

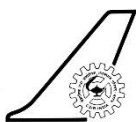


EXPRESSION OF INTEREST

FOR

DESIGN AND ENGINEERING OF AIRFRAME
FOR SARAS MK2

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
NATIONAL AEROSPACE LABORATORIES
P.B. NO.1779, HAL AIRPORT ROAD, KODIHALLI,
BENGALURU-560017



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ISO:9001:2008

Certified

EXPRESSION OF INTEREST

CSIR- National Aerospace Laboratories (NAL), Bengaluru, India is one of the premier laboratories under Council of Scientific and Industrial Research, an autonomous body under Department of Scientific and Industrial Research (Government of India), New Delhi. CSIR-NAL is a Science and Knowledge based Research, Development and Consulting Organization. It is internationally known for its excellence in Scientific Research in Aerospace Engineering.

An Expression of Interest (Eoi) is initiated at CSIR-National Aerospace Laboratories (CSIR-NAL) for “**Detail design and engineering of airframe for SARAS MK2**” from an established aircraft design/manufacturing company for the following: -

Sl. No.	File No.	Item Description
01.	NAL/PUR/ACD/200/20-Z	1. Detail design & Engineering for Fuselage structure. 2. Detail design & Engineering for Wing structure. 3. Detail design & Engineering for Vertical and Horizontal Fin structure. 4. Detail design & Engineering for Control Surfaces structure.

1. The address for submission of document and for obtaining further information:
Controller of Stores & Purchase
Purchase Section
CSIR- National Aerospace Laboratories
PB No.1779, HAL Airport Road, Kodihalli, Bengaluru – 560017
Karnataka-India
Tel # : 080 25086040/6041/6044
Fax # : 080 25269611
Email : purchasek@nal.res.in, mkala@nal.res.in, spo@nal.res.in
2. The Bidding document can be downloaded free of cost directly from Central Public Procurement Portal (CPPP) of Government of India website <http://eprocure.gov.in/epublish/app> and CSIR-NAL website www.nal.res.in.
3. The prospective bidders shall adhere to due dates specified in Tender Details corresponding to this Tender.
4. The Schedule for Submission of Bids and Opening of Bids is as follows: -

Date & Time of Submission of Bid		Date and Time of Opening of Bid	
Date	Time (IST)	Date	Time (IST)
29-Oct-2020	10:30	29-Oct-2020	11:00

5. Date and Time for receipt of hard copy of proposals: The proposals in hard copy should reach the tender box on or before the date and time mentioned at Sr. No.4 for submission of proposals. Late/delayed proposals will not be considered. Postal/Courier delays will not be accepted as an excuse. In case the last date and time is declared a holiday at a late date, then the due date and time for receipt, opening will be shifted to the next working date and time automatically. **No corrigendum will be issued in this regard.**
6. A brief description of the **Engineering Services** is appended herewith. The Participants are requested to submit documentary evidence to prove technical capabilities, client list, experience and credentials as per **Annexure-I and Annexure-II** enclosed.
7. The Technical Committee shall finalize specifications after knowing/obtaining details about relevant/available technology in the market suiting to the requirement and R&D needs of our Laboratory.
8. For evaluating the responses, CSIR-NAL, if required, may call the bidders for presentation of their case. Presentation can be considered via WebEx/Skype/Video Conferencing also.
9. The Director, CSIR-National Aerospace Laboratories (NAL), Bengaluru, India reserves the right to accept or reject any or all EOI notification/tenders/offers or withdraw the Notice at any stage of processing without assigning any reasons whatsoever, such an event would not cause obligation of any kind to CSIR-NAL.

sd/-
Stores & Purchase Officer
For and behalf of CSIR

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1. Organization Background

National Aerospace Laboratories (NAL), a constituent of the Council of Scientific and Industrial Research (CSIR), India, established in the year 1959 is the only government aerospace R&D laboratory in the country's civilian sector. CSIR-NAL is a high-technology oriented institution focusing on advanced disciplines in aerospace. CSIR-NAL has several advanced test facilities, and many of them are recognized as National Facilities. These are not only the best in the country, but are also comparable to other similar facilities in the world. CSIR-NAL has provided significant value added inputs to all the Indian national aerospace programmes. Its contributions over the last six decades have enabled it to create a niche for itself in advanced aerospace research and technology development. CSIR-NAL has also developed many critical technologies for the strategic sector and continues to support the mission-mode programmes of the country.

CSIR-NAL's mandate is to develop aerospace technologies with strong science content, design and build small, medium sized civil aircraft, and support all national aerospace programmes

2. Project Background

CSIR National Aerospace Laboratories (CSIR-NAL) has taken up the design and certification of a 19-Seater Light Transport Aircraft - Saras MK2, a twin-engine turboprop aircraft to offer connectivity to small cities. Three view diagram with salient dimensions* is shown in Figure 1.

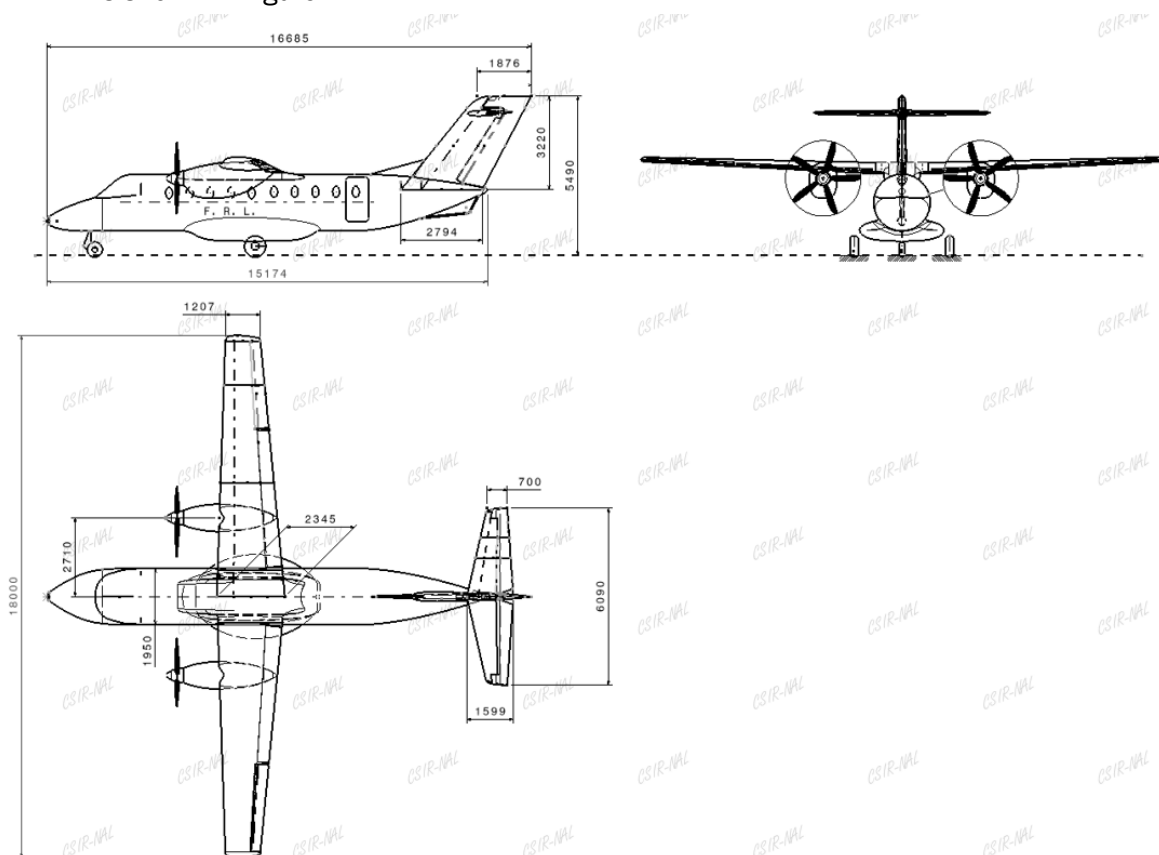


Figure 1. SARAS MK2 Three-View Diagram

* Dimensions shown are representative and subject to revisions

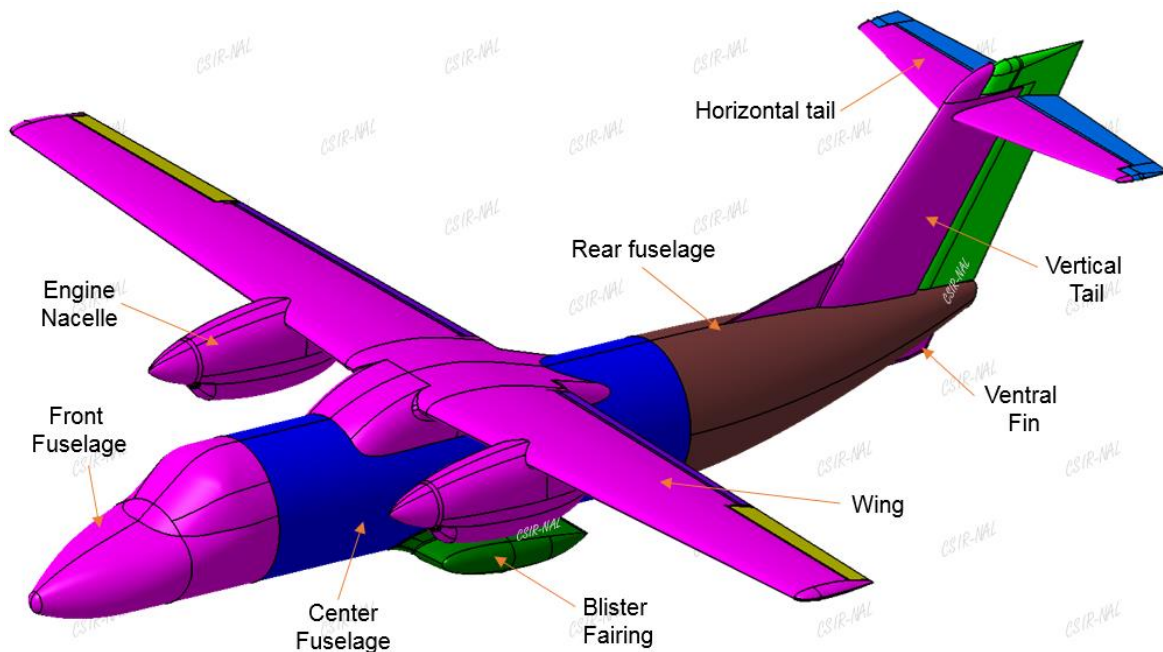


Figure 2. SARAS MK2 configuration

3. Purpose and service outcomes statement of the assignment

The purpose of this assignment is for detail design and Engineering services for the following:

1.	Detail design & Engineering for Fuselage structure.
2.	Detail design & Engineering for Wing structure.
3.	Detail design & Engineering for Vertical and Horizontal Fin structure.
4.	Detail design & Engineering for Control Surfaces structure.

The outcome of these services are described in Section 8 of this document. For the achievement of these work packages, the Engineering Service Provider shall meet the regulations of

- FAA Title 14, FAR Part 23, amendment 63 and associated Advisory Circulars.
- Top-level aircraft requirement (TLAR) for Saras MK2, specific to the work packages.
- Any other requirements specified by CEMILAC (DDPMAS) / DGCA (CAR 21).

CSIR-NAL reserves the right to split, add, remove or modify any of the Work Package.

4. Scope of work for detail design and engineering of Airframe.

The Work Package wise statement of work between customer and the Engineering service providers are detailed below.

4.1 Work Package 1 - Detail Design and Engineering for Fuselage Structure.

4.1.1 Scope of work

The scope of this work package pertains to SARAS MK2 Fuselage, Blister Fairing and Ventral Fin structure. The objective of this work package is to carry out detail design and associated stress analysis, Fatigue and Damage Tolerance (F&DT) of Critical areas, CAD model generation, drawings for manufacturing, installation, assembly and support during manufacturing for Non-conformance and higher issues.

The Engineering Service Provider will take up the structural design definitions from PDP for detail design, which would be mostly metallic with few composite parts. As part of this work package, the Engineering Service Provider has to carry out detailed sizing, Detailed FEM (DFEM), stress analysis reports, create manufacturable detailed part definitions (3D), part & assembly drawings to meet budgeted weight. The considerations for detail design are as quoted below but not limited to meeting FAR 23 requirements, load requirements, safety factors requirements, weight & C.G. limits, Design For Manufacturing and Assembly (DFMA), tooling requirements, materials & processes, adjoining sections/assembly, system installations, clash and clearances, Interchangeability (ICY) requirements, lower manufacturing cost etc. This work package would also include engineering support during (i) Component manufacturing and assembly (non – conformity support), (ii) Jig fixture design (to resolve interface issues with tool design team of NAL), (iii) static test (to resolve design issues of component) and (iv) flight test (non – conformity support).

The anticipated work involved is approximately 2600 drawings (number of Left Handed, unhandled and unrepeatable part/assembly drawings (with associated models), including secondary parts). The number is indicative in nature based on earlier variant. It is to be noted that the detail design phase is evolutionary and iterative in nature. The number of drawings indicated cannot be certainly and/or reliably known at the beginning. The engineering service provider shall estimate the number of drawings and effort involved independently.

4.1.2 Work Content of Fuselage Work Package

4.1.2.1 Work Content for Front Fuselage

Major Components
Nose Radome (composite)
Cockpit floor and pilot seat attachments
Windscreen frames with transparency
Frames (machined and sheet metal)
Stringers
Skins (metallic except Front Top Skin)
Front Top Skin assembly (above windscreen frame) (Composite)
Joints between skin, frame and stringer, Splice joints
Stringer clips
Structural parts of Main instrument panel, Side consoles & Center pedestal

Forward pressure bulkhead
Cockpit partition wall assembly(composite)
NLG bay walls
NLG Bay door with follow up mechanism
NLG attachments
Provision for Forward Jacking Point
Avionics bay door
Scoops for bay ventilation
Access panels (Avionic bay etc.)
Structural provisioning for Mechanical systems (FCS, ECS, Powerplant and Hydraulics), Avionics, Electricals and Interior panels

4.1.2.1 Work Content for Centre Fuselage

Major Components
Frames (machined and sheet metal)
Stringers
Skins (metallic)
Joints between skin, frame and stringer, Splice joints
Stringer clips
Cabin floor structure
Door surrounding structure
Pax Seat rails
Window assembly with Transparency
Floor board
Fuselage-wing fairing interface attachment (Composite/Metal)
Rear pressure bulkhead (Composite)
Blister Fairing attachment provision
Provision for slinging
Structural provisioning for Mechanical systems (FCS, ECS, Fuel, Power Plant, Hydraulics, De-Icing etc.), Interior panels, lashing for baggage compartment, lavatory, Avionics and Electricals etc.

4.1.2.2 Work Content for Rear Fuselage

Major Components
Frames (machined and sheet metal)
Stringers (Metal / Composite)
Skins (Metal / Composite)
Joints between skin, frame and stringer, Splice joints
Stringer clips
Access Panels (Service bay etc.)
Tail cone
Service door
Ventral Fin attachment provisioning.
Structural provisioning for Mechanical systems (FCS, ECS, fuel, Power Plant, Hydraulics, De-Icing etc.), Avionics and Electricals etc.

4.1.2.3 Work Content for Blister fairing

Major Components
Frames (machined and sheet metal)
Stiffeners/Intercostal (composite/metallic)
Skin (composite/metallic)
Access Panels
MLG Bay door with follow up mechanism
MLG attachments
Provision for Jacking Points
Structural provisioning for Main Landing gear, Mechanical systems (Hydraulics etc.) and Electrical etc.

4.1.2.4 Work Content for Ventral Fin

Major Components
Skin (composite/metal)
Access panels
Spars
Ribs

4.2 Work Package 2 - Detail Design and Engineering for Wing Structure

4.2.1 Scope of work

The scope of this work package pertains to SARAS MK2 Wing structure (control surfaces not included). The objective of this work package is to carry out detail design and associated stress analysis, Fatigue and Damage Tolerance (F&DT) of critical areas, CAD model generation, drawings for manufacturing, installation, assembly and support during manufacturing for Non-conformance and higher issues.

The Engineering Service Provider will take up the structural design definitions from PDP for detail design, which would be mostly Composite and few Metallic parts. As part of this work package, the Engineering Service Provider has to carry out detailed sizing, Detailed FEM (DFEM), stress analysis reports, create manufacturable detailed part definitions (3D), part & assembly drawings to meet budgeted weight. The considerations for detail design are as quoted below but not limited to meeting FAR 23 requirements, load requirements, safety factors requirements, weight & C.G. limits, Design For Manufacturing and Assembly (DFMA), tooling requirements, materials & processes, adjoining sections/assembly, system installations, clash and clearances, Lightning protection schemes for fuel and non-fuel zones, Interchangeability (ICY) requirements, lower manufacturing cost etc. This work package would also include engineering support during (i) Component manufacturing and assembly (non - conformity support), (ii) Jig fixture design (to resolve interface issues with tool design team of NAL), (iii) static test (to resolve design issues of component) and (iv) flight test (non - conformity support).

The anticipated work involved is approximately 800 drawings (number of Left Handed, unhandled and unrepeatable part/assembly drawings (with associated models), including secondary parts). The number is indicative in nature based on earlier variant. It is to be noted that the detail design phase is evolutionary and iterative in nature. The number of drawings indicated cannot be certainly and/or reliably known at the beginning. The service provider shall estimate the number of drawings and effort involved independently.

4.2.2 Work Content of Wing Structure work Package

4.2.2.1 Work Content of Wing Structure Interspar Box (Composite)

Major Components
Spars
Ribs
Stringers
Skins
Access Panels
Skin joints
Spar joints
Wing tip / Winglet (skin and sparlets)
Provision for slinging, mooring and jacking (Metallic)
Engine / Nacelle Attachment (Metallic)
Lightning protection system (Metallic)
Structural provisioning Mechanical systems (FCS, Fuel, Etc.) and Electricals/hydraulics, etc.

4.2.2.2 Work content of Leading edge assembly (metallic)

Major Components
Ribs
Skins
Tee members
Baffle plate
Provisioning for de-icing boot
Structural provisioning Mechanical systems (FCS, power plant, Etc.).

4.2.2.3 Work content of Fixed trailing edge assembly (Composite)

Major Components
Aft Rib
Aft Skins
Shroud Screen
Access Panels
Control Surface attachment Brackets (for Inboard and Outboard Flaps, Ailerons and Spoilers)
Structural provisioning Mechanical systems (FCS, Etc.).

4.2.2.3 Work Content for Wing-Fuselage Fairing (Composite)

Major Components
Frames
Stiffeners
Skins
Access Panels
Lightning protection system (Metallic)
Structural provisioning for Mechanical systems (FCS, ECS, fuel, Power Plant, Hydraulics, De-Icing, Etc.), Avionics and Electrical etc.

4.2.2.4 Work content of Wing Fuselage Attachment (Metallic) – 5 assemblies

Major Components
Attachment brackets
Links

4.3 Work Package 3 - Detail Design and Engineering for Vertical and Horizontal Fin Structure

4.3.1 Scope of Work

The scope of this work package pertains to SARAS MK2 Vertical Fin, Horizontal Fin and Dorsal structure (control surfaces not included). The objective of this work package is to carry out detail design and associated stress analysis, Fatigue and Damage Tolerance (F&DT) of Critical areas, CAD model generation, drawings for manufacturing, installation, assembly and support during manufacturing for Non-conformance and higher issues.

The Engineering Service Provider will take up the structural design definitions from PDP for detail design, which would be mostly Composite and few Metallic parts. As part of this work package, the Engineering Service Provider has to carry out detailed sizing, Detailed FEM (DFEM), stress analysis reports, create manufacturable detailed part definitions (3D), part & assembly drawings to meet budgeted weight. The considerations for detail design are as quoted below but not limited to meeting FAR 23 requirements, load requirements, safety factors requirements, weight & C.G. limits, Design For Manufacturing and Assembly (DFMA), tooling requirements, materials & processes, adjoining sections/assembly, system installations, clash and clearances, Lightning protection schemes, Interchangeability (ICY) requirements, lower manufacturing cost etc. This work package would also include engineering support during (i) Component manufacturing and assembly (non – conformity support), (ii) Jig fixture design (to resolve interface issues with tool design team of NAL), (iii) static test (to resolve design issues of component) and (iv) flight test (non – conformity support).

The anticipated work involved is approximately 350 drawings (number of Left Handed, unhandled and unrepeated part/assembly drawings (with associated models), including secondary parts). The number is indicative in nature based on earlier variant. It is to be noted that the detail design phase is evolutionary and iterative in nature. The number of drawings indicated cannot be certainly and/or reliably known at the beginning. The service provider shall estimate the number of drawings and effort involved independently.

4.3.2 Work Content of Vertical and Horizontal Fin structure Work Package

4.3.2.1 Vertical Tail

- Work Content of Vertical Fin (Composite)

Major Components
Spar
Ribs
Skins
Access Panels
Attachment brackets (Metalic)
<ul style="list-style-type: none"> • Fuselage & Fin • Vertical Fin & Horizontal Fin • Vertical Fin & Rudder

Lightning protection system
Structural provisioning Mechanical systems (FCS, Etc.), and Electricals/hydraulic, etc..

- Work Content of Leading edge assembly(metallic)

Major Components
Ribs
Skins
Baffle plates
Access Panels

4.3.2.2 Horizontal Tail

- Work Content of Horizontal Fin (Composite)

Major Components
Spar
Ribs
Stringers
Skins
Access Panels
Attachment brackets (Metalic)
<ul style="list-style-type: none"> • Vertical Fin & Horizontal Fin • Horizontal Fin – Elevator
Lightning protection system
Structural provisioning Mechanical systems (FCS, Etc.).

- Work content of Leading edge assembly(metallic)

Major Components
Ribs
Skins
Baffle plates
Access Panels

4.3.2.3 Work Content of Vertical Fin – Horizontal Fin Attachment (Metallic)

Major Components
Attachment brackets

4.4 Work Package 4 - Detail Design and Engineering for Control Surfaces Structure

4.4.1 Scope of Work

The scope of this work package pertains to SARAS MK2 Inboard Flap, Outboard flap, Aileron, Elevator, Rudder and Spoiler. The objective of this work package is to carry out detail design and associated stress analysis, Fatigue and Damage Tolerance (F&DT) of Critical areas, CAD model generation, drawings for manufacturing, installation, assembly and support during manufacturing for Non-conformance and higher issues.

The Engineering Service Provider will take up the structural design definitions from PDP for detail design, which would be mostly Composite and few Metallic parts. As part of this work package, the Engineering Service Provider has to carry out detailed sizing, Detailed

FEM (DFEM), stress analysis reports, create manufacturable detailed part definitions (3D), part & assembly drawings to meet budgeted weight. The considerations for detail design are as quoted below but not limited to meeting FAR 23 requirements, load requirements, safety factors requirements, weight & C.G. limits, Design For Manufacturing and Assembly (DFMA), tooling requirements, materials & processes, adjoining sections/assembly, system installations, clash and clearances, Lightning protection schemes, Interchangeability (ICY) requirements, lower manufacturing cost etc. This work package would also include engineering support during (i) Component manufacturing and assembly (non – conformity support), (ii) Jig fixture design (to resolve interface issues with tool design team of NAL), (iii) static test (to resolve design issues of component) and (iv) flight test (non – conformity support).

The anticipated work involved is approximately 550 drawings (number of Left Handed, unhandled and unrepeatable part/assembly drawings (with associated models), including secondary parts). The number is indicative in nature based on earlier variant. It is to be noted that the detail design phase is evolutionary and iterative in nature. The number of drawings indicated cannot be certainly and/or reliably known at the beginning. The service provider shall estimate the number of drawings and effort involved independently.

4.4.2 Work Content of control Surfaces structure Work package

4.4.2.1 Work Content of Control Surfaces

- Inboard and outboard Flaps Structure (Composite)

Major Components
Inboard Flap Mechanism parts (Metallic)
Inboard Flap attachments (Metallic)
Spar
Ribs
Skins
Access Panels
Lightning protection scheme (Metallic)
Simulation by Kinematics / ADAMS (retracted-deployed positions, wing loaded and unloaded condition)

- Aileron structure (Composite)

Major Components
Aileron Mechanism parts (Metallic)
Aileron attachments (Metallic)
Spars
Ribs
Skins
Access Panels
Tab Mechanism parts (Metallic)
Tab Attachment (Metallic)
Tab structure
Mass balance (Metallic)
Lightning protection scheme (Metallic)
Structural provisioning Mechanical systems (FCS, Etc.).

Simulation by Kinematics (retracted-deployed positions)

- Rudder Structure (composite)

Major Components
Rudder Mechanism parts (Metallic)
Rudder Attachments (Metallic)
Spars
Ribs
Skin
Access Panels
Horn Balance Structure
Mass balance (Metallic)
Tab Mechanism parts (Metallic)
Tab Attachment (Metallic)
Tab structure
Lightning protection scheme (Metallic)
Structural provisioning Mechanical systems (FCS, Etc.).
Simulation by Kinematics (retracted-deployed positions)

- Elevator Structure (composite)

Major Components
Elevator Mechanism parts
Elevator Attachments
Spars
Ribs
Skins
Access Panels
Tab Mechanism parts
Tab Attachment
Tab Structure
Horn Balance Structure
Mass balance
Lightning protection scheme
Structural provisioning Mechanical systems (FCS, Etc.).
Simulation by Kinematics (retracted-deployed positions)

- Inboard and outboard Spoiler Structure (Composite)

Major Components
Spoiler Mechanism parts (Metallic)
Spoiler attachments (Metallic)
Spar
Ribs
Skins
Simulation by Kinematics / ADAMS (retracted-deployed positions, wing loaded and unloaded condition)

4.5 Project review & Schedule

Reviews like Requirement Capture Review, Critical Design Review and Technical Progress Reviews shall be conducted. The support of engineering service provider is envisaged during Ground Tests and Flight Readiness Reviews.

Regular Technical Progress Reviews (TPR) are mandated between Technical co-ordination team and Service co-ordination team for all technical reviews and clarifications. Project progress review is to ensure that the subcontracted activity is progressing satisfactorily and is being performed correctly.

Description	Period
Technical Progress Reviews (TPR).	Minimum twice a week
Dedicated technical meeting	Need basis
Management review	Monthly

Quality of Deliverables:

As the timely delivery of reports, drawings and models is critical to the program, the Engineering Service Provider should set up a Quality Check team with Subject Matter Experts for ensuring their correctness and completeness.

Product Quality Targets:

The Engineering Service Provider will have to meet the following quality targets for First Time Right (FTR):

- Part and assembly drawings: > 95%
- Part and assembly models: > 95%
- Technical content of stress reports: > 98%

On time Delivery:

- On time delivery of CAD & FE models / drawings / stress reports: >98%
- Design non-conformity lead times to be as mutually agreed.

Schedule:

The representative schedule for each of the Work Packages are indicated as below:

Work Package	Requirement Capture Review and Deliverable D1	CDR (Deliverable D2+D3)	Drawing Release (Deliverable D4)	Engineering Support (Deliverable D5)
Fuselage	T0 + 2	T0 + 6	T0 + 12	T0 + 30
Wing	T0 + 2	T0 + 6	T0 + 12	T0 + 30
HT & VT	T0 + 1	T0 + 5	T0 + 10	T0 + 30
Control Surfaces	T0 + 1	T0 + 4	T0 + 10	T0 + 30

Schedule of Work Packages

T0 is the placement of PO and signing of contract with the successful bidder as defined in section 10 of this document. The numbers indicated in the above table are in months.

5. Background material, data, reports, inputs to be provided from CSIR-NAL

CSIR-NAL would provide the following inputs to execute these work packages.

- Numerical Master Geometry
- Station Diagram
- Stringer Layout
- Weight targets
- Design Requirements from TLAR specific to these work packages.

- Preliminary CATIA V5 3D models (layouts) from PDP containing the following:
 - Structural arrangement
 - 3D models with approximate thickness meeting PDP loads for parts
 - Type of fasteners and location at specific areas
 - Location of major cutouts and access for maintenance
 - Locations of mechanical, avionics, electric system to design secondary brackets.
 - A few typical models/drawings from an earlier variant in for reference
 - 3D models of structural fasteners

- GFEM models with critical load cases
 - Skin as 2D plate / shell elements
 - Frames/ribs/spar as 2D plate / shell elements
 - Stringer and gussets as 1D element / 2D plate / shell elements
 - Major attachment brackets (Eg. Wing-fuselage, etc.) as 2D plate / shell elements
 - Fasteners not simulated (except for certain critical areas, as needed)
 - Details of constraints
 - Definition of materials
 - Layup details for composite parts.
 - Appropriate boundary conditions

- Documents related to
 - Design Guidelines and standards to address the 3D models and drawings
 - Part definition guidelines
 - Machined parts
 - Sheet metal parts
 - Extruded part
 - Composite parts
 - Assembly / joints
 - CAD modelling Methodologies
 - Drafting methodologies
 - Fastener specification
 - Fastener Manual
 - Part numbering system
 - Tolerances
 - Part marking

 - Materials and Process Standards
 - Material properties
 - Heat treatment
 - Surface treatment
 - Protection requirements
 - NDT Methods
 - Cutting tools list
 - Curing and post curing processes

The above listed manuals are tentative and the detailed list will be finalized during the signing of the contract.

- Seed / initiating/template Files
 - 3D CAD model
 - Drafting model with Title block and frame
 - Bill of Material / Material schedule
 - Weight and C.G. Document Format.
 - Drawing Applicability list Document format.
 - Drawing Change Notice (DCN)/ Project Slip (PS) / Deviation notes
- Checklists
 - FE models
 - Stress reports
 - F & DT reports
 - CAD models and drawings
 - Machined Parts
 - Sheet metal parts
 - Composite parts
 - Assembly

Other necessary inputs electrical bonding, Lightning protection schemes, Tooling hole locations, PLM flowchart, etc. will be provided as the project progresses.

6. Expected Requirements

In these work packages, the Engineering Service Provider is required to carry out, but not limited to, the following activities.

6.1 D1 - Analysis documents as indicated

- Guidelines, manuals and standards covering the following for this work package.
 - Finite Element Modelling and analysis aspects
 - Methods (SOM / Hand Calculations)
 - F&DT Methodology
 - Stress Report Format
 - F&DT Report Format

CSIR-NAL team would review the methods/approaches proposed by Engineering Service Provider before the formal release of documents.

6.2 D2 - Detailed Analysis as indicated

- Derive loads for detailed sizing from the GFEM data provided.
- The weight targets of assemblies specified during kick-off meeting to be met. Reduce the weight of the structure in DDP.
- Generate DFEM models based on detail design.
- The stress analysis shall cover static, fatigue, damage tolerance requirements specified by FAR 23 and associated Advisory Circulars. The simulation results are to be supported by hand calculations / industry standard analytical procedures, as applicable.
- Prepare stress reports for the detail design phase for CDR.

- 6.3 D3 - Interface Clearance Arrangement models and drawings consisting of the following
- Define the parts thickness as per detailed load requirements, required factor of safety, suitable material and its processes.
 - Materials for components need to be selected from the standard approved material list provided by CSIR-NAL.
 - Master geometry surfaces are not to be edited. In case of any higher issue release, the same will be communicated by CSIR-NAL.
 - Adjoining system equipment and its parts like cables, tubes etc. are not to be edited. In case of any updates/changes, the same will be communicated by CSIR-NAL.
 - Define the 3D parts considering comprehensive manufacturing and assembly procedures (DFMA) following industry best practices. The 3D modelling methodology to be followed as per manuals provided.
 - Assembly design is to be done considering tooling (jigs and fixtures) requirements, ease of assembly and access clearances for maintenance personnel.
 - Fasteners to be selected from the approved list.
 - All fasteners are to be cleared for relevant loads. Each fastener hole/axis has to be co-axially aligned with the adjacent parts/assembly following representation as per the provided manuals.
 - All fasteners called in the assembly are to be verified for inter-rivet pitch, edge distances, head clearance, head placement (outer or inner), type, material, grip length etc.
 - Detail sizing of metallic and composite parts including skin engineering such as zonal thickness distribution, ply details & stacking sequence for composite parts.
 - All the composite parts (including composite skins) are to be modelled using Part design module (plies not needed). Additionally, composite skins to be also modelled using CD3/CPD module of CATIA V5 for ply wise modelling and creation of ply-book.
 - Parts, joints, fasteners definitions
 - Clearance and clash resolution
 - No Fowling of the control surface structure with parent structure during simulation/kinematics
 - Commonisation of Brackets, cleats, clips and parts like splice plated in Joints, etc.
 - Assembly and part Numbering assigned in assembly hierarchy

All design issues are to be resolved concurrently as the Engineering Service Provider progresses and completes activities listed in D1, D2 and D3. During this stage, the Engineering Service Provider shall provide Interface clearance Arrangement 3D models, assemblies & Interface clearance drawing defined for these work packages. After acceptance of Interface Clearance drawings and models, the Engineering Service Provider can proceed with generation of 2D part drawings and assemblies.

Interface Clearance drawings to contain the views of overall structure of the finalized 3D parts assembled with fasteners, with major dimensions. The Interface Clearance drawing views to contain the assembled views of ribs or frames along with skins, stringers, access doors, brackets, cleat/clips, system interface components with major dimensions. The overall views can be for different levels/layers in case of overlaps of the parts (to be achieved with CATIA V5 3D clipping-> clipping by slice or clipping box). The purpose of Interface Clearance drawing is for checking of the assembling clearances between parts and between parts and fasteners. These Interface Clearance drawing would be checked and cleared by CSIR-NAL team. These checks in the Interface Clearance drawings are

apart from the 3D Interface checks, 3D clash/clearance checks between parts and between parts and fasteners. The information of the different views that would be needed to generate the views can be provided during the execution of the project.

Review of this Interface Clearance arrangement models and drawing is from the start of the project on a weekly basis. This activity should be completed before CDR to facilitate the release of part drawings after CDR.

6.4 D4- Drawing Generation

- Generate 2D drawings by following the manuals and sample drawings provided. The part and assembly drawings shall cover all dimensions, tolerances, sealant requirements, suitable notes (including material process and finish), part markings, weight, EBOM, etc. The drawings have to follow the drafting methodology manual and part numbering scheme provided by CSIR-NAL.
- The sheetmetal parts to have a view of the developed part in the drawing, that is generated using CATIA V5 SL3 license.
- 3D part and 2D drawings are to be linked with indicated software version.
- The tolerance for the drawings are to be as per the tolerance manual provided by CSIR-NAL.
- 2D drawings are to be associated with Bill of Materials (part list) as per the manuals provided.
- Installation drawings of mechanical, electrical and avionics systems on to the structure.
- Tracking of all the technical queries with its responses.
- Deviation notes (if any) to be provided with detail description.
- Updates of Models and Drawings to address the Manufacturing / assembly issues arising before the release of last drawing.

6.5 D5-Engineering Support during Prototype Manufacturing

The work packages also include the engineering support from the Engineering Service Provider to update models, drawings, EBOM, DAL resulting due to manufacturing / design issues during component manufacturing and assembly (non – conformity support), Jig Fixture Design (to resolve interface issues with tool design team of CSIR-NAL), static test (to resolve design issues of component) and flight test (non – conformity support).

During manufacturing and assembly, non-conformance (NC) are anticipated namely on drawings, 3D models and physical parts/assemblies. These are broadly classified as (i) Production Queries (PQ) and/ or Request for Action (RFA) (ii) Snags. The support team should bring in the execution knowledge of these work packages and update the models and drawings.

7. Software Tools to be used for Execution

The applications and connections required for the achievement of the service are the following ones:

PLM	Teamcenter or 3D Experience
Modelling & Drafting:	CATIA V5 R2020 Composite: CD3/CPD (for composite skins only) Sheetmetal Development: SL3
FEA (Pre/Post Processor):	Hyperworks 2020 or Latest
FEA (Solvers):	MSC NASTRAN, Hyperworks (Optistruct)
Fatigue & Damage Tolerance	MSC NASTRAN (embedded Fatigue) / FRANC 3D / NASGRO / MSC MARC
Documentation:	MS Office 2016 Word, Excel, PowerPoint. Adobe PDF, etc.

Tools

8. Deliverables

The Deliverables for each of the work packages are as below:

Description	Deliverable / format
Manuals and formats – D1	
Finite Element Modelling and analysis aspects	Word Document
Methods (SOM / Hand Calculations)	Word Document
F&DT Methodology	Word Document
Stress Report Format	Word Document
F&DT Report Format	Word Document
CDR Related Activities - D2	
DFEM / local FE models that are associated to respective assembly / parts / attachments. Updated FE models based on approved design.	Hypermesh FE Models (*.HM), Input data in NASTRAN format (*.DAT / *.BDF) and output data in MSC NASTRAN format (*.F06, *.PCH, *.OP2).
Stress reports as per the scope of these work packages containing respective assembly / parts / attachments.	Soft copy of Word Documents and 10 sets of printed copy of the report
List of all associated FE reports, stress report and the corresponding FE models and CAD Assembly/parts used.	Word Document
CDR Related Activities - D3	
Interface clearance arrangement Models and Drawing	CATIA V5 CATPart, CATProduct & CATDrawing
Release of Drawings and Models in PLM – D4	
3D parametric models of parts (LH and unhandred parts positioned as needed in PLM RH parts to be mirrored and positioned in PLM)	CATIA V5 CATPart / PLM
3D models of Assemblies with tree structure	CATIA V5 CATProduct / PLM
2D drawings of each part	CATIA V5 CATDrawing

2D drawings of assemblies	CATIA V5 CATDrawing
Bill of Material / material schedule as per tree structure	Word Document
Installation drawings for each system assembly	CATIA V5 CATDrawing
Tolerance Stackup analysis reports	Word Document
Sequence of Assembly for all major assemblies	Power point
Drawing Change Notice (DCN) / Project Slip (PS) / Deviation notes or Equivalent documents as per PLM	CATIA V5 Models / Drawings / PLM
Drawing Applicability List (DAL) Document	Word Document
Weight and C.G. reports As part of the weight & C.G report, Station wise weight distribution to be also furnished.	Word Document / Excel
Drawings with EBOM	One set of paper (80-100 GSM) print for signature Scanned softcopy of signed drawings with EBOM 7 sets of photocopies in 1:1, after signature
Macros / Automation files / knowledge ware files	Excel / .exe / CATIA files / as applicable
Engineering Support during Prototype Manufacturing – D5	
Updating of CAD & FE models, drawings, EBOM, during manufacturing and assembly of prototypes.	Stress reports, CATIA V5 Models, and Drawings for affected parts and assemblies.
Resolutions of PQs, Snags, DCNs and Project Slips during manufacturing and assembly of prototypes.	One set of paper (80-100 GSM) print with signature for DCN and PS along with higher issue drawings. Scanned softcopy of signed drawings with EBOM 8 sets of photocopies in 1:1, after signature

All deliverables & communication shall be in English.

9. Facilities such as local conveyance, office space, etc.

The Engineering Service Provider should execute this work package in India with an exclusive and secured network at its premises. The Engineering Service Provider should also place adequate (mutually agreed) number of employees for co-ordination purpose on day-to-day basis at CSIR-NAL premises. The employees of Engineering Service Provider should be well experienced in the related work with good technical communication skills. CSIR-NAL would provide work place, workstations and internet facility at its premises for the co-ordination team. The employees of Engineering Service Provider placed for coordination would have to follow the rules and regulations of CSIR-NAL.

The Engineering Service Provider shall be responsible and organize itself accordingly to provide for its personnel's travel arrangements including their accommodation, for co-ordination purpose and any other purpose.

10. Overall process followed for procurement of Engineering Services

Following process shall be followed for the procurement of Engineering Services:

A)	Eol Process:	
	10.1	Publication of Expression of Interest (Eol) by CSIR-NAL
	10.2	Replies to queries raised by the bidders (if any) by CSIR-NAL
	10.3	Submission of Expression of Interest (Eol) by bidders
	10.4	Evaluation of Eol as per Technical Evaluation Matrix of this document by Evaluation Committee appointed by Director, CSIR-NAL
	10.5	Publication of evaluation results
B)	Post Eol Process:	
	10.6	Request for Quotation will be sent by Invitation to only those shortlisted firms found to be eligible as per the evaluation. The shortlisted companies should sign Non-Disclosure Agreement (NDA) to receive Request for Quote (RFQ). CSIR-NAL reserves the right to split, add, remove or modify any of the assignments for seeking RFQ.
	10.7	Receipt of Technical and financial Bid from the selected bidders
	10.8	Opening of bid
	10.9	Negotiation with L1 bidder
	10.10	Award of contract to successful bidder after finalization of delivery and payment milestones.
10.11	Execution of contract with the successful vendor and monitoring of the progress by Monitoring Committee as per section 12 of this document	

11. Criteria of proposal evaluation and selection procedure

11.1 Evaluation of the proposal is adapted from the “Manual for Procurement of Consultancy and Other Services – 2017”, Ministry of Finance, Department of Expenditure, Gol.

11.2 Technical Evaluation Matrix:

The selection of successful bidder is based on the process as defined in “Manual for Procurement of Consultancy and Other Services – 2017”. The matrix for evaluation is given below:

Sl. No.	Criteria	Weightage	
	Sub-criteria	Criteria Total	Sub-criteria
1	Programs executed and on-going related airframe of Civil Aircraft (Fixed Wing)	70%	
	Experience in Fuselage Detail design (metal and Composite)		35%
	Experience in Wing, HT & VT, Control Surfaces Detail design (metal and Composite)		35%
	DFEM Capability		15%
	F&DT Capability of metallic structures		10%
	NC Support Experience		5%
2	Infrastructure	15%	
	Manpower: Detail Design		50%
	Manpower: Stress		20%
	Licenses Availability		30%
3	Overall financial strength of the company in terms of group turnover, profitability and cash flow (liquid assets) situation	15%	
	Turnover figure for last three years.		50%
	Net profit figure for last three years		25%
	Assets and Liabilities		25%
	Total	100%	

Minimum qualifying score for the next stage of evaluation is 75%.

12. Procedure for review of the Engineering services

CSIR-NAL will constitute Monitoring Committee (MC) for each Work Package as specified in section 4 of this document. This committee will consist the domain experts from within CSIR-NAL and other organization at the discretion of Director, CSIR-NAL.

The Engineering Service provider is expected to provide the deliverables as specified in section 8 of this document to the single point contact identified by CSIR – NAL against each Work Package in section 4. The MC’s set up against each Work Package will review the deliverables. The recommendations of the MC’s should be incorporated in the final version of the deliverables.

The deliverable is deemed to be complete only after the MC accepts the same. Payment shall be linked to successful completion of delivery milestones.

13. Engagement of Third party services

The Engineering service provider shall not subcontract this work package in part or full. However, the Engineering service provider can engage the third party services of consultants or consultancy firms. The Engineering service provider should take prior approval for such engagements and the area of consultancy of third party services with regard to the work package from CSIR-NAL.

14. Program Manager:

Vendor shall appoint a program manager for managing the overall program. The program manager will be the focal point for all communications between CSIR-NAL and Vendor. The Program Manager will coordinate all technical disciplines associated with this program and will assure the performance of Supplier tasks in accordance with the program needs according to the statement of work.

15. Documentation:

The detailed list of released documents to be prepared by the vendor for various Work Packages on mutually agreed basis. All documents shall be in English.

16. Similar Work Experience Details:

The interested Engineering Service Providers need to furnish the details of the company and the work carried out with respect to the work package described. The Appraisal form format is enclosed in ANNEXURE-II, to enable the Engineering service providers to furnish the data. The data furnished will be used to evaluate and select the bidders as per section 11. The potential bidders should provide the relevant information in the appraisal form.

17. Commercial

- 17.1 The Bidder shall be a company having an average turnover of Rs.300 Crore for each of the last Three financial year ending on 31st March 2020.
(a) Audited Balance sheets.
(b) CA Certificate with CA's Registration number/Seal. Indicating required turnover
- 17.2 Average Net Worth the Tangible Net Worth of the bidder shall be positive CA Certificate with CA's Registration number/Seal.
- 17.3 The Bidder shall enclose the following documents:
(a) Copy of Company registration certificate issued by statutory authority (duly attested by Notary Public).
(b) Copy of Memorandum and Article of Association (duly attested by Notary Public).
- 17.4 Blacklisting Declaration that the bidder has not been banned or delisted by any Govt. of India or Quasi Govt. Agencies or PSUs. If banned / delisted, the fact must be clearly stated. Self-Declaration on company letterhead.
- 17.5 The Bidder may submit a Budgetary Estimate for **any or** all the items under the Scope of Work. The Budgetary Estimates shall be held confidential and will not be disclosed to other Bidders after the EOI responses are opened.

17.6 Bid Validity Period: The offered bid shall be valid for a period of 120 days from the date of submission of Bids as per Tender Document.

18. Other Terms

18.1 Expression of Interest

In order to fine-tune the technical specifications for carrying out **Detail Design and Engineering of Airframe for SARAS MK2** and for short-listing of potential Bidders, Expression of Interest is being sought from reputed and competent Bidders/consulting firms. Bidders are requested to submit all the required documents for Bidder evaluation as per Pre-qualification criteria.

18.2 Purchase of EOI Document

The Expression of Interest document shall be downloaded from Central Public Procurement Portal (CPPP) of Government of India website <http://eprocure.gov.in/epublish/app> and CSIR-NAL Website www.nal.res.in at free of cost.

18.3 Clarifications on the EOI Document

Any clarification in the EOI document may be sent in writing to the following address or through email:

Controller of Stores & Purchase
Purchase Section
CSIR- National Aerospace Laboratories
PB No.1779, HAL Airport Road, Kodihalli,
Bengaluru – 560017, Karnataka-India
Tel # : 080 25086040/6041/6044
Fax #: 080 25269611
Email purchasek@nal.res.in, mkala@nal.res.in.

However, no extension of the time or date of EOI submitted will be provided on the ground that CSIR-NAL has not responded to any query/clarification raised by any Bidder.

18.4 Amendment of Terms and Conditions of EOI

18.4.1 CSIR-NAL may at its discretion or as a result of a query, suggestion or comment of an Bidder, may modify the EOI document by issuing an amendment or a corrigendum at any time before opening the EOI. Any such Addendum or Corrigendum will be uploaded on CPPP Portal <http://eprocure.gov.in/epublish/app> and CSIR-NAL's website www.nal.res.in and the same will be binding on all the Bidders, as the case may be.

18.4.2 CSIR-NAL at its discretion may extend the due date of submission of EOI and the decision of CSIR-NAL in this respect would be final and binding on the respondents. In the event of changes in the time schedule, CSIR-NAL shall notify the same only through its CSIR-NAL website www.nal.res.in. Interested Bidders are advised to check the above website regularly for corrigendum / addendum, if any, which will be published only in the web site.

18.4.3 No oral modification or interpretation of any provisions of this EOI shall be valid. Written communication shall be issued by CSIR-NAL when changes, clarifications or amendments to the EOI document are deemed necessary by CSIR-NAL at its sole discretion.

18.5 EOI submission shall be in English language. EOI response shall be free from correction, over writing, erasures etc. Duly authorized representative of the Applicant shall sign on each page of the EOI documents. EOI documents shall be prepared in such a way so as to provide a straight forward, concise description of Applicant and capabilities to satisfy the requirements of this EOI.

- 18.6 If at any time during the examination, evaluation and comparison of EOI, CSIR-NAL at its discretion can ask the Bidder for the clarification of its EOI. The request for clarification and the response shall be in writing. However, no post submission of EOI, clarification at the initiative of the Bidder shall be entertained.
- 18.7 All cost and expenses associated with preparation and submission of EOI response shall be borne by the Bidder while submitting the EOI. CSIR-NAL shall have no liability, in any manner in this regard, or if it decides to terminate the process of short listing for any reason whatsoever.
- 18.8 No Agent/Agents or third party/parties are engaged by CSIR-NAL in this process.
- 18.9 CSIR-NAL is not responsible for any firm/agency expression or representing to express himself/herself/themselves to be the agent or third party representing CSIR-NAL in this process.
- 18.10 It is advised to deal directly with CSIR-NAL representative who is the signatory to this document.
- 18.11 Disregard of any instruction may result in offer being ignored.
- 18.12 This EOI and subsequent tender is governed by TERMS AND CONDITIONS of CSIR-NAL.
- 18.13 Canvassing by respondents in any form, including unsolicited letters on EOI submitted or post corrections shall render their EOI response liable for summarily rejection.
- 18.14 Conditional offers will be summarily rejected. EOI which is found to be incomplete in content and / or attachments and / or authentication etc. is liable to be rejected.
- 18.15 EOI that are incomplete in any respect or those that nor consistent with the requirements as specified in this document may be considered non-responsive and may be liable for rejection and no further correspondence will be entertained with such Bidders.
- 18.16 **Requested for proposal (RFP) will be issued only to the shortlisted firms who have responded to this EOI. This will be online through e-Tender Central Public Procurement Portal (CPPP) of Government of India, <https://etenders.gov.in>.**
- 18.17 CSIR-NAL reserves the right to accept or reject any or all EOI notification/tenders/offers or withdraw the Notice at any stage of processing without assigning any reasons whatsoever, such an event would not cause obligation of any kind to CSIR-NAL.
- 18.18 Bidder evaluation criteria**
- 18.18.1 Bidder evaluation will be made by a Committee constituted by the Director, CSIR-NAL for “Detail design and engineering of airframe for SARAS MK2”.

Vendor Details

The following details shall be submitted along with EOI response.

Sr. No.	Documents	Compliance [Yes / No]
A	Company Profile	
1	Name of the Organization: Website	
2	Name of the Contact Person: a) Name: b) Address c) Telephone: d) Fax: e) E-Mail:	
3	Year of Incorporation	
4	Type of Organization a) Public Sector/ Limited/Private Limited/ Partnership/ Proprietary/ Society/ Any other b) Whether 'Foreign Equity Participation (Please give name of foreign equity participant and percentage thereof) c) Names of Directors of the Board/ Proprietors d) Name and address of NRI(s), if any	
5	Category of the firm: Large/Medium/Small scale unit	
6	Address of the Registered Office:	
7	Number of Offices with addresses (Excluding Registered Office): a) India b) Abroad	
8	Certificate of registration as a manufacturing unit	
9	Permanent Account Number	
10	GST Number	
11	Black Listing declaration	
12	Validity of the response	
13	Group Turnover figure for last three years*	
14	Net profit figure for last three years*	
15	Assets and Liabilities*	

* URL Links should not be provided. Figures to be keyed in.

B.	ESSENTIAL REQUIREMENTS	
16	The turnover is to be supported by financial statement of accounts/ Annual reports duly certified by a Chartered accountant/ Balance sheets of last 3 years/ Income tax returns for the last 3 years period.	
17	Documentary evidences in support of capabilities of the Bidder as per the following details:	
(a)	An Engineering firm with at least Seven years' experience in airframe design and engineering of commuter aircrafts.	
(b)	Profiles of the key resources (20+ years of relevant experience) who would participate in this work package to be furnished.	
(c)	CEMILAC / DGCA / EASA / FAA or equivalent country specific regulatory authority approved airframe design.	
(d)	Accreditation to EN9100 / AS9100D	
18	The bidder can show Expression of Interest in any or all work packages defined in section 4. The bidder should provide person-hour estimates for work packages accordingly.	

Note: The above information is mandatory. Eol bids found to be UNRESPONSIVE/AMBIGUOUS will be summarily disqualified

Signature with Name & Seal:

Place:

Date:

Vendor Appraisal Form

The following details shall be submitted along with EOI response.

For Airframe Detail Engineering Only

Sl. No.	Description of company & details	Remarks
1	Location where this work package would be executed.	
2	Vertical under which this facility is administratively linked	
3	Location of airframe engineering department	
4	Manpower* with Airframe Experience Only: Structural Designer (specialist 25+ years) Stress Analysts (0-5 years) (5-10 years) (10+ years) (specialist 25+ years) Structural Detail Design (0-5 years) (5-10 years) (10+ years) CAE modellers (0-5 years) (5-10 years) (10+ years) CAD modellers and draftsmen (0-5 years) (5-10 years) (10+ years)	
5	Facility - Major customers/ projects	
	Indian Customers	
	Foreign Customers	

* Profiles of the key resources (20+ years of relevant experience) who would participate in this work package to be furnished.

Facilities

Detailed Engineering support Facilities

Sl. No.	Description of facility	Remarks
1	Availability of CAD tools and number of licences for: CATIA V5 (breakup of modules to be furnished)	
2	Availability of CAE tools and number of licences for: MSC NASTRAN and associate modules (Number of MasterKey Plus tokens to be furnished) PATRAN (Number of licenses to be furnished) Hypermesh (Number of Hyperworks units to be furnished) Femap (Number of licenses to be furnished)	
3	F&DT software available	
4	Availability of PLM tools and number of nodes (no. of users) for: Teamcenter 3D Experience	

Accreditation

Sl. No.	Description of facility	Remarks
1	QMS setup: Accreditation to EN9100 / AS9100D	
2	Accreditation to CEMILAC and/or DGCA as Design Organisation (Specific approvals to be mentioned)	

Programs executed and on-going related airframe of Civil Aircraft (Fixed Wing)
(Detail Engineering in Metallic and Composites structures)

Please note the following while filling the data:

- 1) Projects executed by Indian team (location: in India and outside) only to be specified.
- 2) Projects related to primary structural detail engineering executed in the last 10 years (maximum).
- 3) Projects related to design modifications, secondary structures, Non-Conformance and DMU projects to be provided separately in the last 10 years (maximum).
- 4) Projects related to Aircraft interiors, ducting, Electrical installation and the like should not be provided.

The following details are to be provided to each project separately.

Project Description	
Section of aircraft (tick the relevant boxes)	Front Fuselage <input type="checkbox"/> Center Fuselage <input type="checkbox"/> Rear Fuselage <input type="checkbox"/> Wing Leading edge <input type="checkbox"/> Wing Interspar box <input type="checkbox"/> Wing fixed trailing edge <input type="checkbox"/> Horizontal Fin <input type="checkbox"/> Vertical Fin <input type="checkbox"/> Control Surfaces <input type="checkbox"/>
Class of Structure (tick the relevant boxes)	Primary Structure <input type="checkbox"/> Metallic Structure <input type="checkbox"/> Composite Structure <input type="checkbox"/> Secondary Structure <input type="checkbox"/>
Activities carried out in the project (tick the relevant boxes)	Conceptual design / studies <input type="checkbox"/> Preliminary design <input type="checkbox"/> Detail Design <input type="checkbox"/> Drawing Generation <input type="checkbox"/> Classical Stress analysis and DFEM <input type="checkbox"/> F&DT of metallic structures <input type="checkbox"/> Non-Conformance Support <input type="checkbox"/> DMU of aircraft in service <input type="checkbox"/> Design Modification on aircraft in service <input type="checkbox"/>
Input received • Design • Analysis	
Execution Approach in Brief (Main steps involved)	
Team Size • Detail Design • Analysis	

<p>Person months Breakup</p> <p>a. Conceptual design / studies, Preliminary design, Detail Design & Drawing Generation</p> <p>b. Classical Stress analysis, DFEM, F&DT of metallic structures</p> <p>c. Non-Conformance Support, DMU of aircraft in service, Design Modification on aircraft in service.</p>	
<p>Project Timelines</p> <ul style="list-style-type: none"> • Ongoing / Completed • Year/s of Execution (From & to) • Duration in Months 	
<p>Location/s</p> <ul style="list-style-type: none"> • Outside India • In India 	
<p>Deliverables (number of parts / assembly drawings) (stress reports for justification and certification support)</p>	
<p>Value addition by company</p>	

Signature with Name & Seal:

Place:

Date: