

Annexure -A

**Specifications for outsourcing “IO
intensive Embedded Software”
Development activities**

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1 Introduction

1.1 Project Overview

The IO intensive Embedded Systems receives the inputs from the aircraft and codes them and sends these coded inputs to mission computer on MIL-STD-1553B AVIONICS bus. It also receives the data from mission computer and drives the outputs

This embedded software was developed using 2167A process and in OOAD methodology. It follows a typical V cycle steps and there are documents for requirements, design and testing. There is an independent IV&V team and the external certifying team that would have to be involved, end-to-end.

This RFP is to address the activities that are to be taken up to perform a software update and maintenance for a period of ONE year.

2 Supplier - Pre-requisite Qualification for Execution of Work Package

1. Supplier's project team experience in Airworthy Avionics LRUs Design, Development, testing and Certification for of Military Avionics LRU's would be considered desirable. Vendor shall provide the proof for the same during the submission of the bid.
2. The supplier having CEMILAC Certificate for Design house or Military Avionics LRUs would be considered desirable. Vendor shall provide the proof for the same during the submission of the bid.
3. Minimum SEI CMMI Level 3 or AS 9100 Rev C or ISO 9001:2015 certification is mandatory. Vendor shall provide the proof for the same during the submission of the bid.
4. Supplier shall not subcontract the project.
5. Acquirer shall explain the status, architecture, the development and testing mechanisms to the supplier.
6. Supplier's project team should have executed successfully
 - a. minimum of 4 different projects in the domain areas specified in section 6 with each project span of minimum 6 months OR

- b. minimum of 2 different projects in the domain areas specified in section 6 with each project span of minimum 12 months

Vendor shall provide documentary evidence for the execution of these projects with satisfactory feedback from the user during the submission of bids. During TEC, verification checks on the satisfactory completion of these projected projects will be carried out by ADA if required.

7. During technical bid evaluation, vendor shall demonstrate the technical knowhow and skills in the areas in section 6. The non-submission of these documents and non-completion of POC would lead to rejection of technical bids.
8. Supplier shall produce Software development plan in compliance with ADA software development process.
9. Based on the performance demonstrated by the supplier scope of the work shall be evaluated for the improvement. In case of the non-performance, acquirer has the right to terminate the contract at a suitable stage of the product.
10. Resource plan shall address attrition risk of the firm.
11. Environment required for executing the project shall be provided by ADA
12. Shall deploy minimum 4 team members including a dedicated team Leader/single point of contact for the project.
13. All items developed by supplier under this project are proprietary of ADA and shall not be disclosed and supplier does not have any rights on the software/artifacts developed.
14. Periodical project review shall be conducted with the supplier at least once in two weeks. The constitution of the review team shall be worked out by ADA.
15. All artifacts developed during the project life cycle shall be submitted to ADA with source code and documentations at appropriate stages.
16. Supplier shall sign Non-DISCLOSURE Agreement with ADA.
17. Supplier shall maintain highest level security for the items developed and for the development environment for this project.

3 Work Share between ADA team and the Supplier

The Process to be followed is briefly described below:

1. ADA hereafter referred to as the acquirer of the project shall submit the set of Software Requirements and interface control requirement(s) which need to be developed and tested.

2. Supplier who is responsible for the supplying the developed and tested subsystem to ADA hereafter referred to as supplier and shall be responsible for software development, testing, co-ordination, documentation and certification.
3. Supplier shall study the software requirements and interface requirements before implementation.
4. During the course of the study the supplier is encouraged to ask all the related queries clearly understanding the requirement(s). Acquirers shall give the required inputs to the supplier's project team during the development phase of the project.
5. Supplier shall maintain the process and configuration management for the sub systems using the tools specified and provided by the acquirer.
6. Supplier shall submit artifacts as per defined process. This shall be discussed and agreed upon at the start of the project.

4 Scope

This section elaborates all the tasks required in a typical IO intensive Embedded software life cycle from requirements analysis to fitment of unit with the certified software in the aircraft.

While the primary objective would be to upgrade the existing IO intensive Embedded software to implement the new requirements, the vendor is expected to manage the complete life cycle activities, which include coordination with different stakeholders across multiple work places.

4.1 Objectives

This section shall describe the tasks list of the statement of work for IO intensive Embedded Software update. The SOW shall include all tasks involved in the IO intensive Embedded software life cycle. This SOW is intended to address in four builds with one milestone each. The anticipated duration of each Milestone is 03 months.

4.1.1 Requirements

The probable areas of the work involved are listed below . However during the beginning of every mile stone, requirements that are to be taken up as part of each build will be defined during the project planning phase. The list of artifacts to be released as part of each build and each milestone are defined in this SOW.

4.1.1.1 Areas of Activities

The requirements to be implemented are envisaged in any of the following areas:

4.1.1.1.1 Driver development in MPC5777C platform for bare board using ADA MULTI GHS Ver 7.1.4(or higher) ADA & C language cross Compiler

1. 1553B
2. RS422
3. RS232
4. Discrete inputs
5. Discrete outputs
6. Analog inputs
7. Voice chip outputs.

4.1.1.1.2 Code development in MPC5777C platform for bare board using ADA MULTI GHS Ver 7.1.4(or higher) ADA & C language cross Compiler

1. Discrete And Analog Input interface module
2. Discrete And Analog Output interface module
3. Processor Memory module
4. Interface module
5. Flashing Module

4.1.1.1.2.1 Discrete and Analog Input Module

1. Reading of the data from the hardware
2. Processing / sampling of the data based on algorithms provided by ADA
3. Packing of the data in 1553B format
4. Debugging of problems
5. MATLAB based plot generation
6. Integration of the module with other modules

4.1.1.1.2.2 Discrete and Analog Output Module

1. Unpacking of the data in 1553B format
2. Processing of the data based on algorithms provided by ADA
3. Writing of the data from the hardware
4. Debugging of problems

5. MATLAB based plot generation
6. Integration of the module with other modules

4.1.1.1.2.3 Frequency Input and Output Module

1. Unpacking / Packing of the data in 1553B format
2. Processing of the data based on algorithms provided by ADA
3. Writing/reading of the data from/to the hardware
4. Debugging of problems
5. MATLAB based plot generation
6. Integration of the module with other modules

4.1.1.1.2.4 Processor and memory modules

1. Reading and writing of various memory devices like RAM, NVRAM, DPRAM data etc
2. Processor configuration
3. Computation of data based on algorithm provided by ADA
4. Inter Processor Communication
5. Debugging of problems
6. Integration of the module with other modules.

4.1.1.1.2.5 Interface module

1. Configuration , Initialization and Handling of user defined of timers
2. Handling of user defined and hardware interrupts and their sub routines
3. Configuration, Initialization , protocol implementation and handling of various chips like 1553B , RS422, RS232, Voice etc

4.1.1.1.2.6 Flashing module

1. Erasing and Flashing of code to the FLASH memory
2. Downloading of code to RAM for debugging

4.1.1.1.3 Testing activities

1. RAM debugging
2. Test case generation based on the above requirements
3. Code walk through after implementation
4. CSU / CSC level testing

5. Regression testing for minor changes
6. Verification of code for coding standard
7. Interface checks
8. Functionality testing for each modules
9. Run time testing with other sub systems
10. MATLAB based plot generation
11. Problems reporting
12. Snag and data analysis

4.1.1.1.4 Process Requirements

The vendor shall follow the process defined currently to design, implement, test, the software

- i. The process includes requirement analysis, design, development, implementation and testing
- ii. The process includes all the required documentation, reviews and coordination with different agencies.
- iii. The process includes testing of Test Jig Software enhancements .The actual Test jig software updates is not in the scope of this SOW
- iv. The support activities for aircraft and other rigs includes carrying out Pre-installation checks, snag verification, flight data analysis and aircraft level testing

4.2 Performance Review and Assessment

- i. Program manager of the Acquirer shall review the progress made by the deployed team on the work assigned in the presence of project manager from supplier side.
- ii. Monthly / weekly meeting shall be held at ADA for the work assignment, schedule and realization plans.
- iii. The assessment of the work of the team shall be done based on the following:

Development:

- Ensuring the development of the project in SDLC environment
- Number of new requirements Vs implementation of the same
- Number of problems resolved

- Release of artifacts for each build and for each mile stone duly accepted.

Testing :

- Number of new versions released and tested
 - Ensuring the verification and validation of the project in SDLC environment
 - Number of test cases generated and executed
 - Number of problems reported
 - Number of PI-checks / RFTs carried out
 - Number of snags attended
 - Release of artifacts for each build and for each mile stone duly accepted.
- iv. For each defined mile stone the completion report shall be generated by the supplier duly approved by project coordinator of Acquirer.

5 Proof of concept (POC)

During technical bid evaluation, vendor shall demonstrate the technical knowhow and skills in the areas mentioned below. The problem statement covering the below area will be shared during TEC. Vendor needs to demonstrate the solution within three weeks' time at ADA.

Sl.No.	Areas to be demonstrated	Proof Of Concept (POC) Deliverables
1.	Generation of control flow diagram, data flow diagram, sequence diagram as per OOAD for the problem statement	Control flow diagram, data flow diagram, sequence diagram as per OOAD for the problem statement
2.	Generation of system and software architecture design artefacts for the problem statement	System and software architecture design artefacts for the problem statement
3.	ADA 95 language or C/ C++ code development	project code to run in PC based environment for the problem statement
4.	1553B, RS422, RS232 data transfer for the problem statement	Interface design understanding using 1553B/RS422/RS232 data transfer for the problem statement

6 Technical Team Experience

- The deputed team leader shall have ME/BE in Computer science/ Electronics/Instrumentation/Avionics/Aeronautics with minimum experience of 5 years or more in Embedded system Design, development, Testing and Maintenance. The deputed team members shall have ME/BE in Computer science/ Electronics/Instrumentation/ Avionics/ Aeronautics with minimum experience of 3 years or more in Embedded system Design, development, Testing and Maintenance. Experience in Avionics domain is desirable.
- The deputed team shall have experience in handling similar projects
- The team leader shall have knowledge in minimum 3 areas in each sub category and the team members shall have knowledge in minimum 2 areas in each sub category

IDE/Compiler : GHS ADA MULTI 95 , Visual studio , NXP S32 Design studio, DIAB Compiler, QT, Eclipse , Tornado, GNAT, Understand ADA
PROTOCOLs : MIL-STD-1553B, TCP/IP, UDP, AFDX, RS422, RS232, Data Acquisition , TSN

Languages : C, C++, VC ++, Ada 95, Python , Embedded C

Operating System: Windows 64bit , Windows 32bit, LINUX, UBUNTU, RTOS, QNX, Vxworks, Bare board

Embedded systems knowledge : microcontroller, microprocessor, memory handling, interrupt handlers, timers, flashing of software to target, debugging , Voice chip , IO processing , exception handling, DMA

Standards /guidelines : DO- 178C, DOD 2167A, IEEE 12207, MISRA -C

Tools: LDRA, MAT LAB, SIMULINK, RT-RT, One Test, IBM clear case, IBM rational publishing engine, MS project, EXCEL, MS word

7 Items provided by ADA

All the tools, environment and other infrastructure including licenses needed shall be made available by ADA. The details of the hardware and the existing software will be provided during the project execution.

8 Technical Evaluation

- a) During technical evaluation, vendor shall demonstrate the technical knowhow and skills as per POC mentioned in section 5 and section 6.
- b) The vendor shall submit the details and proof of experience as per Annexure – 1 and Annexure - 2
- c) The vendor shall submit the resumes of their regular employees along with technical bid whom they are planning deploy for this project that has experience and knowledge mentioned in SOW along with resource compliance as per Annexure–3.
- d) TEC committee will be evaluating the capability of the vendor based on POC, the vendor’s experience on executing similar projects and the resource’s experience. In case, TEC found the resumes submitted is not as per SOW, the vendor needs to submit alternate resumes as per SOW within a weeks’ time.
- e) Vendor shall provide the confirmation for their willingness to deploy at least half of the resources which are found suitable by the TEC committee during the evaluation if PO is placed. In case, it is found that the vendor is not complying the same, ADA is having rights to terminate the PO.

9 Schedule and Effort

9.1.1 Schedule for the build

The activities to be carried out for each build will be identified from the areas mentioned in section 4. In the beginning of every milestone, the activities to be taken up will be identified from the areas listed depending on the project need and priority. The schedule shall be discussed for the same between supplier and acquirer team and mutually agreed upon .The project timeline with the milestones for each build is given below :

T0—Start of the Project / build

Milestone Number	Description	Time Line
Mile stone 1	Requirement capture , Design completion (reviewed and cleared internally) Development and Reports release as applicable Testing and Reports release as applicable	T0 + 3 months : T1

Milestone Number	Description	Time Line
Mile stone 2	Requirement capture , Design completion (reviewed and cleared internally) Development and Reports release as applicable Testing and Reports release as applicable	T1 + 3 months : T2
Mile stone 3	Requirement capture , Design completion (reviewed and cleared internally) Development and Reports release as applicable Testing and Reports release as applicable	T2 + 3 months : T3
Mile stone 4	Requirement capture , Design completion (reviewed and cleared internally) Development and Reports release as applicable Testing and Reports release as applicable	T3 + 3 months : T4

Singed copies of the following with co-ordination from ADA shall be submitted as per the applicability:

Mile stone 1 deliverables and Reports:

Report no: CIU_Milestone_Quarter_1_report

1. Change notice X* to System segment specification document (SSS)
2. Change notice X* to Software/ Functional requirements document (SRS/FRS)
3. Change analysis report
4. Change notice X* to Interface control document
5. Change notice X* to Software design document(SDD)
6. Source code for Designer Build
7. Change notice X* to Software test document(STD)
8. Acceptance Test document (ATP)
9. CSU / CSC report with tested modules with 100 % coverage
10. Source code for Tested Build
11. CSCI internal test report
12. Acceptance Test Report(ATR)
13. Version description document (VDD)

14. Release note
15. Memory and processor load analysis
16. Timing report
17. Change notice X* to Pre Installations (PI) checks document
18. Change notice X* to Request for Test Document (RFT)
19. Software test Report (STR)
20. PI report after software updation

*-- X indicates a running number provided by project co-ordinator

Mile stone 2 deliverables and Reports:

Report no: CIU_Milestone_Quarter_2_report

1. Change notice Y** to System segment specification document (SSS)
2. Change notice Y* to Software/ Functional requirements document (SRS/ FRS)
3. Change analysis report
4. Change notice Y** to Interface control document
5. Change notice Y** to Software design document(SDD)
6. Source code for Designer Build
7. Change notice Y** to Software test document(STD)
8. Acceptance Test document (ATP)
9. CSU / CSC report with tested modules with 100 % coverage
10. Source code for Tested Build
11. CSCI internal test report
12. Change notice Y** to Acceptance Test Report(ATR)
13. Version description document (VDD)
14. Release note
15. Memory and processor load analysis
16. Timing report
17. Change notice Y** to Pre Installations (PI) checks document
18. Change notice Y** to Request for Test Document (RFT)
19. Software test Report (STR)
20. PI report after software updation

**-- Y is next number to X

Mile stone 3 deliverables and Reports:

Report no: CIU_Milestone_Quarter_3_report

1. Issue Two to System segment specification document (SSS)
2. Issue Two to Software/ Functional requirements document (SRS/ FRS)
3. Change analysis report
4. Change notice Z*** to Interface control document
5. Issue Three to Software design document(SDD)
6. Source code for Designer Build
7. Issue Three to Software test document(STD)
8. Acceptance Test document (ATP)
9. CSU / CSC report with tested modules with 100 % coverage
10. Source code for Tested Build
11. CSCI internal test report
12. Acceptance Test Report(ATR)
13. Version description document (VDD)
14. Release note
15. Memory and processor load analysis
16. Timing report
17. Change notice Z*** to Pre Installations (PI) checks document
18. Change notice Z*** to Request for Test Document (RFT)
19. Software test Report (STR)
20. PI report after software updation

***-- Z is next number to Y

Mile stone 4 deliverables and Reports:

Report no: CIU_Milestone_Quarter_4_report

1. Change notice 1 to Issue Three of System segment specification document (SSS)
2. Change notice 1 to Issue Three of Software/ Functional requirements document (SRS/ FRS)
3. Change analysis report
4. Change notice P**** to Interface control document
5. Change notice 1 to Issue Three of Software design document(SDD)
6. Source code for Designer Build
7. Change notice 1 to Issue Three of Software test document(STD)

8. Acceptance Test document (ATP)
9. CSU / CSC report with tested modules with 100 % coverage
10. Source code for Tested Build
11. CSCI internal test report
12. Acceptance Test Report(ATR)
13. Version description document (VDD)
14. Release note
15. Memory and processor load analysis
16. Timing report
17. Change notice P**** to Pre Installations (PI) checks document
18. Change notice P**** to Request for Test Document (RFT)
19. Software test Report (STR)
20. PI report after software updation

****-- P is next number to Z

Apart from the above , any activity for the support of the current build (points i to v mentioned in section 4.1.1.1.4) shall be addressed in parallel based on the aircraft programme requirements demand from, the project coordinator. The schedule shall be discussed for the same between supplier and acquirer team and mutually agreed upon.

9.1.2 Effort Estimate

- The effort estimated is likely to vary in the range of total SLOC $\pm 10\%$.
- The onboard software shall be considered to be of a class A/ B level of DO-178B/C equivalent

10 Deliverables

Supplier shall deliver the activities as per section 4.

11 Acceptance criteria and Payment terms

- a. Supplier shall meet the requirements as per section 4
- b. Acceptance shall be milestone linked. One milestone per build is visualized.
- c. Milestone completion letter from team ADA after each milestone shall be required to acceptance.
- d. The approved mile stone report shall be submitted along with deliverables for payment.

e. Payment shall be made mile stone based as follows:

Sl.no	Description	% of PO for each Milestone
1	Mile Stone 1 : Ist build	25.0
2	Mile Stone 2 : IInd build	25.0
3	Mile Stone 3 : IIIrd build	25.0
4	Mile Stone 4 : IVth build	25.0
	Total	100

12 Terms & Conditions

- i. The SOW shall be required to be executed at ADA premises.
- ii. IPR of the software developed is with ADA and all the items developed by supplier under this project are proprietary of ADA and supplier does not have any rights on the software/artifacts developed.
- iii. Vendor shall take care of logistics for travelling to ADA premises.
- iv. Security procedures of ADA shall be followed for all the deployed resources.
- v. Resource deployment of engineers from the day of Purchase Order in concurrence with ADA.
- vi. Supplier shall take the responsibility to address the resignations with appropriate replacements ensuring the schedules are not getting affected. However the change in the personnel needs to be intimated and approved by the ADA project coordinator.
- vii. Supplier shall deliver the manpower services who are on the permanent roles of the company with sincerity and by maintaining confidentiality.
- viii. Police verification letter to be obtained for the deployed resources before executing the work
- ix. Confidential agreement (NDA) to be signed by the supplier.
- x. The working schedule shall be as per ADA norms.
- xi. Supplier shall ensure scheduling of usage of resources and ensuring that absence and attrition does not affect the deliverables.
- xii. In case of outstation trails, re-imbusement shall be made at actual or equivalent to entitlement of Scientist B whichever is less on submission of documentary evidence and submission of tax invoice. Vendor's quote not to include any cost as it is a re-imbusement.

13 Glossary

AI	Analog Input
AO	Analog Output
CSC	Computer Software Component
CSU	Computer Software Unit
CSCI	Computer Software Configuration Item
DI	Discrete Input
DO	Discrete Output
EU	Electronic unit
LRU	Line Replaceable Unit
LOC	Lines of code
RAM	Random Access Memory
NVRAM	Non volatile RAM
DPRAM	Dual Port RAM
SOW	Statement of work
SLOC	Software Lines of code

Annexure -1: Company Experience Details Template

S. No	Technical areas as per SOW	PO description with details of work carried out	Reference PO	PO relevance w.r.t ADA SOW section No	No of resources deployed for the PO

Annexure –2: Company Details Template

Sl.no	Parameter	Information
1.	Year of Establishment of Company	
2	Total employee strength in India	
3	Years of experience in the relevant domains demanded by SOW and the tools used	
	Embedded software development	Years : Tools:
	Test rig software development	
	Simulation software development	Years : Tools:
	RTOS based Software development	Years : Tools:
	Certification	Years : Tools:
	Any Other Areas	Years : Tools:
4.	Total employees currently working in the company with relevant experience demanded by SOW	
5.	Mitigation Plan for the milestone completion	

Annexure –3 : Experience Compliance Matrix for the Resources planned to be deployed by the vendor

Sl. no	Requirement	Details
1.	Name of the resource	
2.	Total No of Years / months of experience	
3.	No of Years / months of experience in vendor's firm	
4.	Qualification Compliance w.r.t SOW	
5.	Experience Compliance w.r.t SOW	Project name : Name of the project Works carried out : Description of the work carried out by the resource for the project No of years / months worked in the project:
6.	Skill set Compliance w.r.t SOW	
	IDE / Compiler	Projects handled with this area:
	PROTOCOLs	Projects handled with this area:
	Languages	Projects handled with this area:
	Operating System	Projects handled with this area:
	Embedded systems knowledge	Projects handled with this area:
	Standards / Guidelines	Projects handled with this area:
	Tools	Projects handled with this area:
	Any Other Areas	