EXPRESSION OF INTEREST

FOR

ENGINEERING SERVICES & TECHNICAL SUPPORT FOR DEVELOPMENT, FLIGHT TESTING AND CERTIFICIATION

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

Council of Scientific and Industrial Research
NATIONAL AEROSPACE LABORATORIES
P.B. No. 1779, HAL Airport Road, Kodihalli, Bengaluru – 560 017
Phone: +91-80-25086040/41/44 Fax: +91-80-25269611
E-mail: purchasek@nal.res.in

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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) seeks technical consultancy proposal and support for design, development, flight-testing and certification from an established aircraft design/manufacturing company for the following: -

Sl. No.	File No.	Item Description
01.	NAL/PUR/CAD/396/19-Z	Engineering services & technical support for development, flight testing and certifications

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)
6-Feb-2020	**10:00 Hrs**	**6-Feb-2020**	**11:00 Hrs**

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 **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** 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 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.

Controller of Stores & Purchase
For and behalf of CSIR

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 presently taken up the design and certification of a 19 -Seater Light Transport Aircraft. The certification basis will be FAR 23, amendment 64 and a few requirements from FAR 25.

CSIR-NAL proposes to seek technical consultancy and support for design, development, flight-testing and certification from an established aircraft design/ manufacturing company ('Vendor') in select areas.

3. Purpose and service outcomes statement of the assignment

The purpose of this assignment is to seek technical support in the following areas:

• Aerodynamic Optimization
• Stability and Control evaluation
• Mechanical systems selection & sizing including ECS, CPCS, Hydraulic systems
• Design of Landing gear, Brake systems & wheels
• Airframe design including Cabin interiors and furnishing
• Powerplant and Fuel System
• Electrical and Avionics System design & selection
• System Safety and Reliability
• Flight testing and Certification

The outcome of the technical support is to obtain aircraft certification for Military as well as Civil regulatory authorities. The Military Certification will be accorded by CEMILAC and Civil Certification will be accorded by DGCA/EASA/FAA.

4. Detailed scope of work statement including schedule for completing the assignment

The task wise statement of work between customer and the consultant are detailed below.

4 .1 Task 1 Data Capture:

4.1.1 CSIR-NAL responsibility: CSIR -NAL will provide following data /documents

a)	Top level Aircraft specifications
b)	Aircraft level detail requirements
c)	Details of two (pusher and tractor) configurations under study for finalization

4.1.2 Vendors responsibility & deliverables:

a)	Review of pusher and tractor configurations proposed by CSIR-NAL and suggestions for improvement and provide 3 views of the complete aircraft
b)	Provide preliminary assessment of pros and cons of the two configurations proposed by CSIR-NAL

4.2 Task 2 : Aerodynamic Configuration Optimization

4.2.1 Task 2 A : Aerodynamic Configuration Studies

4.2.1.1 CSIR-NAL responsibility: CSIR-NAL will generate following documents for Pusher as well as Tractor engine configurations

a)	Configuration concepts and 3 D CAD Geometry with Constraints
b)	CFD studies for basic aerodynamics, control effects and power effects
c)	Preliminary wind tunnel model configuration test results
d)	Stability and Control analysis
e)	Configuration design document with performance targets and estimates
f)	Shortlisted test facilities to generate aerodynamic data for certification
g)	Obtain comprehensive wind tunnel test results for certification

4.2.1.2 Vendors responsibility & deliverables:

Sl. No	Task 2 A	Outcome , Deliverables and Reports
a)	Review top level requirements and suggest configuration changes	Submit report on Review and recommendations for improvements based on analysis
b)	Review the geometry, constraints and results of computational and wind tunnel test data for improvements achieved	Submit report containing review and observations/recommendations based on analysis.
c)	Carry out CFD simulation with actual propeller geometry for the following items/steps: • Clean aircraft (without props); Propeller Simulation: propeller alone with minimum body (to capture thrust from prop chart)	1) Report containing details of CFD simulation (solver, turbulence model, boundary conditions, mesh) and results including power effects and control derivative 2) Mesh and case data files

	• Propeller integrated to aircraft CAD geometry: Estimate propeller induced airframe drag, Installation loss (thrust, propeller efficiency), One engine inoperative conditions: evaluate effect of asymmetric slipstream and p-factor effect (and critical engine).	3) Data for design like Force / Moments, performance, hinge moments, control derivatives.
d)	Analyze airworthiness compliance as per FAR for flight in icing conditions using suitable CFD tools and recommend ice protection strategy	Submit report containing details of assumptions, simulation, results and recommendations for icing systems
e)	Review CFD /preliminary WT results & performance calculations carried out by CSIR-NAL	1) Submit report compiling the suggestion on improvements with analysis justification for aerodynamic fixes / improvements if any within prescribed geometry constraints including the retro modification scheme in the present baseline geometry to meet the stated objectives. 2) Submit report containing recommendations on the configuration to meet TLAR and airworthiness requirements.

4.2 .2 Task 2 B: Generation of Aerodynamic data at WT for certification

4.2.2.1 CSIR-NAL responsibility: CSIR NAL will generate and carry out following

a)	Final wind tunnel model design document.
b)	Fabrication of wind tunnel model of suitable scale and carry out comprehensive wind tunnel testing including power effects.

4.2.2.2 Vendors responsibility & deliverables:

Sl. No	Task 2 B	Outcome , Deliverables and Reports
a)	Recommend suitable test facility and model size based on preliminary design document	Submit report on model size and suitable facility
b)	Review the final wind tunnel model design document and recommend the changes	Submit report containing recommendations and analysis
c)	Review data generated by customer during tests	1) Submit report with recommendations for aerodynamics improvements / fixes leading to finalization of aerodynamic configuration meeting the performance specification. 2) Submit report on WT data for submission to regulatory authority

4.3 Task 3: Airframe Design compliance to FAR

4.3.1 CSIR-NAL responsibility: CSIR NAL will generate following documents/ data

a)	Preliminary weight budget, mass-CG calculation and V-n diagram document
b)	Preliminary airframe structural layouts and station diagrams for full aircraft
c)	Preliminary conceptual schemes for crashworthiness (belly landing and ditching)
d)	Preliminary cockpit and passenger cabin layout
e)	Preliminary LRU/equipment layout and maintainability
f)	Preliminary airframe layout for lightning compliance
g)	Finalized airframe layout, station diagrams and cabin layout with critical loads document as per FAR
h)	Airframe design documents for joints, splices and interfaces
i)	Dynamic and flutter analysis
j)	Numerical simulation of crash
k)	Simulation and test results of bird impact
l)	Fatigue and damage tolerance analysis and testing

4.3.2 Vendors responsibility & deliverables:

Sl. No.	Task 3	Outcome , Deliverables and Reports
a)	Review preliminary weight budget, mass-CG calculation and V-n diagram document	Submit report on preliminary weight budget, mass-CG calculation and V-n diagram document and suggest recommendations/improvements for weight and CG optimization.
b)	Review of structural layouts and station diagrams for full airframe namely wing, HT, VT, control surfaces and fuselage and ICY (interchangeability) points	Submit report on structural layouts and station diagrams and suggest improvements /modifications to meet performance and regulatory requirements.
c)	Review of concepts of following major joints/ interfaces 1) Wing-Fuselage 2) VT-Fuselage 3) HT-VT 4) All control surface joints including Flaps, trim tabs attaching with their respective parent surfaces 5) MLG/NLG-Fuselage 6) Engine-Pylon, Pylon-Wing or Pylon-Stub wing with fuselage depending on configuration 7) Wing-Winglet	1. Submit report covering design concepts and final recommendations of joints to be adopted, taking into account various design considerations such as fail-safe and damage tolerance, ease of manufacturing, assembly and maintainability. 2. Submit report on feature level testing of critical joints.
d)	Review of schemes for major skin splicing in fuselage and wing while taking into account various design considerations such as damage tolerance, sealing, ease of manufacturing, assembly and maintainability	Submit report covering design concepts and final recommendations on joints to be adopted while taking into account various design considerations such as fail-safe and damage tolerance, ease of manufacturing, assembly and maintainability. Suggest feature level testing of critical joints.

Sl. No.	Task 3	Outcome , Deliverables and Reports
e)	Review of selection of materials namely metallic/composites for various components of airframe so as not to exceed OEW (Operational Empty Weight) of 4900Kg	Submit report covering recommendations on metallic/composite materials for various parts of airframe to meet OEW Operational Empty Weight target. Suggest alternative materials to achieve stated OEW.
f)	Review of schemes and numerical simulation report for ensuring crashworthiness of fuselage including belly landing and ditching conditions	1) Submit report covering schemes for complying FAR 23 requirements on crashworthiness of fuselage for belly landing and ditching and suggest improvements / modifications. 2) Submit report on type of tests and/or numerical simulation to be carried out for showing compliance.
g)	Review of schemes of cockpit and passenger cabin layout	1) Submit report covering cabin layout conforming to FAR 23 requirements and passenger comfort. 2) Submit report covering location of passenger door, emergency door locations and emergency evacuation procedures. 3) Submit report covering cockpit layout with respect to cockpit ergonomics, pilot workload and safety. 4) Submit schemes for baggage holds, baggage-stacking arrangement, baggage loading and unloading procedures. 5) Submit reports on improvements / modifications to the above.
h)	Review of schemes for passenger and emergency door mechanisms (latching and locking), fixing of door kinematic points with respect to fuselage	Submit report on schemes for passenger and emergency door mechanisms (Latching and Locking), fixing of door kinematic points with respect to fuselage.
i)	Review of schemes for LRU/equipment layout and maintainability	Submit report covering the LRU/ equipment layout and recommendations on access panels for maintainability.
j)	Review of schemes for direct effects of lightning on airframe	Submit report covering schemes that have to be adopted during detail engineering phase for direct effects of lightning on airframe for composite parts (including fuel tank) of airframe.

k)	Review of attachment schemes for all control surfaces including flaps	1) Submit report of attachment schemes for all control surfaces including flaps. 2) Submit report on clearance between parent and moving surfaces for proper deployment considering structural deformations during flight.
l)	Review of schemes for main landing gear and nose landing gear deployment and retraction along with corresponding doors	Submit report of schemes for main landing gear and nose landing gear deployment and retraction along with corresponding doors.
m)	Review of dynamic and flutter analysis	Submit report on review of dynamic and flutter analysis
n)	Review of simulation and test results of bird impact testing (as per FAR 25)	Submit report and recommendations on analysis of bird impact testing and suggest improvements as per regulatory requirements.
o)	Roadmap for the preparation of structural repair manual	Provide a detailed roadmap for structural repair manual for both metallic and composite parts
p)	Review of fatigue and damage tolerance analysis reports and test plans	Submit report and recommendations on damage tolerance analysis and suggest improvements as per regulatory requirements

4.4 Task 4 : Flight Control System, Stability and Control

4.4.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a)	Definition of control surfaces and trim tab geometry and deflections
b)	Definition of control column/wheel/pedal to control surface gearing ratios
c)	Analysis of longitudinal, Lateral, Directional stability and control and trim with CG variations and stability margins
d)	Control surface flutter analysis
e)	Stall characteristics and mitigation strategy
f)	Generate hinge moments data (ESDU/DATCOM/CFD) and estimate control forces
g)	Design Reports and CAD layouts for control column for elevator mechanical push-pull/cable control system
h)	Design report and CAD layouts for elevator circuit with LH-RH disconnect mechanism meeting safety and control requirements (FAR 25)
i)	Design report and CAD layouts for aileron circuit meeting safety and control requirements.
j)	Design Report and CAD layouts for rudder circuit from cockpit to rudder end. The solution can be hydraulic / electro mechanical actuators to meet rudder boost requirements. The design solutions shall define PCU, AFU with trimming; rudder boost operational requirements; engine torque (pressure) differential sensing; redundancy management; control architecture including switches in MIP. Sizing, generation of specification for actuators and identify vendor for actuators
k)	Design report and CAD layouts for mechanism of Flap control system for smooth operation and cater for malfunction, jamming. Sizing, generation of specification for actuators
l)	Design report and CAD layouts for Trim tab actuation (elevator and ailerons) with dual-redundant actuation mechanism with suitable trim-actuators to cater for single failure.
m)	Dynamic stability and handling qualities analysis including ground handling

4.4.2 Vendors responsibility & deliverables:

Sl. No.	Task 4	Outcome , Deliverables and Reports
a)	Review of the analysis and suggest improvements to control surface sizing and redundancy management to meet FAR requirements	Submit reports on sizing of control surface and redundancy management and suggest improvements as per regulatory requirements
b)	Review of Design/layout of control column for elevator mechanical push-pull/cable control system	1) Submit report on layout of control column for elevator with suitable mechanism and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
c)	Review of Design/layout of elevator circuit with LH-RH disconnect mechanism meeting safety and control requirements (FAR 25)	1) Submit report on elevator circuit disconnect with suitable mechanism and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
d)	Review of Design/layout of aileron circuit meeting safety and control requirements.	Submit report on aileron circuit with suitable mechanism and suggest improvements.
e)	Review of Design/layout of rudder circuit from cockpit to rudder end.	1) Submit report on rudder circuit and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
f)	Review of Design/layout of improved mechanism of Flap control system for smooth operation and cater for malfunction, jamming.	1) Submit report on flap control system and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
g)	Review of Trim tab actuation (elevator and ailerons) with dual-redundant actuation mechanism with suitable trim-actuators to cater for single failure.	1) Submit report on trim tab actuation and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
h)	Review flutter analysis results, verify compliance and recommend design solutions	Submit report on flutter analysis and suggest improvements.
i)	Review of Dynamic stability and handling qualities including ground handling analysis carried out by customer.	Submit report on dynamic stability and handling qualities and suggest improvements.

4.5 Task 5: Development of Autopilot (AP) and Stall Warning System (SWS) and Stall Protection

4.5.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a)	Autopilot (AP) System requirements document
b)	Autopilot System Architecture including Redundancy management, SAFE autopilot disengage mechanisms & Voting Logic
c)	Stand-alone yaw damper functionality
d)	Control law algorithms Functional Requirements Document (FRD)
e)	Actuator requirement specification
f)	AP Integration scheme with Avionics suite
g)	Stall Warning System (SWS) requirements document
h)	Basis of requirement of Stick Pusher on a Stall Projection Device including schematic
i)	SWS Architecture including Redundancy management
j)	SWS computational algorithms
k)	SWS Integration scheme with Avionics suite
l)	Approach to flight clearance & certification for AP and SWS
m)	Flight Test Matrix to ensure sufficient coverage as part of Certification to meet FAR 23/25 requirements for AP & SWS

4.5.2 Vendors responsibility & deliverables:

Sl. No	Task 5	Outcome , Deliverables and Reports
a)	Review of Autopilot System requirements document	Submit report on Autopilot system requirements and suggest improvements.
b)	Autopilot integration with flight controls	Submit report on Engineering Scheme for Autopilot integration with flight controls.
c)	Review of Actuator requirement specification	1. Submit report on actuator requirements and suggest improvements. 2. Recommend vendors for supply
d)	Review of Autopilot System Architecture including Redundancy management, SAFE autopilot disengage mechanisms & Voting Logic	Submit report on system architecture, redundancy management, disengagement mechanisms and suggest improvements.
e)	Review of Stand-alone yaw damper functionality	Submit report on yaw damper functionality and suggest improvements
f)	Review of control law algorithms	Submit report on control law algorithms and suggest improvements
g)	Review of integration scheme with Avionics suite	Submit report on AP and avionics integration scheme and suggest improvements
h)	Review of Stall Warning System requirements document	Submit report on SWS requirements and suggest improvements
i)	Review of Stall Warning System Architecture including Redundancy management,	Submit report on SWS architecture and redundancy management and suggest improvements

Sl. No	Task 5	Outcome , Deliverables and Reports
j)	Review of Stall computation algorithms	Submit report on SWS algorithms and suggest improvements
k)	Review of integration scheme of SWS with Avionics suite	Submit report on SWS and avionics integration scheme and suggest improvements
l)	Stall warning and Stick pusher: Review report of stall characteristics and design for mitigation (SWS, stick shaker, stick pusher firing angles).	1) Submit report on stall characteristics and suggest improvements. 2) Submit reports for suitable LRUs and recommend vendors for supply.
m)	Review of Flight Test Matrix to ensure sufficient coverage as part of Certification to meet FAR 23/25 requirements	Submit report with Suggestions for an Optimum flight testing strategy to meet FAR requirements for AP and SWS
n)	Approach to flight clearance & certification	Submit report on flight certification and clearance approach for AP and SWS

4.6 Task 6: Power plant and Fuel system

4.6.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a)	Engine and propeller sizing, specification and selection based on flight mission profiles
b)	Structural layout of engine and airframe integration
c)	Engine mass flow data, engine mounting details, oil cooling system requirements and interfaces of other LRUs to the engine
d)	Details of Nacelle
e)	Heat Transfer and heating load analysis
f)	Single lever engine control
g)	Fuel system architecture and design
h)	Power plant and fuel system test rig specification and architecture
i)	Fire protection system architecture and design
j)	Scheme of engine testing in test rigs and aircraft integrated tests
j)	Propeller de-icing scheme & design

4.6.2 Vendors responsibility & deliverables:

Sl. No	Task 6	Outcome , Deliverables and Reports
a)	Review of sizing, specifications and selection of engine, propeller and other interface systems.	Submit report on sizing and selection of engine, propeller and suggest improvements.
b)	Review of Nacelle system including intake, inertial separator, exhaust ducting, mounting, fuel blow back system, oil cooling ducting, sizing of heat exchanger, ejectors sizing, specifications of LRUs, etc.	Submit report on nacelle system and suggest improvements.
c)	Review of single lever engine controller design with quadrant box including detailed engineering	Submit report on single lever engine controller design and suggest improvements

d)	Review of fuel system design & Heat Load analysis	Submit report on fuel system design and heat load analysis and suggest improvements
e)	Review of Power plant and fuel system test rig specification and architecture.	Submit report on power plant and fuel system test rig and suggest improvements
f)	Review of fire protection system	Submit report on fire protection system and suggest improvements
g)	Review of the test schedules for testing in test rigs and aircraft integration tests and technical support	Submit report on test schedules for testing in test rigs and aircraft integration and suggest improvements
h)	Review of propeller de-icing scheme & design	Submit report on propeller de-icing scheme and suggest improvements

4.7 Task 7 : Environmental Control System (ECS) and Cabin Pressure Control System (CPCS)

4.7.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a)	Requirements, description, architecture and performance of environmental and cabin pressure control system
b)	Analysis and sizing of ECS ducting system with airframe interfaces
c)	Detailed layout design of ECS and CPCS
d)	ECS Test rig architecture and specifications
e)	Test schedule for cabin pressurization tests
f)	Anti-icing and/or de-icing system design, analysis and testing

4.7.2 Vendors responsibility & deliverables:

Sl. No	Task 7	Outcome , Deliverables and Reports
a)	Review requirements, architecture and performance of ECS and CPCS systems	1) Submit reports on recommendations based on analysis and calculations 2) Recommend vendors for supply
b)	Review the Analysis and Sizing of ECS ducting system with airframe interfaces.	
c)	Review the detailed design layout of ECS / CPCS	
d)	Review the ECS test rig architecture, specification	
e)	Suggest Technical specifications & Requirements of CPCS test rig for performance testing and for clearance from regulatory bodies. Suggest Test rig architecture and specifications	Submit Design Report on Test rig architecture and specifications
f)	Review test schedule for cabin pressurization tests	Submit report on test schedules for cabin pressurization tests and suggest improvements
g)	Review of anti-icing and/or de-icing system design, analysis and test results	Submit report on anti-icing and / or de-icing system design and suggest improvements

4.8 Task 8: Review of Landing gear , Brake system & Wheels

The airplane will be equipped with tricycle landing gear with low pressure tires for operation on undeveloped/semi prepared airstrips. Using hydraulic power, the landing gears will be retracted and extended for normal and emergency operations, steering of nose wheel, operations of normal and emergency and parking braking etc.

4.8.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a) b)	Landing gear and brake management system requirements and preliminary hydraulic system architecture (sink rates, landing speeds, landing weight, CG, number of landings, CBR ratios for airstrips, brake energy brake speeds and other environmental specifications)
c)	Airframe CAD geometry for installation of landing gear (NLG and MLG)
d)	Installation studies, interface structural design and spatial and kinematics studies based on the CAD model from the vendor and generation of reports
e)	Loads definition and qualification requirements
f)	Integration of landing gear to airframe and hydraulic system
g)	Design of Landing gear (NLG and MLG), brake management systems and wheels based on geometry and load definitions as per requirements including design reports, stress analysis/qualification test plans/test reports.
h)	Design and architecture of hydraulic system, nose wheel steering system including selection and sizing of components
i)	Aircraft level landing gear, brakes and hydraulic system, integration and test schedules

4.8.2 Vendors responsibility & deliverables:

Sl. No.	Task 8	Outcome , Deliverables and Reports
a)	Review on Design of Landing gear (NLG and MLG) , brake management systems and wheels based on geometry and load definitions as per requirements	Submit report on Design of Landing Gear, brake management systems and wheels
b)	Review the design of hydraulic system, nose wheel steering system including selection and sizing of components.	Submit reports on sizing and specifications of recommended LRUs including suitable vendors for supply
c)	Review of hydraulic system test rig specifications, architecture and test schedules	Submit report on test rig specifications, architecture and test schedules based on design analysis and calculations
d)	Review aircraft level test document for landing gear and hydraulic system	Submit report on aircraft level test document for landing gear and hydraulic system based on design analysis and calculations
e)	Review ground integration schedules/Tests	Submit report on recommendations and participate during A/c equipping & Ground tests.
f)	Integrated Logistic support	Provide documents for ILS like Servicing schedules, Maintenance manuals, Storage instructions, Spares, Tests equipment's, Training etc

4.9 Task 9: Avionics and Electrical System

4.9.1 CSIR-NAL responsibility: CSIR-NAL will provide following documents

a)	Avionics and Electrical System requirements, definition and architecture (Hardware and Software) to FAR 23 compliance and related civil aircraft standards/guidelines
b)	Sub-System sizing and definition of avionics and electrical system
c)	Redundancy management scheme for Electrical and Avionics
d)	EMI/EMC design considerations, Grounding Scheme and Lightning zonal analysis including LRU level analysis
e)	Antenna siting analysis
f)	Aircraft Cockpit from aesthetic and ergonomics consideration for civil aircraft Avionics and Electrical Flight test schedule in compliance with FAR 23, AC 25-7A and 23-8C requirements
g)	Avionics and Electrical Installation, wiring, routing, looming with clash analysis
h)	Avionics and Electrical Ground Integration Test rig requirements, architecture and design.
i)	Avionics and Electrical Ground support maintenance definition and architecture
j)	Flight test instrumentation scheme for complete aircraft
k)	Indirect effects of lightning on aircraft systems

4.9.2 Vendors responsibility & deliverables:

Sl. No.	Task 9	Outcome , Deliverables and Reports
a)	Review of Avionics and Electrical Requirements, definitions and Architecture with single AFCS integrated to Avionics per FAR 23. Detailed	Submit report with gap analysis and suggestions / recommendations to meet the identified gaps and FAR 23 requirements. Shall also recommend the sensor system for AFCS integration using avionics sensors along with OEM for complete suite.
b)	Review of Sizing of sub-systems like power sources, primary and secondary distribution system for Electrical system	Submit report with trade-off and calculations along with identified technologies(power, weight, connectors, cables etc.), OEM and part number recommendations
c)	Review of Redundancy Management of Avionics and Electrical System	Submit report with trade-off and RM Schemes along with identified technologies, OEM and part number recommendations
d)	Review EMI/EMC design considerations, Grounding scheme and Lightning zonal analysis including LRU level analysis	Submit report with clear recommendations for LRU level EMI/EMC considerations, aircraft level grounding scheme and LRU locations specific sensitivity analysis.

e)	Review of Antenna siting analysis and	Submit Report with siting analysis along with recommendations for co-ordinates on aircraft supported by antenna pattern analysis compliant to FAR 23. Shall also suggest state of the art technologies for antenna (conformal antenna wherever feasible)
f)	Review of aircraft Cockpit from aesthetic and ergonomics consideration for civil aircraft	Submit report of aircraft Cockpit from aesthetic and ergonomics consideration for civil aircraft with suggestions, improvements and recommendations
g)	Review of Avionics and Electrical system Route to Certification per FAR 23/AC 25-7A/23-8C from requirements till certification including flight testing	Submit report with identified critical test cases to clear FAR 23 requirement. Report shall also cover the test cases, procedure, sequencing & pririoty of tests, document format to capture & compile the results applicable to cert agencies and the consolidated compliance chart. Shall also recommend additional Flight Test instrumentation if required to clear FAR 23 certification including conduction of flight tests.
h)	Review of Avionics and Electrical ground integration test rig compliant to FAR 23 where certification credits shall be taken from this test rig	Submit report /proposal defining the detailed ground integration test rig requirements, architecture and recommend improvements. Shall also suggest the OEM/Systems for optimal performance as per avionics and electrical architecture.
i)	Review of Avionics and Electrical Installation, wiring, routing, looming with clash analysis	Submit report with recommendations to clear the EMI/EMC/safety/regulations on aircraft installation.
j)	Review of Flight Test Instrumentation scheme, architecture, parameters for complete aircraft level with DAQ and Telemetry to cover all the subsystems across aircraft	Submit report of Flight Test Instrumentation scheme, architecture, parameters for complete aircraft level systems and recommendations with state of the art technology, identification with OEM
k)	Review of indirect effects of lightning on aircraft systems	Submit report on indirect effects of lightning and suggest improvements

4.10 Task 10: System Safety and Reliability

4.10.1 CSIR-NAL responsibility:

a)	Aircraft level Functional Hazard Analysis(FHA) and Aircraft Level Fault Tree Analysis(FTA) - During Aircraft level requirements identification phase (Concept Development)
b)	System level FHA - During allocation of Aircraft functions to systems (Preliminary Design)
c)	Preliminary System Safety Analysis (PSSA) includes FTA/Dependency Diagrams/Markov Analysis of proposed architecture of each system, Particular Risk Analysis (PRA), Common Mode Analysis(CMA) of Aircraft – during development of system architecture (Preliminary Design)
d)	System Safety Analysis (SSA) includes Implemented System Level FTA, Failure Mode Effect Analysis(FMEA), PRA, CMA and Zonal Safety Analysis(ZSA) - During allocation of requirements to hardware & software and system implementation (Detailed Design, Design Validation & Verification)

4.10.2 Vendors responsibility & deliverables:

Sl. No.	Task 10	Outcome , Deliverables and Reports
a)	Review Functional hazard analysis of systems	Submit report based on analysis and compliance to FAR
b)	Review Fault tree analysis of systems	
c)	Review Failure Mode Effects and Analysis of Systems	
d)	Review Common Cause Mode Analysis of Systems	
e)	Review Zonal Safety Analysis of Systems	
f)	Review Particular Risk Analysis of Systems	
g)	Review Dependency Diagrams/Markov Analysis of proposed architecture of each system	

4.11 Task 11 : Flight Testing and Certification

4.11.1 CSIR-NAL responsibility:

a)	To prepare flight test program & effort plan
b)	Flight test schedules for systems and subsystems
c)	Carry out flight tests as per agreed program.
d)	Carry out flight tests and provide test results of flight trials.
e)	Prepare certification program.
f)	Prepare Route to certification document
g)	Certification of Integrated System
h)	Flight Test Data Analysis Reports and Compliance Matrix for submission to Airworthiness Authority

4.11.2 Vendors responsibility & deliverables:

	Task 11	Outcome , Deliverables and Reports
a	Review Means of Compliance Basis Table	Submit report detailing the outcome of review to fulfil certification requirements. Include substantiation for changes required in Basis.
b	Review document detailing comprehensive Flight Test Effort Plan, Test methodology for assessment of flight characteristics leading to certification	1) Submit report assessing the adequacy of Flight Test effort/ methodology. 2) Prepare detailed flight test optimised sequenced plan to achieve certification of the aircraft.
c	Review Aircraft system/Sub-system evaluation test effort plan;	Submit report detailing adequacy of Flight Test effort for aircraft systems. Prepare a sequenced aircraft system and sub-system evaluation Flight Test plan for aircraft system certification.
d	Prepare safety assessment for Flight tests plan and system evaluation test plan.	Submit report detailing safety assessment for flight testing. The report should highlight flight tests assessed to be high-risk/critical and recommend practical methods to handle such tests including risk-mitigation factors.
e	Provide support in Flight Test activity and preparation of documentation to meet CEMILAC / DGCA / FAA requirements: ○ Support in planning identified 'high risk/critical' flight tests as per (d).	Provide Technical support to assist in preparation of documents to be submitted to certification authorities.
f	Review of data reduction carried out by CSIR-NAL-for (1) aircraft performance flight tests (2) high-risk/critical flight tests as stated already	Submit report for data reduction of (1) aircraft performance flight tests (2) high-risk/critical flight tests. Make recommendations to cover cases of non-compliance or inadequacy.

4.12 Project Review and Schedule

Reviews like Requirement Review, Preliminary Design Review and Critical Design Review, Review of the Ground Test Results and Flight Readiness Reviews shall be conducted with the involvement of both the parties. After the flight trials, there shall be a review to analyze the flight test results.

Design Reviews

The purpose of the design review (DR) meetings is to present the design and actions on vendor's comments for finalising the reports. Vendor shall assist CSIR-NAL in preparation of the DR's agenda.

CSIR-NAL/Vendor shall prepare the design review presentations as per applicable tasks two to three weeks in advance. The relevant specialists will participate as a technical consultant and will provide comments in the following Design Reviews (DR)

Sl. No.	Item	Working days	Location	Months
1.	Aircraft & Systems level requirements Review	5	India	T_0+ 3
2.	Preliminary Design Review	5	Customer premises	T_0 + 8
3.	Critical design Review Program & Contract Management Review 1	5	India	T_0 + 14
4.	Ground Integration Program & Contract Management Review 2	5	India	T_0 + 30
5.	Flight Readiness Review	2	India	T_0 + 32
6.	Flight Test Data Analysis & Certification review Program & Contract Management Review 3	5	India	T_0 + 48

T_0 is effective date of contract.

Note:

a)	In case of delay in realisation of aircraft, vendor shall extend support activities for a period of 12 months without any financial implications.
b)	The time frame for Aircraft design, development & certification activities given in Appendix 1

5. Expected requirement of key professionals and kind of expertise

Refer Sr. No.15 to 17 of Annexure-I.

6. Deliverables:

All the recommendation submitted by Vendor should be supported by technical analysis or empirical computation as applicable. The deliverables of this assignment are provided in detailed against each task in section 4 of this document.

7. Background material, data, reports to be provided to the consultant

The background material, data and reports to be provided to the consultant by CSIR-NAL is listed under the heading Data Capture in section 4.1 of this document.

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

The firms should include the cost of local conveyance in the offer. The reviews will be conducted at CSIR –NAL.

9. Overall process followed for procurement of consultancy services

Following process shall be followed for the procurement of consultancy services:

A)	**EoI Process:**	
	9.1	Publication of Expression of Interest (EoI) by CSIR-NAL
	9.2	Replies to queries raised by the bidders (if any) by CSIR-NAL
	9.3	Submission of Expression of Interest (EoI) by bidders
	9.3	Evaluation of EoI as per Technical Evaluation Matrix of this document by the Consultancy Evaluation Committee as appointed by Director, CSIR-NAL
	9.4	Publication of evaluation results
B)	**Post EoI Process:**	
	9.5	Request for Quotation will be sent by Invitation to only those shortlisted firms found to be eligible as per the evaluation
	9.6	Receipt of Technical and financial Bid from the selected bidders
	9.7	Opening of bid
	9.8	Negotiation with L1 bidder
	9.9	Award of contract to successful bidder after finalization of delivery and payment milestones.
	9.10	Execution of consultancy contract with the successful vendor and monitoring of the progress by Consultancy Monitoring Committee (CMC) as per section 11 of this document

10. Criteria of proposal evaluation and selection procedure

10.1 Evaluation of the proposal is adapted from the "Manual for Procurement of Consultancy and Other Services – 2017", Ministry of Finance, Department of Expenditure, GoI.

10.2 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	Past experience of the Engineering Services & Technical Support as a Firm	60%	
	• Number of years' relevant experience		20%
	• Past experience in carrying out technical services either as OEM or for other OEM for		
	◆ Design of commuter aircraft		25%
	◆ Certification of commuter aircraft		25%
	• Past experience in design of aircraft systems as OEM or for other OEM		30%
2	General profile of qualification, experience and number of key staff (not individual CVs)	25%	
	• Qualifications		30%
	• Relevant experience in the field		70%

3	Overall financial strength of the consultant in terms of 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%
	Totals	100%	

11. Procedure for review of the consultancy

CSIR-NAL will constitute Consultancy Monitoring Committee (CMC) for each task 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 consultant is expected to provide the deliverables in the form of reports as specified in section 4 of this document to the single point contact identified by CSIR – NAL against each task in section 4. The CMC's set up against each task will review the deliverables. The recommendations of the CMC's should be incorporated in the final version of the report.

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

12.0 Program Manager:

Vendor shall appoint a program manager for the purpose of managing the overall consultancy program. The program manager will be the focal point for all communications between CSIR-NAL and Vendor. He 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 SOW.

13.0 Documentation:

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

14.0 Similar Work Experience Details:

Sl. No.	Name of the work with location	Date & Ref. no of completion certificate (If available)	Date of start Cost of work	Reference document (Work Order/ Work Completion Certificate) to be attached, mention page no

15.0 Commercial

15.1 The Bidder shall be a company having an average turnover of Rs.500 Crore for each of the last Three financial year ending on 31st March 2019. [Refer Section 10.2, Sr. No.4].
(a) Audited Balance sheets.
(b) CA Certificate with CA's Registration number/Seal. Indicating required turnover

15.2 Average Net Worth the Tangible Net Worth of the bidder shall be positive CA Certificate with CA's Registration number/Seal.

15.3 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).

15.4 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 letter head.

15.5 The Bidder may submit a Budgetary Estimate for 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.

15.6 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.

16.0 Other Terms

16.1 Expression of Interest

In order to fine-tune the technical specifications for carrying out **Engineering services & technical support for development, flight testing and certifications** and for short-listing of potential Bidders, Expression of Interest is being sought from internationally reputed and competent Bidders/consulting firms. Bidders are requested to submit all the required documents for Bidder evaluation as per Pre-qualification criteria.

16.2 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.

16.3 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.

16.4 Amendment of Terms and Conditions of EOI

16.4.1 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.

16.4.2 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.

16.4.3 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.

16.5 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.

16.6 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.

16.7 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.

16.8 No Agent/Agents or third party/parties are engaged by CSIR-NAL in this process.

16.9 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.

16.10 It is advised to deal directly with CSIR-NAL representative who is the signatory to this document.

16.11 Disregard of any instruction may result in offer being ignored.

16.12 This EOI and subsequent tender is governed by TERMS AND CONDITIONS of CSIR-NAL.

16.13 Canvassing by respondents in any form, including unsolicited letters on EOI submitted or post corrections shall render their EOI response liable for summarily rejection.

16.14 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.

16.15 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.

16.16 **All the responses received on our subsequent CPPP enquires will be considered and restricted to firms submitted EOI.**

16.17 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.

16.18 Bidder evaluation criteria

16.18.1 Bidder evaluation will be made by a Committee constituted by the Director, CSIR-NAL for Engineering services & technical support for development, flight testing and certifications

ANNEXURE-I

The following details shall be submitted along with EOI.

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	Status of ISO Certification	
12	Black Listing declaration	
13	Validity of the response	

B.	ESSENTIAL REQUIREMENTS	
14	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.	
15	Documentary evidences in support of capabilities of the Bidder as per the following details:	
(a)	Original Equipment Manufacturers (OEMs) of commuter aircraft or an Engineering firm with at least fifteen years' experience in design and engineering of commuter aircrafts with proven expertise in any or all of the following: design, development, certification of Airplanes for FAR 23 commuter or FAR 25 transport class of aircraft.	
(b)	Provided design and engineering services/solutions to at least one commuter / passenger aircraft program in the areas of design/ testing/certification for FAR 23 or FAR 25 compliances. In case the vendor supplied the design to another company who certified the aircraft, then the vendor needs to provide the details of the same (Organization and Aircraft name). Vendor should have proven professional design and certification team with at least 15 years' experience in relevant field. The vendor shall provide evidences like Curriculum Vitae of the design team, Experience Certificate of Design consultancy provided to commuter category aircraft.	
(c)	EASA/FAA or equivalent country specific regulatory authority approved design and Airworthiness agency required for certification specific tasks.	
(d)	AS9100D approved Quality management system and NADCAB accreditation where relevant.	
(f)	In addition to the documents mentioned above, Vendor shall provide the following: Documentary evidence/ authentic information relating to the nature of business, manpower strength, specialists experience, product range, infrastructure facilities, copies of approvals & quality accreditations, copies of design organization approval under EASA/FAA and copies of audited profit / loss account and balance sheets for at least last 3 years to be provided along with Technical Bid.	

16	The list of activities vendor proposes to carry out in order to comply with the deliverables against each task. (Ex: Section 4.4.2 (a) requires the vendor to "submit the reports on sizing of control surface and redundancy management and suggest improvements as per regulatory requirements". This may require the vendor to perform an independent analysis / calculations and determine whether the control size proposed by CSIR-NAL meets each and every relevant FAR requirement. Further, if the vendor determines that the control surface is inadequate to meet any relevant FAR requirement, they shall propose a suitable modification with supporting technical evaluations.)	
17	Against each activity identified by the vendor in Sl. No.16 above, they have to provide an man-hour estimate.	

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

Signature with Name & Seal:

Place:
Date:

ACTIVITY BAR CHART: SARAS-Mk2 AIRCRAFT