, if any in the manufacturing jigs are documented and improvement plans are established.			
2	The design has been assessed for Design for Manufacturing, Design for Assembly and Design for Testability			
3	Automatic Test Equipment (ATE) specifications are finalized.			
4	Draft Production ATPs are generated and discussed with LAToT partners.			
I. Risk Management				
1	The risk identified during initial phases of the projects (like peer review, PDR, DDR) are tracked and eliminated.			
2	New Risks from implementation, Limited Series Production, (LSP) and Series production are identified and mitigation planned.			
J. Certification				
1	Type Approval Basis / Type certification Basis is finalized and approved by CEMILAC.			
2	Compliance Standards are tailored in accordance with the project requirements and concurred by CEMILAC.			

Appendix – C1 : Generic List of Analysis for Avionics

1. Thermal Analysis 2. De-rating analysis 3. Reliability analysis 4. Signal Integrity Analysis 5. Power Integrity analysis 6. AC/DC load analysis 7. Structural load analysis 8. Electrical load analysis 9. Zonal Safety analysis 10. Particular Risk Analysis 11. Common Cause Analysis 12. Functional Hazard Analysis 13. Fault tree analysis 14. FMEA/FMECA	15. Preventive Maintenance Analysis 16. Corrective Maintenance analysis 17. Pressure and flow analysis 18. Dynamic and static load analysis 19. Electromagnetic Environmental Effects Integration Analysis 20. Closed loop analysis 21. Finite element analysis 22. Sensitivity analysis 23. Magnetic flux analysis

Appendix – C2 : Generic List of Analysis for Aero-Mechanical Equipments/Systems

1. Static Stress Analysis 2. Dynamic Analysis (Shock, Vibration etc) 3. Kinematic Analysis 4. CFD Analysis 5. Clash/Gap Analysis 6. Performance Analysis 7. Store Separation Analysis 8. Thermal Analysis 9. Reliability analysis 10. Structural load analysis 11. Zonal Safety analysis 12. Particular Risk Analysis 13. Common Cause Analysis 14. Functional Hazard Analysis 15. Fault Tree Analysis 16. FMEA/FMECA 17. Fatigue Analysis 18. Flutter Analysis	19. Pressure and flow analysis 20. CLAW Analysis (Open & Closed Loop) 21. Finite Element Analysis 22. Sensitivity analysis 23. Performance Analysis 24. Motion in Rail Analysis 25. Store Separation analysis 26. Engine Plume Compatibility analysis etc.,

Appendix – D : List of Qualification Tests

In general, qualification test requirement for the airborne stores are categorised as environmental qualification test and functional qualification test

A. Environmental Tests include the following

1. High Temperature
2. Low Temperature
3. Altitude
4. Humidity
5. Rain
6. Sand & Dust
7. Salt fog
8. Icing & Hail Storm
9. Thermal Shock
10. Combined Temperature, Altitude and Humidity (CTAH)
11. Explosive decompression test
12. Solar radiation
13. Fungus
14. Vibration
15. Acceleration (Functional, Structural and Crash)
16. Mechanical Shock (functional, crash, transit drop, bench handling)
17. Explosive atmosphere
18. Contamination resistance
19. EMI/EMC (Conducted/Radiated Susceptibility/Emission)
20. Power Supply Compatibility
21. Indirect Effects of Lightning

B. Additional Design Validation Testing

1. Compass Swing
2. Highly Accelerated Life Testing (HALT)
3. Sunlight Readability
4. NVG Compatibility
5. Aerodynamic Load Test

C. Lifing test shall include the following

1. Endurance test

D. Screening Tests

1. COTS screening
2. Environmental Stress Screening (ESS)
3. Highly Accelerated Stress Screening (HASS)

Appendix – E 1 : List of Documents & Data Required for Certification of Avionics

1. Technical Specification
2. Approved Standard of Preparation (SoP) along with all the manufacturing drawings
3. Schematics & Bill of Materials
4. Module Specification and test documents
5. Assembly and Test Document ATP
6. Configuration documents with list of deliverables like cables and test equipment
7. Approved Supplier list
8. Technical Specifications for test equipment's or STTE
9. SOP for STTE
10. Software Version Description Document
11. Software Accomplishment Summary (SAS) and Hardware Accomplishment Summary (HAS) in-case of firmware
12. Platform specific configuration documents in case used in different platforms
13. First Article Inspection Report (In-case of ToT items)
14. Environmental qualification test Report
15. Functional performance Qualification test reports
16. Lifing Documents
17. Maintenance Manuals
18. Overhaul Manual
19. Mod leaflets if any
20. Reliability Report/data
21. Certificate of Conformance (CoC)
22. System Safety Assessment
23. Interface Control Document

Appendix – E 2 : List of Documents & Data Required for Certification of Aero-Mechanical systems and Armament

1. Technical Specification
2. Fatigue Life Spectrum
3. Installation and Interface Control Document
4. System Safety Analysis Report including FMECA, FTA, etc.
5. System Reliability Analysis
6. Functional Hazard Analysis
7. Performance Estimation/analysis
8. Static Stress Analysis
9. Fatigue life analysis Report
10. Thermal Analysis Report
11. Kinematic Analysis / Clearance Studies
12. CFD Analysis
13. Dynamic Analysis
14. Declaration of Design and Performance(DDP)
15. Certificate of Design(CoD)
16. Description and Operational Manual
17. Standard of Preparation/Component Build Standard
18. Illustrated Parts Catalogue
19. Environmental qualification test & Report
20. Functional performance Qualification test & reports
21. Endurance test & reports
22. EMI/EMC Test Plan and Report
23. Mil STD 704D Compliance (Aircraft Electrical Power Characteristics)
24. Qualification Test Procedures
25. Acceptance Test Procedures
26. Qualification Test Reports including test reports for storage/shelf life and Service life (Operational/Technical Life & Calendar life)
27. Acceptance Test Reports
28. Copy of Approval from Technical Airworthiness Authorities
29. Component Maintenance Manual
30. Design Change Notes / Modification details in Service

31. Flight Manuals (in case of Engines)
32. Reliability Report/data

Note: Design Documents and Analysis reports listed above may vary from store to Store. Depending of the nature of the product, applicable documents may be discussed with CEMILAC and included in the RFP.

Appendix – F: Reference Checklist for verification to ensure certification requirements are captured

Sno	Activity	Yes/No
1.	If Certification Authority has been specified and Certification Basis specified in RFP	
2.	All Pre RFP Certification Activities are captured	
3.	Confirm requirement for Data Access to CEMILAC captured	
4.	Confirm Review and Audit clause is included	
5.	Confirm Inclusion of Certification Requirement in derived RFPs	
6.	If of QA Agency are identified and specified	
7.	Is Quality Management System requirement defined	
8.	Has the System Engineering approach to product development emphaised.	
9.	Has criticality of the system defined	
10.	Are all detailed Requirement Specification included	
11.	Are all the necessary reviews, analysis, modelling requirements included	
12.	Has the criteria for fabrication of the product including jigs and fixtures included	
13.	Capture of Software certification requirement	
14.	Has all Test reviews, equipment and their approval included	
15.	Is Continued Airworthiness requirement captured	

16.	Are all required Documentation included	
17.	Is AHSP identified	
18.	Are Tools, Testers and Ground Equipment included	