

Tender No: LRDE/MMFD-PUR/26-27/27DCT007

LRDE: SOW



(ISO 9001-2015 Certified Establishment)

## Scope of Work for

**Development, Supply, Site Assembly, Integration and  
Installation of High-Resolution Radar Hardware**

**ELECTRONICS & RADAR DEVELOPMENT ESTABLISHMENT**

Government of India, Ministry of Defence  
Defence Research & Development Organization  
CV Raman Nagar, Bangalore-560 093

Dec 2025

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### RECORD OF AMENDMENTS

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					Name	Date
-	Initial Version			Dec 2025	Project team	24/12/25

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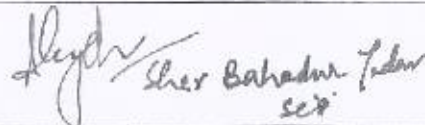
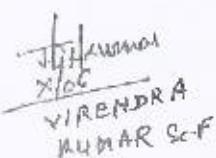
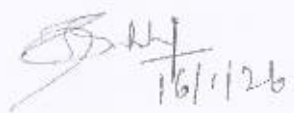
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**DOCUMENT SUMMARY**

<b>1. Title:</b> Scope of Work for Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware		
<b>2. Type of Document:</b> Scope of Work	<b>3. Classification:</b> Restricted	
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<b>15. Prepared by:</b> Name & Signature	Project Team	 Shree Bahadur Jindal Sc-F
<b>16. Reviewed by:</b> Name & Signature	 VIRENDRA KUMAR Sc-F	
<b>17. Approved by:</b> Name & Signature	 16/11/26 SENTHIL RENGARAMAN J, Scientist 'G' DRDO, Ministry of Defence, Govt. of India C.V. Raman Nagar, Bengaluru-560093	

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### LIST OF ABBREVIATIONS

Abbreviation	Expansion
AAAU	Active Antenna Array Unit
AAAU BB	AAAU Building Block
ATE	Automatic Test Equipment
ATP	Acceptance Test Plan
ATR	Acceptance Test Report,
BFE	Buyer Furnished Equipment,
BFI	Buyer Furnished Instrument
BOM	Bill Of Material,
CCP	Command & Control Post,
COC	Certificate Of Compliance,
COTS	Commercial Off The Shelf
CSCI	Computer Software Configuration Item,
DBF	Digital beam Former
CDR	Critical Design Review
DDR	Detail Design Review
ECAD	Electronic Computer-Aided Design,
ECR	Engineering Change Request,
FAI	First Article Inspection
EMI/EMC	Electro Magnetic Interference/ Electro Magnetic Compatibility
ESS	Environmental Stress Screening,
FMECA	Failure Mode Effects and Criticality Analysis
FRACAS	Failure Reporting Analysis and Corrective Action System
GOI	Government Of India
HALT	Highly Accelerated Life Test
HASS	Highly Accelerated Stress Screening
IP	Industry Partner
IPR	Intellectual Property Rights
LQT	Limited Qualification
LRU	Line Replaceable Unit
MCAD	Mechanical Computer-Aided Design



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NABL	National Accreditation Board for testing and calibration Laboratories
NFTR	Near Field Test Range
NPI	New Product Introduction
ODTRM	Octal-channel Digital Transmit-Receive Module
OEM	Original Equipment Manufacturer
PDB	Power Distribution Box
PDM	Product Data Management
PDR	Preliminary Design Review
POS	Proof Of Screen
PRR	Production Readiness Review
QA	Quality Assurance
QAP	QA Plan
QOS	Quality of service
QTP	Qualification Test Plan
QTR	Qualification Test Report
RCS	Radar Cooling System
RCC	Radar Command and Control
RE	Radiating Element
RICD	Radar Interface Control Document
RMA	Return Material Authorization
RPS	Radar Power System
RSU	Radar Synchronization Unit
RTS	Radar Target Simulator
SAT	Site Acceptance Test
SI	Signal Integrity
SOP	Standard Of Preparation / Standard Operating Procedure
SP/SPU	Signal Processor /Signal Processing Unit
STE	Special Test Equipment
SCPU	Space Control & Processing Unit
STCPU	Space Time Control & Processing Unit
TDP	Technical Data Package
THCS	Temperature & Humidity Control System

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## 1. General

### 1.1. Scope

This document establishes the Scope of Work (SOW) for the ***“Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.”***

The following terms will be used in this document:

- System - Active Array Antenna Unit (AAAU)
- Project - Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.

This Statement of Work (SOW) defines Seller responsibilities and Buyer tasks in the execution of the Project. *“Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.”*

### 1.2. Definitions

Term	Definition
The Buyer	DRDO
The Seller	The industry partner for execution of the project.
Sub-Contractors	Indigenous major sub-contractors
The Project	Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.

### 1.3. Seller's Tasks

The following list defines Seller's tasks within the framework of the contract:

- Project Management
- System Engineering
- Quality Assurance
- Hardware Development
- Software Development
- Firmware Development
- Manufacturing, Production and Procurement
- Assembly, Integration and Testing
- AAAU Installation/System Integration
- Integrated Logistics Support (ILS) Package



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- Warranty and support

#### 1.4. Buyer's Tasks

The following list defines Buyer's tasks within the framework of the contract:

- Conduction Technical Interchange Meetings
- Project Reviews and Progress monitoring
- Co-ordination among cross functional teams/stakeholders
- Approval of required documents and test results Buyer shall review and approve the documents prepared by the Seller.
- Buyer shall review and approve the design changes (as required) throughout the Project development lifecycle.
- Buyer shall provide name plate format, logo etc. for each LRU/PCB to be engraved for product identification and marking. (as defined in Sec 3.8.3 Part numbering & Marking).
- Site Acceptance Test etc.

Note: The Technical specifications shall be issued only after Non-Disclosure Agreement (NDA) is signed by the Seller.

##### 1.4.1. List of Deliveries

The items/components/equipment/services shall be delivered/performed by the Seller within the framework of the contract as per the list of deliverables mentioned in the **Appendix-A, CDRL and TDP as per appendix-B.**



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## 2. Applicable Documents

### 2.1. Contractual Documents

The following details the applicable documents for the project:

- Contract : \_\_\_\_\_
- Statement of Work Document, for the Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware
- Specification for the Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware

### 2.2. Document Priority

In any case of contradiction between an applicable document and any requirement herein, the contradiction shall be resolved in accordance with the following order of priorities:

1. Contract
2. Statement of Work for the Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.
3. Specification for the Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware.

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### **3. Seller Tasks**

#### **3.1. General**

This section details the tasks to be performed by the Seller in order to achieve the contract goals. The Seller will assume full responsibility for the contract tasks according to the definitions in the following paragraphs and the applicable documents. Seller shall sign NDA for obtaining Technical specification documents for the Development contract.

#### **3.2. Contract Management**

This contract shall be managed by the Seller to handle the multiple sub-systems development in a concurrent manner, in order to complete the contract as per the schedule. For each subsystem development and production, the Seller should ensure that adequate and appropriate resources are made available for the completion of the tasks and activities as per the schedule agreed upon.

The Seller shall appoint Project Manager for the contract who will be a single point of contact/main Point of Contact (POC) with LRDE. Project Manager shall organize regular technical and project review meetings. The Project manager will be responsible for the full execution of the project, including co-ordination, contract management, scheduling, project reviews and synchronization of activities.

#### **3.3. Project Management**

##### **3.3.1. Project Management Plan (PMP)**

The Seller shall prepare and submit to the Buyer the PMP document. The PMP shall specify the project management concept, organization, methodology and procedures required to manage the project. The PMP document shall be presented at the PDR Meeting (**Appendix - B CDRL**). The PMP shall address the followings topics:

- Master Project Schedule GANTT and PERT chart
- Project organization with roles and responsibilities
- Project Management Plan and control procedures
- Reports and action items
- Configuration management
- Sub-contractors integration and management
- Scheduling and milestone reports
- Make or buy decisions





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- Buyer's Furnished Equipment (BFE) monitoring
- Risk mitigation program

### 3.3.2. Project Organisation

The Seller shall be responsible for appointing a project manager for the project, who will be the top executive responsible for the full execution of the project. The project manager will serve as the main point-of-contact with the Buyer.

The Seller shall form a project organization for the execution of the project which includes the following executives:

- Project Manager
- System Engineer (Performance Assurance)
- Manager (Active Array Electronics/Subsystem)
- Manager (System Lead Integration/Collimation)
- Manager (Software / Firmware)
- Manager (Mechanical)
- Manager (Electrical)
- Manager (Quality Assurance)
- Manager (EMI/EMC)
- Manager (Production)
- TDP / Documentation / Delivery Manager

This team shall be responsible for all project management activities. The Seller shall be responsible for maintaining its team and the appointed management teams of its sub-contractors throughout the duration of the project.

### 3.3.3. Project Planning

#### 3.3.3.1. Master Project Schedule (MPS)

The Seller shall prepare and maintain a Master Project Schedule (MPS) for all project activities, including milestones and key activities. The detailed MPS shall be submitted along with the technical bid for the technical evaluation. Contractual program milestones are shown in **Appendix D**. The Seller shall manage the project schedule by utilizing a computerized scheduling tool (such as Microsoft Project). The Seller will update the work plans on a monthly basis. The Master Project Schedule will be presented by the seller in contract monitoring/progress review meeting (**Appendix B CDRL**).

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### **3.3.3.2. Work Breakdown Structure (WBS)**

The Seller shall prepare and maintain a Work Breakdown Structure (WBS). The detailed WBS shall be submitted along with the technical bid for the technical evaluation.

The WBS shall detail the complete activities towards realization of the prime / critical items and shall have identified responsible person / manager (as defined in Section 3.3.2) The Seller shall utilize the WBS as the main tool for planning the project and for status reports for the Buyer. The WBS will be detailed as part of the PMP and linked with the master project schedule.

### **3.3.4. Project Control**

#### **3.3.4.1. Design Reviews**

Design reviews will be defined as milestones in the Master Project Schedule (MPS). The Seller shall present at each review the engineering documents as detailed in **Appendix B - CDRL**.

The Seller shall submit the review material to the Buyer at least 5 working days prior to each review. The reviews will be conducted at the Seller's premises. The Seller shall invite Buyer's representatives to participate in the design reviews. The duration of each design review shall not exceed two working days, unless decided otherwise. The Buyer will inform the Seller the names of the participants for all necessary clearances 2 working days in advance. The Buyer design review team shall consists of the committee (of team size 6 including chairman) and the Buyer's Integrated Project Management Team (IPMT) as defined in Section 4.1.1.

The Seller shall summarize the reviews (in form of minutes of meeting) and submit the signed off report to the Buyer within 15 days after each review. Completion of the design review will be declared after submitting signed off report and agreed Action Items List.

The Seller may combine the Design Review with a Project Management Review.

#### **3.3.4.2. Project Management Reviews**

##### **3.3.4.2.1. General**

The Seller shall be responsible for conducting a Project Management Review (PMR) every three months at a mutually agreed location. If possible, the management reviews shall be conducted in conjunction with technical reviews and/or other meetings. The duration of each



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management review shall not exceed two working days, unless decided otherwise. The Seller shall be responsible to prepare an agenda for the review, in which the most updated information will be presented.

In the event that the management reviews are conducted at the Seller's premises, the Seller shall invite Buyer's representatives to participate in the management reviews. The Buyer will inform the Seller the names of the participants for all necessary clearances 2 working days in advance. The Buyer's management review team shall consists of the committee (of team size 6 including chairman) and the Buyer's IPMT as defined in Section 4.1.1.

The Seller shall summarize the review (in form of minutes of meeting) and the action items no later than 15 days after the review meeting. Both the Seller and the Buyer shall be liable to fulfil their respective action items.

#### **3.3.4.2.2. PMR Content**

The Seller shall present at the PMR all the updated aspects of the project: production, testing, delivery, milestone achievement, and other relevant topics. For each topic, the actual-versus-planned status shall be presented, as well as plans for continuation. In addition, specific topics shall be presented as per the Buyer's request.

#### **3.3.5. Configuration Management**

The Seller shall be responsible for preparing and managing a hardware firmware and software configuration control plan. The Seller shall present the Configuration Management Plan at the PDR meeting (Appendix B - CDRL).

- a. Seller will have the responsibility to create and manage the complete configuration of each LRU, Subsystem, Systems and Technologies at every stage. Seller shall update and maintain the information about every card, SRU, LRU (deliverable Entity) on daily basis in a formal computerized document.
- b. Seller shall also prepare and maintain a log card as per LRDE format for every deliverable entity. These cards will be managed and maintained on daily basis. These will include service and maintenance history, fault and repair history, usage history etc.
- c. Similar configuration management process will be created and maintained for software & firmware packages. These will include software CSCI's/firmware in each and every LRU, CARD, Simulator and analysis software, test software etc. The Sellers shall maintain the complete revision and subversion controlled version history of the software/firmware entities in a centralized subversion server as deliverable item.

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- d. The Sellers shall be responsible for creation of numbering and labelling scheme for every component, part, SRU, LRU etc. to be developed under this project. Numbering and labelling scheme will be as per the guidelines of LRDE. It will also be responsible for implementation of complete scheme on every smallest component / part.
- e. The Sellers shall be responsible to maintain inventory of each item, equipment, component that is procured, developed under this project in computerized manner in inventory control software and update the same periodically. The Sellers will be required to submit comprehensive account statement for the items.
- f. The Sellers shall be responsible for management of documents under the project / contract.
- g. Sellers will be required to prepare detailed documents for delivery as per Buyer requirements.

### 3.3.6. Sub-Contractor Management

#### 3.3.6.1. General

The Seller shall select the sub-contractors with the approval of the Buyer. The proposed sub-contractor's details such as technical expertise, manufacturing facilities and already realized product should be submitted for review by the Buyer. It is not binding on the Buyer to accept the sub-contractor proposed. The delay beyond three months in finalization of sub-contractor will be accounted as delay in project execution (sole responsibility of seller) and may attract imposition/invocation of contractual condition in terms of LD or even termination of the contract.

The Seller shall ensure that their subcontractor fully comply to the SOW requirements and the applicable documents.

The Seller shall maintain the comprehensive (mechanical assemblies and sub-assemblies, RF, digital, power, cable harnessing, software and firmware developers, assembly and manufacturers) sub-contractor details and submit the same to Buyer during technical bid evaluation.

#### 3.3.6.2. Responsibilities

- The selection of the sub-contractor shall be guided as per the Vendor Qualification Criteria (VQC) in line with the selection of Seller as mentioned in the RFP.
- The Seller shall assume full responsibility for the performance of sub-contractors.



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- The Seller shall integrate the activities of its sub-contractors into their main work plan.
- The sub-contractors shall use similar plan and control tools as defined in the Seller's contract.
- The Seller shall conduct design reviews, technical coordination, and PMRs in order to manage sub-contractor activities.
- Each sub-contractor shall submit periodic status reports to the Seller.
- Each sub-contractor shall conduct a PRR for its sub-systems with the participation of the Seller and Buyer.

### 3.3.7. Risk Mitigation

#### 3.3.7.1. Risk Management Plan (RMP)

The Seller must have technical and financial risk management capability. The Seller shall prepare a Risk Management Plan (RMP) and guidelines that are followed during the lifecycle of the project. The detailed RMP shall be submitted along with the technical bid for the technical evaluation. Risk Management is a continuous activity from program inception and acquisition, to delivery and continuing support functions. The Seller shall present the updated Risk Management Plan (RMP) and Risk management process at the PDR meeting (Appendix B – CDRL).

The project manager shall be responsible for risk management activities. The project manager will be responsible for the implementation and execution of the risk management guidelines as they apply to his specific contract development team.

#### 3.3.7.2. Risk Management Guidelines

The project manager will be responsible for the registration, documenting, and tracking of project risk elements. This register will serve as a management tool used by the project manager to ensure the successful execution of the project.

The following are the general risk management guidelines:

- Risk management is a systematic approach identifying, quantifying, and mitigating project risks
- Risk management is performed throughout the project life cycle
- All potential risks must be identified at the earliest opportunity, thoroughly understood, assessed and mitigated, while clearly communicating the risk status to upper management and to the Buyer



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- All members of the project development team are to be encouraged to identify potential risk elements
- Risk status is clearly communicated on an ongoing basis to Seller and Buyer management during every PMR.

### 3.4. System Engineering

The Seller will be responsible to manage all required system engineering tasks within the framework of the Contract. A System Engineering Management Plan (SEMP) will be presented at the PDR (**Appendix B - CDRL**). The seller shall prepare SEMP and submit along with the technical bid for the technical evaluation. The SEMP flow chart is mentioned in Figure 3-1, for the entire Project. During each stage of SEMP as numbered in the flow chart below, relevant documents have to be submitted to LRDE for approval of the review and progress of the stage.

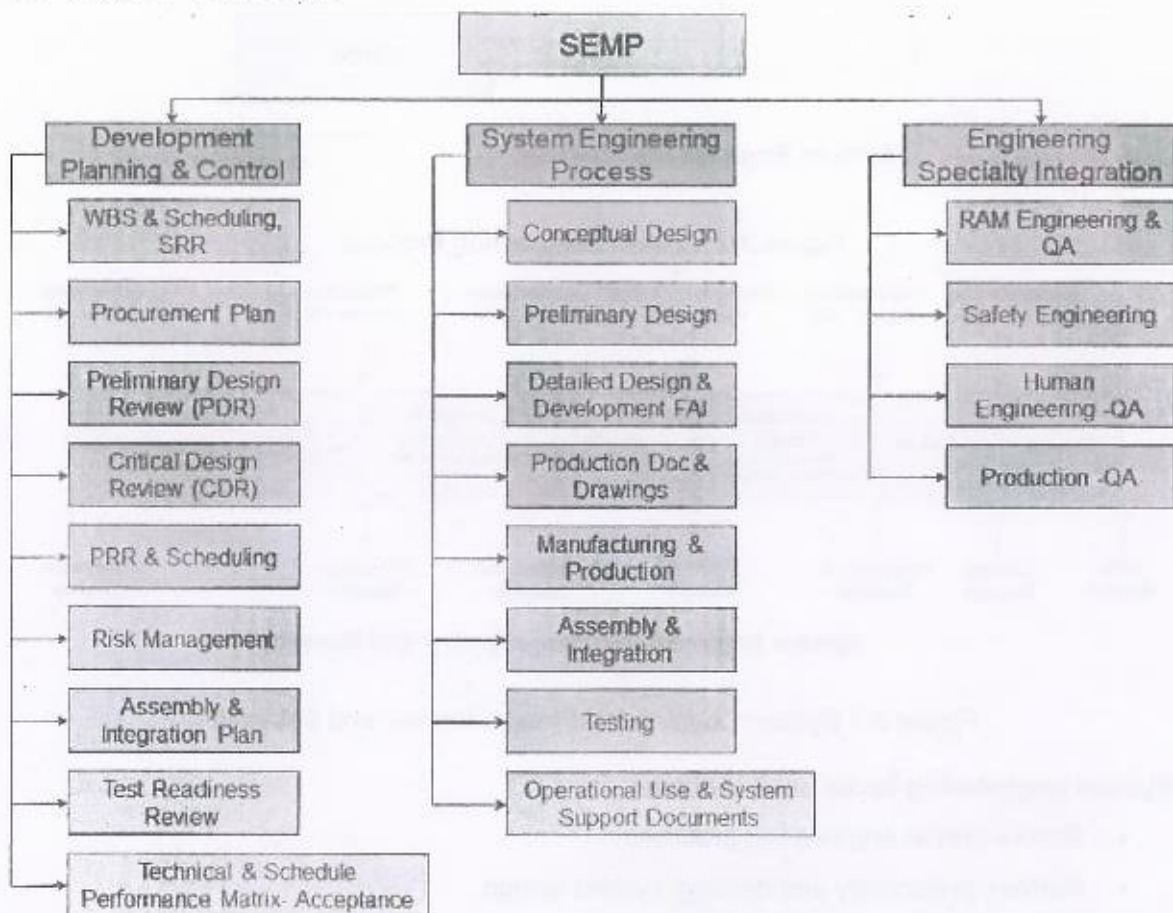


Figure 3-1 System Engineering Management Plan Flow Chart

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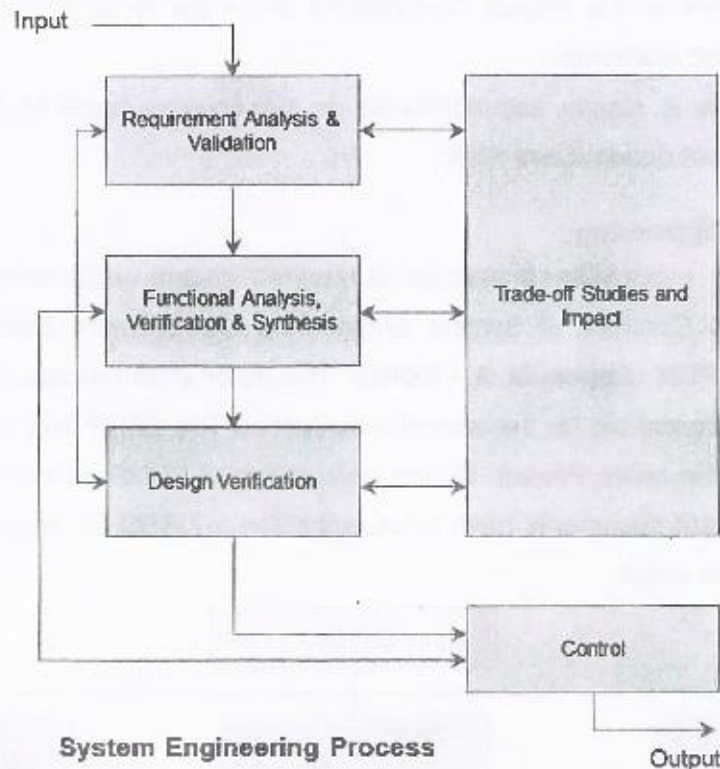


Figure 3-2 System Engineering Process

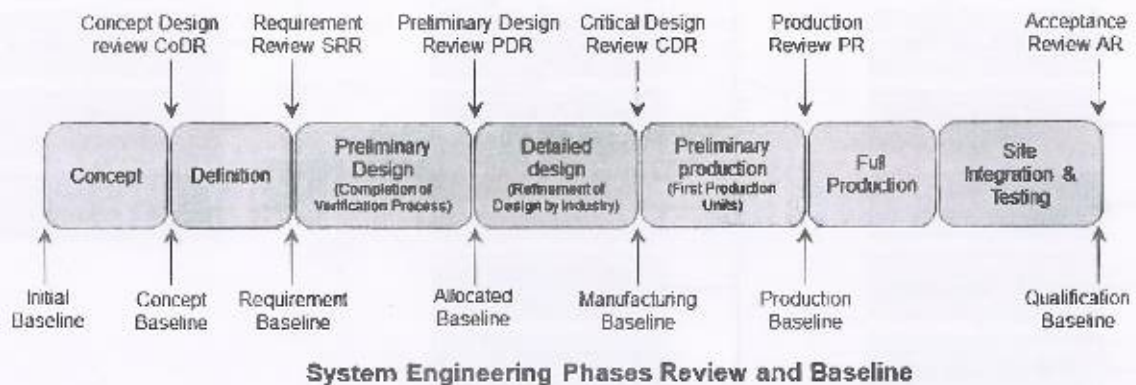


Figure 3-3 System Engineering Phases Review and Baseline

**System engineering tasks shall include:**

- Ensure proper engineering practices
- Perform preliminary and detailed system design
- Perform performance analysis
- Conduct system design reviews
- Perform hardware development



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- Perform Firmware development
- Perform software development
- Risk analysis and mitigations
- Assist Buyer in generation of Radar Interface Control Document (RICD) and Interface Design Document (IDD) of critical items.
- Interface Control Documents (ICD) (Software, Electrical, Mechanical)
- Generate Electrical Interface Design Document (EID) of AAAU consisting of control, data and power lines.
- Perform the configuration control for software, hardware and firmware.
- AAAU collimation procedure Document.
- Quality Assurance Documents (Road Map to type certification, QTP, ATP, ESS, HALT/HASS/POS procedures, reports) etc.
- Any other documents as specified by Buyer, QA/QC agency.
- FMECA and Reliability Analysis and documents.
- Perform system integration, test and evaluation.

#### 3.4.1. Engineering Practices

The Seller shall ensure proper engineering practices during project execution. System engineering tasks are detailed under common activities for all stages. An strict accordance with laid down processes and procedures for development, manufacturing, testing, evaluation, integration and maintenance has to be followed as per the guidelines given below (not limited to):

- a. Seller shall design, develop and produce all radar sub-systems according to the list of deliverables (LOD) and jobs against the specifications and requirements. Seller shall generate and get approval from LRDE on the preliminary design and detailed design along with/including the requirements traceability matrix; how the product design is verified for the requirements for functionality and performance.
- b. Seller shall review the preliminary specification of the system along with LRDE during the initial stages of the project. Seller will then derive detailed specification of the sub-systems/sub-assemblies, which will be presented at the design reviews.
- c. Seller shall generate the detailed ICD of each sub-system and get it reviewed during design reviews.
- d. Seller shall carry-out design and engineering of the units/subunits and submit relevant documents such as schematic layout, Gerber files, mechanical drawings,

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Signal integrity, Power integrity, thermal and structural analysis report of all the components and modules, detailed electrical and mechanical ICD. This will be presented during the design review and reviewed by LRDE.

- e. Seller shall also submit to LRDE, design of the internal and external interfaces of the system which will be reviewed and approved.
- f. There shall be multiple design audit to meet reliability requirements of Digital Active Phased Array Antenna, Antenna Post Mechanical Structure and Radar Technical Complex, prior to detailed design and engineering. The system reliability and maintainability analysis will be presented by the Seller during the design and engineering review before PDR. The procedure of reliability calculations and the reliability figure shall be approved by LRDE.
- g. During test and evaluation, the Seller shall prepare Test Management Plan (TMP), Quality Assurance management Plan documents and get approval from LRDE.
- h. Seller shall generate all documents, viz. Standard Operating procedure (SOP), Quality Assurance Plan (QAP), Technical Specifications (TS) and Acceptance Test Plan (ATP) documents which will detail how the product design shall be verified against the requirements. A verification matrix for the same needs to be enclosed in QAP and submitted to LRDE for approval. The plan shall include the methods by which requirements will be verified (test, analysis/simulation, demonstration, inspection) at LRU level(s) at which various verifications will occur (component, subsystem, item, higher system level) and the specific evaluations to be conducted.
- i. Seller shall develop a detailed plan, execute various tests and evaluations called for in the ATP. Seller shall prepare, provide the summary report(s) concerning design, verification, test and evaluation.
- j. Seller shall conform to MIL-STD Standards and Processes for development and delivery of all hardware, equipment's, components, documents etc.
- k. **Sub-System Specifications:** Seller shall prepare and submit for review the preliminary specifications of each sub-system to LRDE, post signing of the contract. IP will generate detailed specification of the subsystems, which will be presented at the Preliminary Design Review (PDR) and on completion of PDR, Industry Partner may be allowed to proceed with the development / realization of functional units.
- l. **Interface Control Document (ICD):** Seller will prepare and submit to LRDE for review the detail ICD (physical interfaces, external/internal or system & sub-system level). LRDE will review the same and approve for implementation.



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- m. **System Design:** The design of Seller shall be reviewed by LRDE. The Schematic, Layout, Gerber, Mechanical drawings, SI, Thermal Analysis and Power Integrity report of all the components and LRUs will be presented at the Preliminary Design / Technical Reviews, as applicable, and delivered in its applicable format such that the results can be verified using respective tools. The firmware and software design of the LRUs will also be presented at the PDR/ Technical Reviews and their source codes submitted for verification.
- n. **Performance Analysis:** Seller will be required to carry out the performance analysis for each sub-system and if required, integrated system. The performance analysis results will be presented to LRDE in various Technical reviews, as applicable. Further, the analyses may have to be repeated in case of design changes in the sub-system.
- o. **Reliability and Maintainability Analysis:** The system reliability and maintainability analysis will be presented at the PDR/CDR by the Seller. The reliability document prepared by the Industry Partner shall be approved by LRDE. The procedure of reliability calculations and the Reliability Block Diagram (RBD) shall be approved by LRDE.

#### 3.4.2. Radar Interface Control Document (RICD)

The Seller will generate the ICD for all the subsystems including ATE, which will be presented at the Preliminary Design Review (PDR) (**Appendix B – CDRL**). The Buyer will review interface requirements with the Seller and provide the approval for the same.

#### 3.4.3. System Design

The Seller will review the design of the system with the Buyer. The schematic, layout, gerber, mechanical drawings, SI, thermal analysis and power integrity report of all the components and LRUs will be presented at the Detailed Design Review (DDR).

The firmware and software design of the LRUs will also be presented at the DDR. Preliminary cable harness and duct / tray design shall be provided by the Buyer.

The Seller shall review and finalise the manufacturing drawings of the cable harness and duct/tray along with the connector interface panel. The Seller shall realise prototype version for validation of the cable harness design, before final production. The Seller shall also realise the cable harness ducts and the connector interface panel. The seller shall submit all the manufacturing drawing to LRDE for review and approval.



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#### **3.4.4. Physical Interfaces**

Seller shall submit and review with the Buyer, design of the internal and external interfaces of the System. The interconnection details will be submitted during DDR (**Appendix B - CDRL**).

#### **3.4.5. Performance Analysis**

System engineering will define and perform analytical evaluations of performance of the LRUs and components Digital Active Phased Array Antenna, Antenna Post Mechanical Structure and Radar Technical Complex. Results of performance analyses will be presented to the Buyer at DDR. The sub-systems performance is the sole responsibility of the Seller.

#### **3.4.6. Reliability and Maintainability Analysis**

The Seller shall submit the FMEA, FMECA, MTTR analysis report during PDR using the parts count method and part stress method during the DDR.

The system reliability and maintainability analysis including Reliability Block Diagram (RBD) using parts stress method, de-rating analysis, FMEA/FMECA and system safety analysis will be presented at the DDR.

The procedure of reliability calculations and the Reliability Block Diagram (RBD) at LRU level and at Digital Active Phased Array Antenna, Antenna Post Mechanical Structure and Radar Technical Complex level shall be approved by the Buyer.

After the completion of FAI (which includes item functional and environmental qualification), Seller shall submit the updated reliability and maintainability analysis report considering suitable de-rating parameters of the BOM used in the critical / prime items.

#### **3.4.7. Contractual Reviews**

The Seller shall conduct Contractual Reviews i.e., Contract Monitoring and Progress Review (CMPR) in every three months. The CMPR may be conducted at the Seller's or Buyer's premises as per the agreed agenda. Conducting CMPR is the sole responsibility of the Seller. The record of the CMPR shall be concluded and signed off within 15 days from the date of meeting held along with the PDC of the action items generated during the meeting.

#### **3.4.8. Design, Production, Integration and Acceptance Reviews**

The Seller shall conduct Design Reviews. The Design Reviews will be defined as program milestones in project work plan (**Appendix D**). Completion of each review will be declared after submitting an agreed Action Items List. The record of the design reviews shall be



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concluded and signed off with 15 days from the date of meeting held along with the PDC of the action items generated during the meeting. Following are the Design Reviews that shall be conducted within the framework of the project:

#### 1. PDR - Preliminary Design Review

The PDR is aimed to verify and approve compatibility between the detailed Development Specification of the critical items of the System and the Specification of the System / prime item. The development, realization of Antenna Array Electronics & Software Firmware (SRS, FRS), Interconnections, ATE, CAL/RTS System, Digital Active Phased Array Antenna, Antenna Post Mechanical Structure, Radar Technical Complex and System Lead Integrator activity. The specification of all COTS components (processing hardware, test instruments) shall be reviewed and approved during PDR. The interface details (ICD) of the critical items shall be finalised during PDR. The acceptance test procedures of the antenna array electronics and its critical items (ODTRM, SCP, STCP, ATE, CAL/RTS system) shall be finalized during the PDR. The preliminary design of LRUs' test fixtures integration, functional test plan, qualification plan, AAAU collimation and system integration plan along with item acceptance plan shall be reviewed during PDR

#### 2. DDR – Detailed Design Review

The DDR is aimed to approve the fabrication, realization of R&D module and its compliance to the detailed Development Specification of the critical items of the antenna array electronics, interconnection, ATE and CAL/RTS system. The DDR shall review and approve Software Firmware (FDD, SDD), Interconnections' electrical interface details, ATE configuration and coverage of LRU's functional test, CAL/RTS System configuration, performance compliance, Digital Active Phased Array Antenna, Antenna Post Mechanical Structure, Radar Technical Complex, and System Lead Integrator detailed scope. The procurement of all COTS components (processing hardware, test instruments) shall be reviewed and approved during DDR. The interface details (ICD) of the critical items and AAAU/radar system various ancillaries shall be finalised during DDR. The acceptance test procedures of the antenna array electronics and its critical items (ODTRM, SCPU, STCPU, ATE, CAL/RTS system) shall be approved during the DDR. The detailed design of LRUs' test jigs, test fixtures, test cables, integrated functional test plan, qualification plan, AAAU collimation and system integration plan along with item acceptance plan shall be approved during DDR.



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### 3. CDR - Critical Design Review

The CDR is aimed to verify and approve the functional performance/ system performance analysis of the prime/critical items of Digital Active Phased Array Antenna, Antenna Post Mechanical Structure, Radar Technical Complex and compliance to the technical specifications. The CDR may suggest the performance improvement measures which shall be incorporated in the next iteration of R&D module. The CDR shall review LRUs' Software Firmware, interconnections and integrated performance of antenna array electronics. The functionality and performance of ATE shall be demonstrated by testing/evaluation the R&D modules compliance to the test cases mentioned in the specification finalized during PDR/DDR. The functional performance of CAL/RTS hardware and software shall be functionally demonstrated in the lab environment by means of simulation, test hardware, test antenna test cables etc. The CDR shall approve the software/firmware IV&V plan. The LRUs' test jigs, test fixtures, test cables, test software/firmware as per integrated functional test plan shall be demonstrated. The CDR committee shall approve the functionality of the of FAI units, functional reports, qualification reports etc. The CDR committee shall review the LRUs, and Building Block functionality of Digital Active Phased Array Antenna, Antenna Post Mechanical Structure, Radar Technical Complex and Pre-NFTR and NFTR results and recommend for the next stage project execution or contract termination due to non-compliance of technical parameters. CDR committee may recommend tolerance limit of the specific technical parameters without compromising the performance of the radar system.

### 4. PRR - Production Readiness Review

The PRR shall approve the inter changeability and inter-operability of the LRUs, test jigs, test cables, test tools, and test software including GUI to demonstrate the functionality of the module. The inter changeability and inter-operability of the LRUs is the sole responsibility of the Sellers' (in case of apportionment of the quantity). The PRR is aimed to verify the compatibility between detailed Development Specification of critical items and the FAT, ESS, QT, EMI / EMC and HALT / HASS test reports. PRR authorises production of the final quantity of LRUs of Active Array Antenna Unit (AAAU) post functional demonstration of inter changeability and inter-operability of the LRUs, test jigs, test cables, test tools, and test software including



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GUI. The PRR shall approve release of BETA version of software/firmware and recommend to initiate the IV&V activity.

#### 5. SIR – System Integration Review

The System Integration Review (SIR) is aimed to ensure readiness of critical items of Digital Active Phased Array Antenna, Antenna Post Mechanical Structure, Radar Technical Complex and test infrastructure (automated test equipment (ATE), standard test equipment (STE), test jigs, test fixtures, power supplies and cooling units) prior to the System integration. The SIR shall review the availability of all the components (LRUs/SRUs), interconnections (power, control, data, optical grounding/earthing), assembly fixture, mounting fixture, NFTR fixture, etc. The SIR shall review availability of integration plan, integration procedure documents, availability of assembly tools, test tools, test cables, associated infrastructure including trained manpower, will also review the functional/performance test report and design verification report of the critical items.

The Seller shall ensure seamless system integration and demonstrate Pre-NFTR Functionality of the integrated system meeting the performance as mentioned on the technical specification document. The preparation of required documents and Functional Test Report (FTR) consisting of functional / performance and design verification test cases of the critical items is the sole responsibility of the seller.

#### 6. Acceptance Tests Report Review

The Acceptance Tests Report Review is aimed to verify compatibility between the detailed Development Specification of the System and the FAT, NFTR tests results.

Seller shall present at each review, the engineering documents as detailed in **Appendix B -CDRL**.

#### 3.4.9. Technical Interchange Meeting – TIM

The purpose of TIMs is to identify and resolve significant technical problems in a short time, as per the request of one of the parties. TIM shall also be used to closer of action items generated design, project management review and previous TIMs.

These meetings shall be held as necessary, typically once every month. Both parties shall make an effort to combine the TIM together with other contractual reviews. The Buyer's representatives and the Seller's representatives shall participate in these meetings. The Seller shall generate a TIM summary.

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The Seller shall invite Buyer's representatives to participate in the TIM whenever necessary. The Buyer will inform the Seller the names of the participants for all necessary clearances 2 working days in advance. The duration of each TIM shall not exceed two working days, unless decided otherwise. The Buyer's TIM representatives shall consists of the Buyer's IPMT as defined in Section 4.1.1.

The Seller shall summarize the TIM discussion (in form of minutes of meeting) and the action items signed off no later than 15 days after the TIM. Both the Seller and the Buyer shall be liable to fulfil their respective action items.

In case the technical summary bear any financial implications, the issue shall be forwarded to the parties' management for a decision. Where the summary shall require modifications to the system, it shall be executed in compliance with the "Modification Procedures" (Appendix F) and with the Project Contract Terms and Conditions.

#### 3.4.10. Status Report

The Seller shall periodically update and submit, MPS, RMP, WBS, mutually agreed and approved TIM ROD, MOMs etc. once in every month as status report to LRDE which will present the current status of work and the planned activity for the next month. The Seller shall rely on their sub-vendor's monitoring reports as the main tool to do the tracking of progress. The Sellers sub-contractors shall prepare and submit the progress reports reflecting the status to the IP on a fortnightly basis. The reports shall also be provided to LRDE for monitoring and inspection purposes. In addition, the Seller shall present expected problems that may impact the ability to comply with the plan and the suggested approach for handling these problems.

### 3.5. Quality Assurance

#### 3.5.1. Quality Level

The Seller shall meet all the requirements indicated in the Quality Assurance Program (QAP). The QAP shall be provided in the PDR meeting (Appendix B - CDRL).

The quality assurance department shall be responsible for identification, segregation, and control of received discrepant material. Where it is warranted, the Seller quality assurance department will provide notification of discrepancies to the supplier and obtain effective corrective action. Supplier material inspection histories will be compiled and maintained by the receiving inspection department.

The QAP shall be based on Buyer's Quality Assurance Procedures.



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The QAP shall address the following topics:

- QA organization
- Design control (including all specific standards for ground based radar)
- Sub-contractor coordination, audit, and management
- Process control
- Non-conformant materials control
- FRACAS management
- Audits

### 3.5.2. Quality Requirements

The products shall be inspected in accordance with the Quality Assurance Program and Buyer's procedures.

The LRU's, subsystems, technologies being developed by Seller as well as third party contractors engaged by the Seller shall be subjected to various qualification and certification processes. The Seller shall submit the Quality Assurance Plan to LRDE during PDR and shall address the following topics:

- QA organizations, Preparation of QAP documents for the units / subsystems, components that are to be certified.
- Sub-contractor and vendor coordination, audit and management
- Material control, Process control, on-conformance management
  - FRACAS management
  - Audits
- Technical Specification document, SOP document with BOM/Data sheets, Functional test Plan document/ATP document, ESS plan and procedure Documents, Preparation of test plans, test procedures and test reports QTR, ATR, ESS, EMI/EMC, HALT, HASS, POS reports,
- Analysis document (Thermal, structural steady/dynamic analysis, Safety, Reliability, Fault Tree Analysis)
- Manufacturing Process Document (Covering manufacturing details, Stage inspection, Job card, FAT etc.,).
- FMECA document
- Get these documents vetted by LRDE
- Organise, coordinate and carry out the actual tests at specific test locations/ agencies as designated.

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- x. Manage these test reports as per document control process.
- xi. Any other activity related to this task as assigned.
- a. The IPs shall involve LRDE's project/ Buyer /QA/QC representatives to witness the Qualification Tests.
- b. Seller should have Quality team to prepare all the necessary documents as per the agreed upon timelines to meet the Quality of the product. Documents will be approved and verified by LRDE.

### **3.5.3. Sub-Contractor and Seller Monitoring**

#### **3.5.3.1.Responsibilities**

The quality assurance manager is responsible for ensuring that all supplies and services procured from suppliers conform to the project contract requirements. The Seller's program office and purchasing department, in conjunction with the quality assurance manager shall select suppliers that are reputable and consistently perform to purchase order requirements. The effectiveness and integrity of supplier quality control shall be assessed and reviewed to ensure consistently high levels of quality.

LRDE team may visit and inspect the Seller's premise and sub-contractor site at various stages of development to ascertain the design, quality workmanship, adequacy of infrastructure, production process etc. LRDE team may visit to witness functional/ performance test, quality tests, audits, inspection, and acceptance tests and approval of the same as per the milestones, till the completion of development. LRDE team will participate in various activities such as during production set-up, first article inspection and production, quality assurance process, production process and qualification process.

#### **3.5.3.2. Visit to Sub-Contractor Premise**

The representative of LRDE may visit the subcontractor premise (in India or Abroad) for the review, infrastructure visit, quality audit, or factory acceptance test of the manufactured item/ COTS component. It is the sole responsibility of the seller to organize and coordinate such visit as requested by LRDE.

#### **3.5.3.3.Procurement Control Program**

Quality assurance and purchasing will maintain an effective procurement control program that assures:

- Selection of qualified suppliers and qualification of new suppliers



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- Suppliers are properly informed about design, reliability, quality, and certification requirements
- Purchased items are evaluated for suitability and quality while minimizing redundant inspections and maximizing sampling based on supplier history
- Prompt detection and correction of deficiencies
- Procurement status shall be updated to the Buyer in every PMR/CMPRC.

#### 3.5.3.4. Supplier Quality Surveys

Pre-award supplier surveys will be performed and audited by the quality assurance department on sources after careful review of key purchased items and supplies. This activity shall be coordinated with the project office and the purchasing department. The survey evaluation factors will be defined, documented, and made available for review upon request.

To maintain and improve the quality level of sub-contractor material, suppliers will be re-surveyed whenever a quality history indicates a problem trend.

#### 3.6. Hardware Development

The Seller shall perform the necessary hardware development and adaptations to meet the technical specification. The hardware development and adaptation will be performed according to a Hardware Development Plan (HDP).

The HDP shall address the following topics:

1. Identification of hardware developed and adapted items
2. Hardware development methodology (based on the NPI)
3. Interface control with unchanged LRUs
4. Hardware testing methodology
5. Make or Buy decisions
6. Quantity of prototypes for each LRU type - if applicable
7. Definition of qualification testing
8. Interface tests

The HDP shall be presented at the PDR.

For the CDR, final designs for hardware development and adaptations will be incorporated into the following documents that will be presented and aligned in the review meeting:

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- B1 and B2 Development Specification
- Radar Interface Control Document (RICD)

### 3.6.1. Hardware Product Assurance

The Seller shall comply with a standard hardware product assurance procedures.

### 3.7. Software / Firmware Development

The Sellers shall be responsible to develop and certify the associated software/ firmware for the LRUs and test the same with suitable simulators. Sellers will also be responsible for developing the required test software, analysis & simulation software etc. to perform testing as per Test Plan, generate Test Reports and obtain qualification and clearance for the firmware and simulator software developed for IV&V from LRDE. Details of the software /firmware packages and the software simulator packages that have to be developed by Sellers shall be covered in TDP including the source codes.

Sellers will be required to develop test firmware and software for testing of various LRU's, units etc. These software will be required to be developed in VHDL/C/C++, Lab View/Lab Windows/Matlab etc. The Sellers shall ensure availability of experienced team for such activities.

#### 3.7.1. General

The following software and firmware will be developed by the Seller:

- ODTRM, SCPU, STCPU and Power Distribution Box Firmware/ Software, including device drivers, BSPs and IP cores (supplied by OEM or in-house development).
- RTS/CAL and ATE System Software & Firmware/ Software, including device drivers, BSPs and IP cores (supplied by OEM or in-house development).
- LRUs Test and Application GUI, Test software and firmware

Seller will develop firmware according to a Firmware Development Plan (FDP) (Appendix B - CDRL). The FDP will be presented in the PDR.

The FDP shall address the following topics:

- Identification of firmware items
- Firmware development methodology
- Firmware testing methodology



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- Firmware development environment
- Firmware development tools and platform
- Firmware development lab architecture

Seller will develop software according to a Software Development Plan (SDP) (Appendix B - CDRL). The SDP will be presented in the PDR.

The SDP shall address the following topics:

- Identification of software CSCIs
- Software development methodology
- Software testing methodology
- Software development environment
- Software development tools and platform
- Software development lab architecture

The seller shall ensure that the development platform used is current (not older than three year, at the time of delivery) and has support for at least 5 years by the OEM.

### **3.7.2. Seller Software / Firmware Deliverables**

The Seller shall deliver software and firmware along with complete compleiable source code including device drivers, BSPs and IP cores (supplied by OEM or in-house development) as mentioned in Appendix A and Appendix B mentioned in LOD.

### **3.8. Manufacturing and Procurement**

#### **3.8.1. Manufacturing and Procurement Management**

The Seller shall perform and manage the manufacturing and procurement activities for all system components at:

- Seller's premises
- Seller's sub-contractor premises
- Various vendors for COTS items

#### **3.8.2. Manufacturing and Procurement Plan**

Manufacturing and procurement activities shall be performed according to a Manufacturing and Procurement Plan (MPP). The Buyer shall be consulted in the selection of sub-

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contractors. The Manufacturing and Procurement Plan shall be presented at the CDR (Appendix B -CDRL).

### 3.8.3. Part Numbering & Marking

- Every sub-system, LRU and SRU shall be assigned an appropriate part number/model number and serial number irrespective of whether the part is finally cleared or not.
- The numbering scheme and the details of the marking shall be communicated to the Buyer post contract.

### 3.8.4. Qualification Plan

#### 3.8.4.1. First Article Inspection

The Seller shall produce limited FAI numbers for design verification and acceptance. The following tests shall be done on the FAI quantities in sequence:

- Functional Tests
- Environmental Stress Screening (ESS)
- EMI/EMC tests
- Qualification Test (QT)/HALT/POS/HASS

#### 3.8.4.2. Qualification of Production LRUs

All the units developed in country by any Indian Agency shall undergo Quality Assurance process at each level as per agreed QAP.

- In the case of COTS items such as COTS boards etc. the COC from OEM along with Test report for the first article qualification of the part/model number will be necessary. ESS may have to be carried out on each unit.
- Customised units imported: QT as per quality assurance process shall apply in participation with the LRDE.
- Traceability: For all the items being designed and manufactured in country by any agency/ industry, the components, materials etc. must be procured with relevant certificate along with traceability to OEM.
- Seller shall specify the requirements for End-use certificate if any, along with the timelines to bring out clearly any delay on the project delivery.
- All the QT procedures and process for above shall be enumerated in QAP documents and appropriately cleared from QA/QC agencies in this case LRDE.



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- f. All environmental tests should be carried out by the Seller with participation of LRDE QA/ Buyer Reps etc.
- g. It may be noted , that all tests, inspection checks etc. that are carried out outside of DRDO labs, the same shall be done at NABL or appropriately accredited Labs / test facilities only. Seller shall ensure all the test equipments have valid calibration certificate.
- h. The units should meet the standards as mentioned in the roadmap of Quality Assurance Plan document.
- i. Necessary fixtures, interface cables, connectors, test equipment and tools required for the qualification should be arranged by the Sellers.

#### **3.8.4.2.1. Qualification of ODTRM**

The production quantity will be qualified as follows:

- All LRUs (100%) will be subjected to HASS
- For every batch size of 100, one random ODTRM will undergo production QT.
- In the event of failure, required corrections will be made in applicable batches and acceptance will be proceeded as per the mutually approved plan.

#### **3.8.4.2.2. Qualification of SCPU, STCPU, Power Distribution Box**

The 100% production quantity of SCPU, STCPU and Power Distribution Box will be subjected to ESS tests for screening.

#### **3.8.4.2.3. H/w Qualification and Certification Activities**

The Seller shall perform the necessary hardware development and adaptations to meet the technical specification. The hardware development and adaptation will be performed according to a Hardware Development Plan (HDP).

The HDP shall address the following topics:

1. Identification of hardware developed and adapted items
2. Hardware development methodology (based on the NPI)
3. Interface control with unchanged LRUs
4. Hardware testing methodology
5. Make or Buy decisions
6. Quantity of prototypes for each LRU type - if applicable
7. Definition of qualification testing
8. Interface tests

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The HDP shall be presented at the PDR.

For the CDR, final designs for hardware development and adaptations will be incorporated into the following documents that will be presented and aligned in the review meeting:

- Development Specification
- Radar Interface Control Document (RICD)

#### **3.8.4.2.4. F/w and Software Qualification and Certification Activities**

- a. Seller shall coordinate the firmware IV&V and qualification activities for the various firmware packages developed.
- b. In addition, the Seller may be required to develop software packages for testing / generating test vectors, generate test scenarios etc. through available packages or by writing required software.
- c. The internal IV&V will be carried out by the LRDE IV&V team and final IV&V may be done by external IV&V agency hired by Seller.
- d. The Industry Partner shall be responsible for the preparation of all the documents for the software & firmware development/IV&V and qualification. These documents will be in conformance with the DO-178B, Level C and DO-254 Level C (F/W) standards or adopted Software firmware development Standard. The S/W and F/W development shall follow DGSD and IEEE 12207, DO254 or LRDE guidelines meeting the required functionality and Specifications.
- e. The S/W and F/W simulator, Test codes and test GUI to be certified and qualified as per DGSD and IEEE 12207, DO254 or LRDE guidelines to be added in Specifications.

#### **3.8.4.2.5. Qualification of COTS Components**

COTS Components shall be accepted based on manufacturer/OEM COC post scrutiny of COC/test results of supplied units/items. The LRDE team may visit the OEM in India or abroad to witness the compliance of the COC as needed.

Factory Acceptance Test (FAT) for Rotary joints shall be conducted at OEM facility before dispatch. It is Sellers responsibility to organize and coordinate such visit as per the mutually agreed scope and agenda of the visit.



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**Test Required**

S.No	Item Description	Qty	QT	ATP
1.	Antenna Post Mechanical Structure	1 Nos.	QT as per Technical Specs. FAT at OEM facility. SAT on site	ATP Performance check + COC along with test reports complying to environmental conditions.
1.1	AAAU Frame with coolant network	1 Nos.		
1.2	Building block assembly and ancillaries	18 Nos. (QT and ATP on first article only)		
1.3	Antenna Post Y Pedestal for AAAU	1 Nos.		
1.4	NFTR Fixture	1 Nos.	FAT at OEM facility SAT on site	ATP Performance check + COC
2.	Liquid to Refrigerant Cooling System (LRCS)	1 Nos.	QT as per Technical Specs. FAT at OEM facility. SAT on site	ATP Performance check + COC along with test reports complying to environmental conditions.
3.	Radar Power System	1 Nos.	QT as per Technical Specs. FAT at OEM facility. SAT on site	ATP Performance check + COC along with test reports complying to environmental conditions
4.	Temperature and Humidity Control System (THCS)	02 Nos.	QT as per Technical Specs. FAT at OEM facility. SAT on site	ATP Performance check + COC along with test reports complying to environmental conditions
5.	Radar Technical Complex	1 Nos.	QT as per Technical Specs. FAT at OEM facility SAT on site	ATP + COC along with test reports complying to environmental conditions

**3.8.4.3. Defects and Failures**

Any defects and failures during any stage of development or post-delivery shall be investigated by a formally constituted Defect Investigation Board/Committee and appropriate remedial action shall be taken in conformance with the recommendations of the committee. The corrective actions need to be carried out by the Seller free of cost if reported by LRDE within the warranty period.

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Warranty: Seller shall provide item replacement rather than repairs in case of any major functional failures during the warranty period. Turn-around time for replacement/repair during the warranty period shall be less than or equal to one month.

**3.8.4.4. Non Conformance**

- a. Unit / component / items failing during the design / qualification stages will be subjected to reviews for evaluating the cause of such failures. The Sellers/ manufacturers will be required to carry out detailed reviews of faults/ failures and present it to the relevant board for recommendations.
- b. Similarly, all non-conformances, will be subjected to review by duly constituted board and will be cleared / not cleared based on the type of non-conformances.
- c. Based on the board recommendations, the units/item may be accepted with waivers/shortcomings or rejected or accepted after the non-conformances are rectified.
- d. In the event of acceptance of the items with waivers, such waivers will be treated as shortcomings and may be subjected to the cost review.

**3.8.4.5. Qualification Responsibility**

Qualification of Antenna array electronics LRUs will be the responsibility of the Seller. The Seller shall invite Buyer's representatives to witness the Qualification Tests. The Buyer will inform the Seller the names of the participants for all necessary clearances 2 working days in advance.

The Seller shall prepare and submit the following documents as part of the qualification process of the System:

1. Technical Specification
2. Functional test Plan document
3. ATP document
4. LQT Document
5. Analysis document (Thermal, structural steady/dynamic analysis, etc.)
6. Manufacturing Process Document (Covering manufacturing details, Stage inspection, Job card, FAT etc.)
7. SOP document with BOM/Data sheets
8. Reliability Analysis:
  - MTBF document
  - MTBCF document



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- De-rating Analysis document
- 9. MTTR (Maintainability Document)
- 10. FMEA and FMECA analysis
- 11. FTA(System Safety Analysis) document

### 3.8.5. Certificate Of Compliance (COC)

Each LRU shall be delivered together with a Certificate of Compliance (COC). The COC is issued after successful completion of final inspection and testing. If any deficiencies and / or deviations are detected in the products or in the documentation, the seller shall carry out corrective actions i.e., repair or replacement of faulty item.

#### 3.8.5.1. Deviations and Waivers

In any case of deviation from the product's basic configuration requirements, the Seller will formally request a deviation approval from LRDE. Any change required by contractors has to be verified and approved by LRDE's Change Control Board (CCB).

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### **3.9. Transportation**

#### **3.9.1. Preparation for Transportation**

Each system or unit delivered to the Buyer shall be in its final configuration, after passing all acceptance tests successfully.

The Seller shall be responsible for proper preparation, packaging, and marking of all items supplied within the framework of the contract.

Regardless of the above, any commercial equipment will be transported in its original package.

#### **3.9.2. Transportation Responsibility**

The Seller shall transport the system or unit to the Buyer designated site within the country.

### **3.10. System Assembly, NFTR Collimation, Integration and Testing**

#### **3.10.1. System Assembly**

The Seller shall be responsible for the assembly of the Active Array Antenna Unit (AAAU). The assembly shall be performed in one of the Buyer designated AAAU assembly hanger as mentioned in **Appendix D**.

It shall be the responsibility of the Seller to design and fabricate all mechanical fixtures necessary for the AAAU assembly at/for one of the Buyer designated AAAU assembly hanger at LRDE / K-Site (Kolar).

#### **3.10.2. NFTR Collimation**

##### **3.10.2.1. Pre-NFTR Checks**

Pre-NFTR Checks shall be performed post assembly at LRDE / K-Site (Kolar). The Seller shall be responsible for Pre-NFTR checks.

The Seller shall make use of Test Jigs, Test Tools & STE / ATE as defined in **Appendix-A** for the Pre-NFTR Checks.

The requisite test jigs / tools for pre-NFTR and NFTR shall be delivered by the Seller.

##### **3.10.2.2. NFTR Characterization**

NFTR tests shall be the responsibility of the Buyer. NFTR facilities at LRDE / K-Site (Kolar) shall be used. All necessary support for performing NFTR tests shall be provided by the Seller to the Buyer in NFTR chamber at LRDE / K-Site (Kolar). The seller shall develop NFTR interface software and firmware as per the details provided by the Seller.



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### **3.10.3. System Integration**

System performance and functionality shall be the responsibility of the Buyer to prove the radar system. However the system integration shall be responsibility of the Seller, system integration shall be done at K-Site (Kolar) or any designated place within the country.

All necessary support for performing System Integration shall be provided by the Seller to the Buyer at K-Site (Kolar) and then at a designated place within the country as per the scope defined in the Lead system integrator (LSI).

### **3.10.4. System Testing**

#### **3.10.4.1. Test Plan**

The system tests shall be performed according to the Test Plan. The Test Plan shall include sub-system developmental tests, functional tests, qualification and acceptance tests (Appendix B - CDRL).

The Test Plan shall include the system tests to be performed during Pre-NFTR Checks. The Test Plan shall be presented at PDR.

#### **3.10.4.2. Test Procedures**

The acceptance tests shall be conducted in accordance with the Test Procedure document. The Test Procedures document will be submitted during PDR.

#### **3.10.4.3. Test Failure**

Upon occurrence of a failure, a Deviation Request shall be recorded. The Seller and the Buyer shall jointly decide whether to resume the tests before correcting the deficiency, or postpone them.

The Deviation Request shall include a brief description of the failure, the analysis conclusions, and the repair performed.

#### **3.10.4.4. Test Reports**

The test reports shall be presented at the Acceptance Test Report Reviews.

### **3.11. Integrated Logistics Support (ILS) Package**

#### **3.11.1. Spare Parts**

The Seller shall ensure the availability of spares sufficient for a period of at least 20 years post warranty of the system. The spare parts quantity shall be based on RMA calculations

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and analysis which shall be presented during CDR. A detailed list of the spare parts shall be provided by the Seller.

During design of the subsystems, the Seller must select components which are available for a period of at-least 20 years from acceptance of the system.

Seller shall also include consumables, repairable items and non-repairable items during integration and test of the AAAU.

### **3.11.2. System Maintenance**

#### **3.11.2.1. Maintenance Within Warranty Period**

The Seller shall provide comprehensive maintenance of the System during warranty period. This shall include all preventive maintenance and breakdown maintenance on call basis.

The Seller shall make the suitable arrangements to pick-up the item from the LRDE designated place to their repair shop and shall be delivered to LRDE designated site, its cost to be borne by the Seller.

Spares parts during the warranty period shall be repaired or replaced on cost to be borne by the Seller. Cost of all consumables required for the purpose of maintenance during this period shall be borne by the Seller.

#### **3.11.2.2. Maintenance Post Warranty Period**

The Seller shall extend the support during radar system integration for the duration of 24 months as needed to ensure the functionality of the subsystems developed under the present scope beyond the contract PDC. Cost of all consumables required for the purpose of maintenance during this period shall be borne by the Seller.

The Seller may be required to provide comprehensive maintenance of the System through an Annual Maintenance Contract (AMC) for a period of 20 years post warranty. The AMC is not part of the present contract. It will be negotiated (if required) during the warranty period.

The AMC shall include all preventive maintenance and breakdown maintenance on call basis. Spares parts during the AMC period shall be repaired or replaced on cost to be borne by the Buyer.

#### **3.11.2.3. Maintenance Concept and Echelons**

The Seller shall prepare a maintenance plan for the system, which will specify the maintenance concept, activities and responsibilities of the various maintenance echelons. The maintenance plan shall be presented at CDR.



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#### 3.11.2.4. Maintenance Concept / Policy

The maintenance concept is based on three echelons:

- Organizational ("O") level – during ground test- shall be based on detection and isolation of LRU faults, replacement of LRU and verification test of the fault.
- Intermediate ("I") level - at the Buyer's premises shall be based on LRU's fault reported from O-Level. The I-Level shall mainly deal with removal and installation of LRUs/SRUs.
- Depot ("D") level at Buyer's premises or Local sub-contractor
- Depot ("D") level at Vendor's premises for COTS
- Depot ("D") level at Seller's premises for unique / small quantity SRUs

Notes:

- *The system shall be designed for a reduced operation and maintenance cost.*
- *O-Level and I-Level maybe unified in coordination with the Buyer and subject a supporting maintenance analysis.*
- *The maintenance plan shall identify per each LRUs/SRUs the corresponding "D" - level maintenance location. This plan shall be presented at the CDR.*
- *All Depot levels echelons which are not at the Buyer's premises shall be managed by the Seller via Annual Maintenance Contract (optional).*
- *The Seller shall provide information and data required to establish the D-Level maintenance facilities at the Buyer's premises, subjected to the maintenance plan.*

#### 3.11.3. Test Equipment and Assembly Tools

Seller shall deliver all test Jigs/ assembly tools. Wherever support equipment is necessary, standard or common equipment shall be used. All required special tools/test jigs (including ATE as required) for maintenance shall be delivered as part of the deliverables. The ATE and special tools/test jigs shall be finalized based on RMA calculations and presented during CDR. The final Tools and Test Equipment List shall be presented at CDR

#### 3.11.4. Maintenance and Operational Documentation

The Seller shall submit the maintenance (O-Level, I-Level and D-Level) and operational documentation. The Seller shall verify the reliability and integrity of the information of all the documentation provided to the Buyer, and shall complete any missing item of information. All the documentation items shall be submitted in Seller's format unless otherwise specified. All documents shall be provided in English.

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#### **3.11.5. Project Documentation**

The Seller shall perform the entire range of data management activities. For the purposes of this procedure, the list of controlled information is the list of all agreement documents including all their appendices and supplements, design documents, engineering and production documents, maintenance and operational documents.

All documents shall be provided in English. All the documentation items shall be submitted in the Seller's/Buyer's format.

Each item of documentation required by this SOW shall also be provided in magnetic media format. The Seller shall provide the items in a full editable state using the PC software in possession of the Buyer, as shall be agreed between the Buyer and the Seller.

The Seller shall verify the reliability and integrity of the information of all the documentation provided to the Buyer, and shall complete any missing item of information. In order to enable the Buyer to follow system design and production throughout the project, the Seller shall provide the Buyer with updated document versions that shall contain corrections and/or updates of formal contractual data of the technical specifications. All the documentation specified in this paragraph shall be submitted as one set of soft and hard copy.

#### **3.11.6. Additional Technical Support**

Technical assistance shall be made available post NFTR acceptance during the radar system integration, upon the Buyer request.

#### **3.12. Post Delivery support**

Post-delivery of the Digital Active Phased Array Antenna, Antenna Post Mechanical Structure Radar Technical Complex and various subsystem under this contract. The Sellers shall be required to provide complete post-delivery assembly and integration support for 12 months to the LRDE at designated place across the country beyond the PDC of this contract. This aspect will be finalized at appropriate time in discussion with the LRDE & Sellers. However broadly this will involve the following:

Provide onsite support with a team of experienced engineers, technicians along with supervisor and support staff as required for a specific period (for 12 months). Seller shall provide requisite commitment to provide maintenance and servicing support at reasonable cost for a minimum period of 20 years beyond warranty of the last system. The Sellers shall carry out following activities as part of onsite support



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- a. Provide first line maintenance / repair which will involve removal of faulty component, replacement of LRU, functional check in the antenna array assembly.
- b. Coordinate with the OEM / manufacturer / authorized service provider for the respective LRU, component etc. for repair and servicing of the equipment / item.
- c. Seller shall provide a certificate of commitment from the OEM for maintenance, spares and repair of the items for a period of 20 years, after System acceptance.
- d. Manage the spares inventory to ensure availability of serviceable spares at minimum recommended level at all times during Pre-NFTR, NFTR and system integration stage. The Sellers will be required to raise the requirement of replenishment sufficiently in advance to enable LRDE to procure and provide the spares.
- e. Provide comprehensive maintenance for the items and equipment that has been supplied by the Sellers either by himself or through another agency.
- f. Maintain Log books, log cards, calibration status of equipment's etc. and ensure the updating on daily basis.
- g. Installation, Reinstallation of the items, equipment from system as per defined process with proper documentation.
- h. Maintain the history of every equipment components as per usage, repair, servicing, minor as well as major faults and errors.
- i. Maintain and manage software configuration of each and every item including the spares.
- j. Re-installation of software in various boards, systems etc / installation of upgraded, bug fixed , new versions of s/w packages into systems , SRU's etc, after taking the approval from LRDE.
- k. Detailed activities will be finalized as part of the delivery process with the LRDE.

### 3.13. Facilities for Buyer's Representatives

The Seller shall be responsible to arrange suitable logistics for Buyer team towards conducting the project reviews and TIMs at the Seller premises. In the event of the venue of meeting being some other place (within India or Abroad) other than the sellers primary premise, the Seller shall bear all the cost of the Buyer's teams for the complete duration of the stay at that location. In the event of the Seller's premise being located in SEZ (outside CITY limits) and transportation using public transport is time consuming, the seller shall make suitable logistic arrangements and shall bear all the cost of the Buyers designated team for the complete duration of the stay near the Sellers premise.

Seller shall ensure safe working environment for Buyers representatives to carry out their duties as per the best possible safety standards.

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#### **4. Buyer Tasks**

##### **4.1. Project Management**

##### **4.1.1. Project Organization**

The Buyer shall establish an Integrated Project Management Team (IPMT) for the full execution of the project. The contract manager will serve as the main point-of-contact with the Seller. IPMT shall include the following executives:

- Project Manager
- Contract Manager
- Production Manager
- System Engineer (Performance Assurance)
- Manager (Antenna Post Mechanical Structure)
- TDP / Documentation / Delivery Manager
- Manager (Radar Technical Complex)
- Manager (System Lead Integration)
- Manager (LRCS)
- Manager (Radar Power System)
- Manager (THCS)
- Team Leader (Electronics)
- Team Leader (Electrical)
- Team Leader (Software / Firmware)
- Team Leader (System Integration & Collimation)
- Team Leader (Quality Assurance)
- Team Leader (EMI/EMC)

IPMT shall be responsible for all management activities. The Buyer shall be responsible for maintaining the IPMT throughout the duration of the project.

##### **4.2. Equipment and Infrastructure**

In order to support the Seller's tasks, the Buyer will provide to the Seller the required equipment and infrastructure as detailed in **Appendix C (BFE)**.

##### **4.3. Information**

The Buyer shall submit the required information, as specified in **Appendix C (BFI)**.

##### **4.4. Buyer Support**

The Buyer shall provide the required support, as specified in **Appendix C (BFI)**.



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## Appendices

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### List of Deliverables

**Item:** "Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware"

The list of deliverables for the present scope is defined in **Appendix-A and Appendix-B**, the industry partner shall be responsible for the delivery of entire scope mentioned in both the Appendices.

## **Appendix-A**

### **A. List of Deliverables**

List of Deliverables for "**Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware**" are mentioned in the below table.

Table 1. List of Deliverables "Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware"

Sl. No	Deliverables	Set/No. /Job
<b>1</b>	<b>Active Antenna Array Unit (AAAU)</b>	<b>1 Set</b>
1.1	Antenna Emitter/Radiating Element	2280 Nos.
1.2	Octal Digital T/R Module (ODTRM)*	279 Nos.
1.3	Space Control & Processing Unit (SCPU)*	12 Nos.
1.4	Space Time Control & Processing Unit (STCPU)*	3 Nos.
1.5	Power Distribution Box (PDB)	12 Nos.
1.6	Test Tools, Test Jigs, Test Fixtures, Test Cables, Test GUI	1 set
<b>2</b>	<b>System Interconnection Cables (Optical, Power Control)</b>	<b>1 Set</b>
2.1	Cable Routing and Harnessing	1 Job
2.2	SCPU to ODTRM	285 Nos.
2.3	SCPU to Final DBF	12 Nos.
2.4	Final DBF to SP	12 Nos.
2.5	RSU to Final DBF	8 Nos.
2.6	RSU to SP	8 Nos.
2.7	RSU to AAAU	6 Nos.
2.8	RSU to CCP	4 Nos.
2.9	SP to CCP	3 Nos.
2.10	AAAU to CAL/RTS Tower	3 Nos.
2.11	CCP to Cooling System, Power System, THCS, etc	8 Nos.
2.12	Radar system/subsystem earth/grounding cables	1 Set
2.13	Power Distribution Box to Array Electronics	1 Set
<b>3</b>	<b>Automated Test Equipment (ATE)</b>	<b>1 Set</b>
3.1	Integrated ATE for ODTRM, SCPU, STCPU, PDU etc.	1 set
3.2	Integrated cooling unit for the ATE with interconnection	1 set



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3.3	Test Tools, Test Jigs, Test Fixtures, Test Cables, Test GUI	1 set
<b>4</b>	<b>AAAU LRU Software &amp; Firmware</b>	<b>1 Set</b>
4.1	ODTRM Software & Firmware	1 set
4.2	SCPU Software & Firmware	1 set
4.3	STCPU Software & Firmware	1 set
4.4	Power Distribution Box	1 set
4.5	AAAU BIT/ Technical Operator System Software	1 set
4.6	Software & Firmware IV&V compliance & certification	1 set
<b>5</b>	<b>CAL/RTS System</b>	<b>1 Set</b>
5.1	CAL/RTS System Electronic Equipment's	1 set
5.2	CAL/RTS Antenna Set	1 set
5.3	CAL/RTS System Software & Firmware	1 set
5.4	Electro-Mechanical Telescopic Mast	1 set
5.5	Interconnection cable set & Grounding Pit	1 set
5.6	All weather microwave absorbers	1 set
5.7	Multipath diffraction posts	1 set
5.8	System Installation, Training, Acceptance and commissioning	1 Job
5.9	Test Tools, Test Jigs, Test Fixtures, Test Cables, Test GUI	1 set
<b>6</b>	<b>Command and Control Post (CCP)</b>	<b>1 Set</b>
6.1	Radar Processing Hardware	1 Set
6.1.1	HPE DL 580 Gen10 equivalent or above	3 Nos.
6.1.2	HPE DL 360 Gen10 equivalent or above	5 Nos.
6.1.3	Blade Server	4 Nos.
6.1.4	10 G 16 Port Switch (CISCO, all ports with optical transceivers (single mode))	2 Nos.
6.1.5	1G 24 Port Switch (CISCO, all ports with optical transceivers (single mode))	2 Nos.
6.1.6	VGA LCD KVM switch	2 Nos.
6.1.7	IP based KVM Switch	2 Nos.
6.1.8	Smart Rack with cooling mechanism & UPS	2 Nos.
6.1.9	24Inch Ultra HD IPS 4K Freesync Monitor	10 Nos.
6.1.10	Display Unit ((55" LED TV))	4 Nos.
6.1.11	Networking & Cabling for interconnection of all servers, OWS and visualization stations.	2 set
6.1.12	System Integration For Networking And Computing Devices	1 job
6.1.13	Canon Image Runner advance DX C3730	2 Nos.
6.1.14	Dell Mobile Work station with 32 GB RAM or Equivalent	3 Nos.
6.1.15	HP Z8 G4 work station with 192 GB RAM or Equivalent	2 Nos.
6.1.16	APC or equivalent UPS for PCs	15 Nos.
6.2	Sync & Timing Equipment	2 Nos.
6.3	Test Tools, Test Jigs, Test Fixtures, Test Cables, Test GUI	1 set
<b>7</b>	<b>COTS &amp; Test Instruments</b>	<b>1 Set</b>
7.1	Optical Time Domain Reflectometer (OTDR)	1 No.
7.2	Digital Storage Oscilloscope	1 No.
7.3	Function Generator	1 No.
7.4	Handheld Two port VNA 9 KHz to 44 GHz	1 No.
7.5	Handheld Spectrum analyzers 9 KHz to 44 GHz	1 No.
7.6	Optical Splicing Kit Tools	1 No.



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<b>8</b>	<b>System Lab Setup</b>	<b>1 Set</b>
8.1	System Lab Setup Workbench	1 Set
8.1.1	Soldering And Desoldering Station With Digital Display	1 No.
8.1.2	Modular Work Stations	2 Nos.
8.1.3	Crimping Tools	2 Nos.
8.1.4	Desktop Computers	2 Nos.
8.1.5	Computer Workstation	2 Nos.
8.2	Integrated Test Lab Setup *	1 Set
8.2.1	Octal Digital TR Module (ODTRM)	1 No.
8.2.2	Space Control and Processing Unit (SCPU)	1 No.
8.2.3	Space Time Control & Processing Unit (STCPU)	1 No.
8.2.4	Power Supply for ODTRM, SCPU, STCPU	1 No.
8.2.5	Sync & Time Equipment	1 No.
8.2.6	Radar Processing Hardware	1 set
8.2.7	Optical Splitters comprises	1 Set
8.2.7.1	Optical cable assembly for interconnection#	1 set
8.2.7.2	SFP Transceivers	1 No.
8.2.8	Mounting Fixtures & Mechanical Enclosure	1 set
8.2.9	Test Jigs, Test Tools, Interconnection & Assembly tools	1 set
8.2.10	Liquid Cooling for Lab Setup	1 No.
8.2.11	Hardware Storage Rack	1 No.
8.2.12	15kVA UPS	1 No.
8.3	Software Tools/Development Platform	1 Set
8.3.1	Xilinx vivado Enterprise Edition along with Model Composer – 3 license (Node lock)	1 No.
8.3.2	Intel Software Tools	1 No.
8.3.3	Xilinx Kintex UltraScale FPGA KCU1250 Characterization Kit	1 No.
8.3.4	Xilinx Kintex UltraScale FPGA KCU105 Evaluation Kit	1 No.
8.3.5	Zynq Ultrascale + MPSoC ZCU102 Evaluation Kit	1 No.
8.3.6	Single Mode FHD MPO Cassette	1 No.
8.3.7	10-port SFP+ (10G) FMC Module	1 No.
8.3.8	Xilinx Software Tools with One Evaluation Board Programming cables (1 Set)	1 No.
8.3.9	JTAG Programming kit	2 Nos.
8.3.10	Smart synq programming cable	2 Nos.
8.3.11	USB based hardware license dongle (Xilinx Vivado Enterprise Edition along with Model Composer)	2 Nos.
8.3.12	SO Microwave Imaging work bench	1 set
8.3.13	Millimeter RCS work bench	1 set
<b>9</b>	<b>AAAU/Radar System Integration Activity</b>	<b>1 Job</b>
9.1	System Integration	1 Job
9.2	AAAU/Radar System Integration 3D video Model	1 Job
9.3	Functional AAAU Building Block for proof of concept (POC)	1 Job
9.4	NFTR Fixture with 3-axis stabilization for Single BB	1 No.
9.5	Collimation of AAAU BB & NFTR Fixture (3-axis stabilization)	1 Job
9.6	Integration of AAAU & Pre- NFTR Activity	1 Job
9.7	AAAU Interconnection Cables & Grounding Pit	1 Job
9.8	NFTR Activity/Field Collimation	1 Job



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9.9	Radar Integration & RTS Demonstration	1 Job
9.10	Site Activation and System Integration	1 Job
9.11	Test Tools, Test Jigs, Test Fixtures, Test Cables, Test GUI	1 set
<b>10</b>	<b>Radar Technical Complex</b>	<b>01 Set.</b>
10.1	Platform for Radar Subsystems (40mx40m)	1 Set
<b>11</b>	<b>Antenna Post Mechanical Structure</b>	<b>01 Set.</b>
11.1	Antenna Post Y Pedestal for AAAU	01 No.
11.2	AAAU Frame with coolant network	01 No.
11.3	Building block assembly and ancillaries	18 Nos.
11.4	NFTR Fixture	01 No.
<b>12</b>	<b>Radome</b>	<b>01 Set.</b>
12.1	Spherical Radome	01 No.
12.2	Radome Accessories	01 No.
12.3	EM and structural analysis	01 Job
12.4	Packaging & Transportation, Installation	01 Job.
<b>13</b>	<b>Liquid to Refrigerant Cooling System (LRCS)</b>	<b>01 Set.</b>
13.1	Cooling System 2 x110kW, HMI Panel, 20ft ISO Shelter	02 Nos.
13.2	Cooling System Interconnection cables and Hydraulic Network	01 No. set <i>for</i>
13.3	Integration, Testing and Functional Evaluation (Dummy Load)	01 Job.
<b>14</b>	<b>Radar Power System (RPS)</b>	<b>01 Set.</b>
14.1	2x250 kVA DGs with Load Bank and Ancillaries	04 Nos.
14.2	30 kVA DG with Cables, Connectors and Ancillaries	01 No.
14.3	Low Voltage Control Center (LVCC)	01 No.
14.4	Central Power Distribution Center (CPDC)	01 No.
14.5	24" Remote SCADA in Command Shelter	01 No.
14.6	Power Cables with Connectors	01 set.
14.7	Control & Communication Cables with Connectors	01 set.
14.8	Maintenance Tools (as per detailed description of LOD)	01 set.
14.9	Tools & Test Equipment (as per detailed description of LOD)	01 set.
14.10	Cable Tray	01 set.
14.11	Grounding Equipment	01 No.
14.12	Lifting Device (spreader beam along with slings as per design ) with Ancillaries	01 Set
<b>15</b>	<b>Radar System Ancillaries</b>	<b>01 Set.</b>
15.1	Maintenance Shelter	01 Set.
15.2	Lightening Protection System	01 Set.
15.3	Fire Protection System	01 Set.
15.4	Air Ventilation System	01 Set.
15.5	Temperature and Humidity Control System (THCS)	01 Set.
<b>16</b>	<b>CAL/RTS Shelter</b>	<b>01 Set.</b>
<b>17</b>	<b>Command and Control Post Shelter</b>	<b>01 Set.</b>
<b>18</b>	<b>Radar Site Equipment</b>	<b>01 Set.</b>
18.1	Unmanned Aerial Vehicle & Payload Systems	01 Set.
18.2	Geological Compass	01 Set.
18.3	Digital Electronic Spirit Level (Digital Inclinator)	02 Set
18.4	Compact Weather Station	01 Set.
18.5	Laser Range Finder	01 Set.
18.6	Telescopic Tripods - Surveying Accessories	02 Set.
18.7	Telescopes	01 Set.



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18.8	Cable Tray Systems And Cable Ladder Systems	20 Set.
18.9	Outdoor RF Antenna	02 Set.
18.10	Steel Porta Cabin	02 Set.
18.11	Rubber Equipment Trolley	02 Set.
18.12	Assembly Tool Kit	02 Set.
18.13	All weather microwave absorbers	1 Set
19.	<b>Technical Data Package (TDP) as in Appendix 'B' - B.1</b>	<b>1 Set</b>
20.	<b>CDRL document as per CDRL List as in Appendix 'B' - B.2</b>	<b>1 Set</b>

\* Sl. No. 8.2.1, 8.2.2, 8.2.3 are part of the deliverables mentioned at Sl. No. 1.2, 1.3, 1.4 for the costing of the total quantity of the LRUs

# Interconnection cable set consists of Sl. No. 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 and 2.9 shall be delivered during system lab setup.

**Note:**

Seller shall provide mechanical mock ups of subsystems for the fitment and connectivity checks for all subsystems.

**Table 1., Sl. No.9 Detailed Description of AAAU/Radar System Integration as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of AAAU/Radar System Integration).**

- **AAAU/Radar System Integrator Activities are Mentioned Below (Covering the Scope of System Integration, Installation, Commissioning and Operation):**

The industry partner shall be responsible for functional demonstration of Radar System deployed at Radar Technical Complex. Industry shall be responsible for movement of AAAU stores, and subsystem listed under this scope as and when needed during Pre-NFTR, NFTR and system/subsystem installation and integration at Radar Technical Complex. Industry shall be responsible for interconnections of cables, coolant pipes, grounding pits arrangement and fixing of cable trays and ducts as and when needed during Pre-NFTR, NFTR and system/subsystem installation and integration at Radar Technical Complex. Industry shall be responsible for hiring of cranes (up to 100 Ton as per the requirement), Fork Lift (up to 10 Ton), prime movers, trailers and required manpower for movement of stores covering AAAU stores and the stores mentioned in this scope during Pre-NFTR, NFTR and system/subsystem installation and integration at Radar Technical Complex. Industry shall be responsible to obtain necessary security clearance and invitation to visit OEMs of systems/subsystem at OEM premises as per the mentioned milestones or as per the recommendation of CMPRC.



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**AAAU/Radar System Integrator** activities during the development, integration testing, installation commissioning and operation of the radar system.

1. Assembly and Integration of AAAU Building Block (BB) and AAAU
2. Alignment, planarity measurement and adjustment of BB and AAAU
3. Coolant Network Interconnection, Testing and Leakage testing of BB and AAAU
4. Power System Interconnection and Ground cable and Pits interfaces with BB and AAAU and associated subsystem.
5. Radar System Integration, Testing, development of chemical grounding pits, Installation and commissioning support for AAAU during Pre-NFTR, NFTR. Radar system/subsystem (Power system, Cooling system, THCS, Command Shelter, Maintenance Shelters, and CAL/RTS Shelter) installation, integration and commissioning at Radar Technical Complex. Providing logistic support movement of stores, hiring of cranes (up to 100 Ton as per the requirement), Fork Lift (up to 10 Ton), prime movers, trailers, contract manpower for movement of stores.
6. Industry shall be responsible for the operation of the radar subsystems during system evaluation, demonstration, and radiation checks.

**Activities:** The industry partner shall be responsible for functional demonstration of LRUs, AAAU integration (AAAU BB and Final AAAU), Pre- NFTR, NFTR activities, and documentation as system integrator. Industry partner shall carry out following activities during the development and system realization activity:

1. Assembly and Integration of Building Block
2. Functional Checks of Building Block
3. Pre-NFTR activity and NFTR Calibration of Building Block
4. Support during Full Array Integration and Testing
  - a. Array Integration
  - b. Pre-NFTR activity and NFTR Calibration
  - c. Radiation Checks

**Note:**

- i). The industry partner shall provide necessary power source, cooling system , NFTR fixture, test jigs and test tools etc. corresponding to the functional demonstration and calibration of AAAU building block. The configuration of the Building block shall be 320 element antenna array.



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- ii). In the case of Final Array Integration, power source, cooling system and NFTR fixture shall be provided by the seller during integration, assembly, calibration, and system demonstration stage as mentioned in the scope.

**Table 2. Details of AAAU/Radar System Integration Work**

Sl. No.	Activity
1.	AAAU/Radar system integration which includes all activities for transportation from industry to vendors and within LRDE designated site. System assembly, integration, testing, installation, erection and commissioning of Antenna Post Mechanical Structure, Radar Power System, LRCS, THCS, Radar Technical Complex.
2.	Assembly of Building block and ODTRM. Flatness and parallelism to be measured using laser tracker
3.	Assembly of "AAAU Frame with coolant network" to "Building block assembly and ancillaries". Flatness and parallelism to be measured using laser tracker
4.	Assembly of AAAU with NFTR Fixture. Flatness and parallelism to be measured using laser tracker
5.	Movement outside Assembly hangar and Roll in inside NFTR chamber
6.	Erection inside NFTR chamber to vertical position
7.	3 axis alignment of AAAU plane to NFTR probe plane. Measurement using laser tracker.
8.	Erection of Maintenance Platform
9.	Integration of cooling system, Radar power system through power distribution boxes and other subsystems for NFTR
10.	Mounting of all electronic modules (Space Time Control & Processing Unit (STCPU), Space Control & Processing Unit (SCPU) etc.)
11.	Cable routing and harnessing for NFTR
12.	Maintenance during NFTR process such as ODTRM, STCPU, SCPU replacement.
13.	Roll out post NFTR
14.	Disassembly of AAAU from NFTR Fixture
15.	Preparation of Radar Technical Complex site for installation and integration
16.	Transportation of all the subsystems to Radar Technical Complex site.
17.	Installation of Antenna Post Mechanical Structure, Liquid to Refrigerant Cooling System (LRCS), Radar Power System (RPS), CAL/RTS Shelter, Command and Control Post Shelter, Maintenance Shelter, Temperature and Humidity Control System (THCS)
18.	Cable routing and harnessing for all interconnection cables of power, data & control, RF and optical cables.
19.	Integration of "Building block assembly and ancillaries" to "AAAU Frame with coolant network" which includes hoses, adaptors, pipes for entire coolant network, electronic modules (ODTRMs etc.)
20.	Fitment check and functional checks of Antenna Post Y Pedestal for AAAU with Dummy AAAU frame (Dummy frame has to be of same weight and Centre of Gravity as AAAU which includes weight of AAAU Frame with coolant network, Building block



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	assembly and ancillaries, electronics modules)
21.	Integration of "Antenna Post Y Pedestal for AAAU" to "AAAU Frame with coolant network"
22.	Integration of LRCS, THCS, shelters, Radar Power system, Antenna Post Mechanical Structure for all mechanical, hydraulic, electrical, control, RF, optical etc. interconnections
23.	Antenna mechanical Post structure base levelling at Platform of Radar Technical complex
24.	Demonstration of functional performance of Antenna Post Mechanical Structure
25.	Deployment and commissioning of the complete system at Radar Technical Complex site. Maintenance and support as per SoW.
26.	Radar System Radiation & Site Activation, RTS/CAL System Demonstration

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**Table 1. Sl. No.10 Detailed Description: Radar Technical Complex as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables and supplied as part of Radar Technical Complex.)**

S.No.	Item Description	Qty. (Nos./Set)
<b>10</b>	<b>Radar Technical Complex</b>	<b>1 Set</b>
10.1	Hard Platform (40mx40m)	1 No.
10.2	Fire Tank with Pump	1 set
10.3	Cable and pipe trench	1 No.
10.4	Lightning Arrestors	1 No.
10.5	Radar Site Fencing	1 No.
10.6	Site Lighting System	1 No.
10.7	LAN Camera 360° Coverage to Radar Technical Complex	1 Set

**Table 1. Sl. No.11 Detailed Description: Antenna Post Mechanical Structure consist of SL. No 11.1, 11.2, 11.3 and 11.4 as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of integrated Antenna Post Mechanical Structure)**

S.No.	Item Description	Qty. (Nos./Set)
<b>11</b>	<b>Antenna Post Mechanical Structure</b>	<b>1 Set</b>
<b>11.1</b>	<b>Antenna Post Y Pedestal for AAAU</b>	<b>1 No.</b>
11.1.1	Antenna Y Pedestal	1 No.
11.1.2	Azimuth Gear Box with shaft	1 Set
11.1.3	Azimuth Rotary Joint	1 No.
11.1.4	Slew Bearing	1 No.
11.1.5	Azimuth pointer and control system	1 No.
11.1.6	Control panel	1 No.
11.1.7	High resolution Azimuth Encoder	1 No.
11.1.8	Elevation Gear Box with shaft	2 Nos.
11.1.9	Elevation Rotary Joint	2 Nos.
11.1.10	Elevation pointer and control system	1 No.
11.1.11	High resolution Elevation encoders	2 Nos.
11.1.12	Gear and Motor based mechanism	2 Nos.
11.1.13	Maintenance platform	1 No.
11.1.14	Coolant pipes with couplings	1 set
11.1.15	Hose pipes with end fitting	1 set
11.1.16	Mechanical Cable Routing (cable drum) and Harness mechanism	2 set
11.1.17	Limit Switches	1 set
11.1.18	Level Sensor	1 Set
11.1.19	Fasteners (as per design)	1 Set
11.1.20	Pedestal integration tools, slings and measurement kit	1 Set
<b>11.2</b>	<b>AAAU Frame with coolant network</b>	<b>1 No.</b>
11.2.1	AAAU Bare Frame	1 No.
11.2.2	Coolant pipes with couplings (as per design)	1 Set
11.2.3	Hose pipes with SS Adaptors at both ends (as per design)	1 Set
11.2.4	Mounting Shaft	2 Nos.
11.2.5	Fasteners (as per design)	1 Set



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11.2.6	AAAU Frame integration tools, slings and measurement kit	1 Set
11.2.7	Maintenance Platform	1 No.
<b>11.3</b>	<b>Building block assembly and ancillaries</b>	<b>18 Nos.</b>
11.3.1	Building Block Frames	18 Nos.
11.3.2	Coolant pipes with tappings	18 Set
11.3.3	QDCs	300 Set
11.3.4	Hose pipes with SS Adaptors at both ends	300 Nos.
11.3.5	Fasteners (as per design)	1 Set
11.3.6	Building Block integration tools, slings and measurement kit	1 Set
11.3.7	Interconnecting cables, cable trays and ducts (as per design)	1 Set
<b>11.4</b>	<b>NFTR Fixture</b>	<b>01 No.</b>
11.4.1	Movable Trailer	1 No.
11.4.2	Rotary Interface platform for azimuth	1 No.
11.4.3	Lead screw actuators for elevation	2 Nos.
11.4.4	Outriggers	4 Nos.
11.4.5	Lead screw landing gears	6 Nos.
11.4.6	Coolant network	1 Set
11.4.7	Structural members for safety at resting position and deployment position	1 Set
11.4.8	Limit Switches	1 Set
11.4.9	Dummy load as per design for CG balancing at resting position and deployment position	1 Set
11.4.10	Fasteners (as per design)	1 Set
11.4.11	NFTR Mechanical integration tools, slings and measurement kit	1 Set

**Table 1., Sl. No.12 Detailed Description: Radome as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of , Radome).**

S.No.	Item Description	Qty. (Nos./Set)
<b>12</b>	<b>Radome</b>	<b>1 Set</b>
12.1	Spherical Radome	01 No.
12.2	Radome Accessories	01 Set
12.2.1	Equipment door integrated with personnel entry door along with airlock	01 Set
12.2.2	Zenith Access Hatch	01 Set
12.2.3	LED Interior Lightning System	01 Set
12.2.4	Lightning Protection System	01 Set
12.2.5	LED Obstruction Warning Light	01 Set
12.2.6	Photocell Control Aircraft Warning Light	01 Set
12.2.7	Fiberglass Maintenance Kit	01 Set
12.2.8	Inter-Panel Silicone Sealant	01 Set
12.2.1	Zenith Fall Arrest Points	02 Set
12.3	Packaging & Transportation (Wooden Crating)	01 Set

**Table 1., Sl. No.13 Detailed Description, Liquid to Refrigerant Cooling System (LRCS) as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of Liquid to Refrigerant Cooling System (LRCS)).**



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S.No.	Item Description	Qty. (Nos./Set)
<b>13</b>	<b>Liquid to Refrigerant Cooling System(LRCS)- 440 kW</b>	<b>1 set</b>
13.1	Liquid to Refrigerant Cooling unit – 110kW	04 Nos.
13.2	Coolant	3000±100 Liters.
13.3	Coolant hoses Steel braided (70 m length ) with end couplings	02 Nos
13.4	LRCS Tool Box	1 Set
13.5	Fasteners	1 Set
13.6	Cable Sling	2 Set
13.7	Hoisting Apparatus (Power Spreader)	1 No.
13.8	Lifting Accessories	1 Set
13.9	Electric Portable Pump	1 No.
13.10	Drain Hoses	1 Set
13.11	Test Equipment (refer TS document)	1 Set
13.12	Grounding Peg	2 Set

**Table 1. Sl. No.14 Detailed Description, Radar Power System (RPS) as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of Radar Power System (RPS)).**

S.No.	Item Description	Qty. (Nos./Set)																																													
14	Radar Power System (RPS)	01 Set																																													
14.1	2x250 kVA DGs with Load Bank and Ancillaries	4 Nos.																																													
14.2	30 kVA DG with Cables, Connectors and Ancillaries	1 No.																																													
14.3	Low Voltage Control Center (LVCC)	1 No.																																													
14.4	Central Power Distribution Center (CPDC)	1 No.																																													
14.5	24" Remote SCADA in Command Shelter	1 No.																																													
14.6	Power Cables with Connectors	1 Set																																													
14.7	Control & Communication Cables with Connectors	1 Set																																													
14.8	Maintenance Tools (as per list)																																														
	<table><tr><th>SL no</th><th>Item description</th><th>Qty. (Nos./Set)</th></tr><tr><td>1</td><td>Screw drivers for electrical purpose - common 5 Nos, star 5 Nos</td><td>1 Set</td></tr><tr><td>2</td><td>Spanners -open ended (8 mm to 32 mm)</td><td>1 Set</td></tr><tr><td>3</td><td>Spanners -ring (8 mm to 32 mm)</td><td>1 Set</td></tr><tr><td>4</td><td>Ratchet box (10 to 32 mm)</td><td>1 No</td></tr><tr><td>5</td><td>Nose plier (bend &amp; straight)</td><td>1 Set</td></tr><tr><td>6</td><td>General purpose cutting plier</td><td>1 No</td></tr><tr><td>7</td><td>Wire cutter</td><td>1 No</td></tr><tr><td>8</td><td>Allen key Set</td><td>1 No</td></tr><tr><td>9</td><td>Adjustable spanner 0-30 mm</td><td>1 No</td></tr><tr><td>10</td><td>Adjustable spanner 0-50 mm</td><td>1 No</td></tr><tr><td>11</td><td>Belt wrench for DG filters</td><td>2 Nos</td></tr><tr><td>12</td><td>Torque wrench for bus bar tightening</td><td>1 No</td></tr><tr><td>13</td><td>1 Phase Service Lamp (CFL type holder with protective cover (100W) with wire (20m)</td><td>2 Nos</td></tr><tr><td>14</td><td>General purpose vacuum cleaner</td><td>1 no</td></tr></table>	SL no	Item description	Qty. (Nos./Set)	1	Screw drivers for electrical purpose - common 5 Nos, star 5 Nos	1 Set	2	Spanners -open ended (8 mm to 32 mm)	1 Set	3	Spanners -ring (8 mm to 32 mm)	1 Set	4	Ratchet box (10 to 32 mm)	1 No	5	Nose plier (bend & straight)	1 Set	6	General purpose cutting plier	1 No	7	Wire cutter	1 No	8	Allen key Set	1 No	9	Adjustable spanner 0-30 mm	1 No	10	Adjustable spanner 0-50 mm	1 No	11	Belt wrench for DG filters	2 Nos	12	Torque wrench for bus bar tightening	1 No	13	1 Phase Service Lamp (CFL type holder with protective cover (100W) with wire (20m)	2 Nos	14	General purpose vacuum cleaner	1 no	
SL no	Item description	Qty. (Nos./Set)																																													
1	Screw drivers for electrical purpose - common 5 Nos, star 5 Nos	1 Set																																													
2	Spanners -open ended (8 mm to 32 mm)	1 Set																																													
3	Spanners -ring (8 mm to 32 mm)	1 Set																																													
4	Ratchet box (10 to 32 mm)	1 No																																													
5	Nose plier (bend & straight)	1 Set																																													
6	General purpose cutting plier	1 No																																													
7	Wire cutter	1 No																																													
8	Allen key Set	1 No																																													
9	Adjustable spanner 0-30 mm	1 No																																													
10	Adjustable spanner 0-50 mm	1 No																																													
11	Belt wrench for DG filters	2 Nos																																													
12	Torque wrench for bus bar tightening	1 No																																													
13	1 Phase Service Lamp (CFL type holder with protective cover (100W) with wire (20m)	2 Nos																																													
14	General purpose vacuum cleaner	1 no																																													
14.9	Tools & Test Equipment (as per list)	1 Set																																													
S No.	Item Description	Qty. (Set)																																													



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	1	Multi Meter (AC & DC) Fluke 287	1 Set	
	2	Fluke – Clamp Meter (2000A AC and 2000A DC)	1 Set	
	3	Fluke – Digital Megger (1000 V, 2 GΩ)	1 Set	
	4	Fluke – Power Analyzer (Fluke 1777/equivalent)	1 Set	
	5	Fluke Phase sequence tester (Digital)	1 Set	
	6	Screw Driver Set (Flat & Star)	1 Set	
	7	Allen Key Set	1 Set	
	8	Ring & Open Spanner Set (8mm to 32 mm)	1 Set	
	9	Torque Wrench Set	1 Set	
	10	Metallic Tool Box	1 Set	
	11	Crimping Tools (16 sq mm to 400 sq mm)	1 Set	
	12	Earth Tester Fluke 1625	1 Set	
	13	Crimping Tools (0.5 sq mm to 16 sq mm)	1 Set	
14.10	Cable Trays			1 Set
14.11	Grounding Equipment a) Earth pits (chemical / GI) for Neutral and Ground) – 10 Nos. b) Grounding cables - 30 m long – 10 Nos. c) Accessories (Stainless Steel nut, bolts & washers for electrodes & cables etc.)			1 Set
14.12	Lifting Device (spreader beam along with slings as per design ) with Ancillaries			1 No.

**Table 1. SI. No.15 Detailed Description, Radar System Ancillaries as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of Radar System Ancillaries).**

S.No.	Item Description		Qty. (Nos./Set)
<b>15</b>	<b>Radar System Ancillaries</b>		<b>01 Set.</b>
15.1	Maintenance Shelter		01 Set.
	S.No.	Item Description	Qty. (Nos./Set)
	15.1.1	Maintenance Shelter 40 feet (12192mmx3400mm x3400mm)	1 No.
	15.1.2	Air conditioners	4 Nos.
	15.1.3	Humidity & Temperature sensor	1 No.
	15.1.4	Dehumidifier	1 No.
	15.1.5	ATE Rack	1 No.
	15.1.6	Liquid Cooling for ATE	1 No.
	15.1.7	Hardware Storage Rack	1 No.
	15.1.8	15kVA UPS	1 No.
	15.1.9	Fire alarm panel	1 No.
	15.1.10	Fire extinguishers	2 Nos.
	15.1.11	Heat and Smoke detectors	3 Nos.
	15.1.12	Fire siren hooter	1 No.
	15.1.13	EMI power line filter	1 No.
	15.1.14	Isolation transformer	1 No.
	15.1.15	PLC based power distribution panel	1 No.
	15.1.16	27" Display for SCADA	1 No.
	15.1.17	Table	5 Nos.
	15.1.18	Chair	5 Nos.
	15.1.19	White board	1 No.

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	15.1.20	Wall mounted fan	2 Nos.	
	15.1.21	LAN Camera & IP Phone	2 Nos.	
	Temperature and Humidity Control System (THCS)			
	<b>S.No.</b>	<b>Item Description</b>	<b>Qty. (Nos./Set)</b>	
	15.5.1	Temperature and Humidity Control Unit (THCU) – 130kW	2 Nos.	
	15.5.2	Air Ducts (Radome to THCS)	1 No.	
	15.5.3	Air Ducts (THCS to Radome)	1 No.	
	15.5.4	Air distribution network inside Radome	1 Set	
	15.5.5	All tools required for onsite maintenance.	1 Set	
	15.5.6	Fasteners (as per design)	1 Set	
	15.5.7	Spare parts for any repair or servicing during warranty period.	1 Set	
15.5	15.5.8	Qualification, FAT, SAT, Assembly, integration of sub systems, installation, erection and commissioning	1 job	01 Set.
	15.5.9	Cable Sling	2 Set	
	15.5.10	Hoisting Apparatus (Power Spreader)	1 No.	
	15.5.11	Lifting Accessories	1 Set	
	15.5.12	Electric Portable Pump	1 No.	
	15.5.13	Drain Hoses	1 Set	
	15.5.14	Test Equipment (refer TS document)	1 Set	
	15.5.15	Grounding Peg	2 Set	

**Table 1. SI. No.16 Detailed Description CAL/RTS Shelter as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of CAL/RTS Shelter).**

S.No.	Item Description	Qty. (Nos./Set)
16	<b>CAL/RTS Shelter</b>	<b>1 Set.</b>
16.1	EMI / EMC Shelter 20 feet shelter (6m x 2.4m x 2.4m)	1 No.
16.2	MIL grade Air conditioners	1 No.
16.3	Humidity & Temperature sensor	1 No.
16.4	Dehumidifier	1 No.
16.5	5kVA UPS	1 No.
16.6	Fire alarm panel	1 No.
16.7	Heat and Smoke detectors	1 No.
16.8	Fire siren hooter	1 No.
16.9	Fire extinguishers	1 No.
16.10	EMI power line filter	1 No.
16.11	Isolation transformer	1 No.
16.12	Power distribution panel	1 No.



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16.13	Table	2 Nos.
16.14	Chair	2 Nos.
16.15	Instrumentation Rack	1 No.
16.16	LAN Camera & IP Phone	1 No.

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**Table 1., Sl. No.17 Detailed Description Command and Control Post Shelter as per technical specification (The following listed items/ system and subsystem components or parts shall be deliverables, and supplied as part of Command and Control Post Shelter).**

S.No.	Item Description	Qty. (Nos./Set)
<b>17</b>	<b>Command and Control Post Shelter</b>	<b>1 Set.</b>
17.1	EMI / EMC Command Shelter 40 feet (12192mmx3400mm x3400mm)	1 No.
17.2	MIL grade Air conditioners	4 Nos.
17.3	Humidity & Temperature sensor	1 No.
17.4	Dehumidifier	1 No.
17.5	Server rack	2 Nos.
17.6	15kVA UPS	2 Nos.
17.7	27" Inch monitors	8 Nos.
17.8	OWS with 24" dual monitors	3 Nos.
17.9	Video wall (55" LED TV)	11 Nos.
17.10	Fire alarm panel.	1 No.
17.11	Heat and Smoke detectors	2 Nos.
17.12	Fire siren hooter	1 No.
17.13	Fire extinguishers	2 Nos.
17.14	EMI power line filter	1 No.
17.15	Isolation transformer	1 No.
17.16	PLC based power distribution panel	1 No.
17.17	27" Display for SCADA	1 No.
17.18	Table	7 Nos.
17.19	Chair	7 Nos.
17.20	White board	1 No.
17.21	Portable printer table and hardware storage box	1 No.
17.22	Wall mounted fan	2 Nos.
17.23	LAN Camera & IP Phone	2 Nos.

**Time Frame:** Post-delivery of the Radar Hardware under this contract. The Sellers shall be required to provide complete post-delivery assembly and integration support for 12 months to the LRDE at designated place across the country beyond the PDC of this contract.



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## Appendix-B

### B.1. Technical Data Package (TDP)

The directory structure shall be specified by the Buyer. TDP (ECAD and MCAD design / production) documents shall be delivered in native format so that it can be imported in a PDM server (Team centre / 3D experience or equivalent).

#### TDP File / Data / Information Format:

1. All documents in Editable Microsoft Visio / Excel / Word & PDF format shall be provided
2. Schematic, Layout, Gerber, Mechanical Drawings of AAAU Assembly, Components/BOM and LRUs shall be delivered in native file format
3. All Mechanical Sub-Assemblies/ Assemblies, Active Array Electronics LRUs Production, Manufacturing & mounting jigs along with controller test jigs 2D drawings and 3D models shall be provided in native file format
  - a. Mechanical Drawings and 3-D Models, General Assembly Drawings, Master Drawing Index
  - b. Critical Parts Manufacturing Drawing, Assembly Drawing, Manufacturing Process documents
  - c. Schematics and Layout design
  - d. Critical BOM with source of supply and data sheets
4. LRU Test Jigs, Test jig manual, and Test jig source code RF / Digital PCB cutting details (if multiple) shall be provided
5. Mechanical 2D drawings and 3D models drawings of pre assembly test jig of RF /Digital PCB shall be provided in native file format.
6. The detailed TDP matrix is mentioned in the below section.
7. Design Files & BTP Manufacturing Files (List of Design and Manufacturing Files to be delivered)
  - a. Block Level Schematics, Circuit Level schematics(.dsn ,opj files), PCB Layout including .brd file , drill data & Gerber source files including .gbr and .art files.
  - b. Schematics capture and Layout design synchronization file if any,
  - c. Component Data Base, BOM with source of supply and data sheets
  - d. Internal and External ICD, Interface Design Description(IDD) at Message level
  - e. Mechanical Drawings and 3-D Models, General Assembly Drawings, Master Drawing Index

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- f. Parts Manufacturing Drawing, Assembly Drawing, Manufacturing Process documents
- g. Test jigs drawings and appropriate GUI software for testing of Array Electronics
- h. All source codes (VHDL code for FPGA as well as GUI source code), software design documents, test cases in CD form.
- i. Source code of software and firmware shall be delivered in a subversion server.
- j. All above items as part of TDP shall be delivered in a server in the form of given directory structure with version control.



Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware

**High-Resolution Radar Hardware: Technical Data package (TDP)**

CL - Customer Information		Product Information		Order Information		Shipping Information		Billing Information		Sales Information		Inventory Information		Status Information		Comments	
CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
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163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
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325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342
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487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504
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523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540
541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558
559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576
577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594
595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612
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991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008
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1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278
1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296
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1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368
1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386
1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404
1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422
1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440

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Note: TDP data set need to be finalized during PDR/DDR and CDR stage.

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**B.2. Contractual Document Required List (CDRL) Document List**

One set of scanned signed copy of documents as mentioned below shall be delivered along with (editable native file format) soft copy in solid state portable storage media. Solid state portable storage media shall contain CDRL documents including PDR, CDR, ATR, ESS, QT, EMI/ EMC test reports, COC etc, review presentations and MOM.

**Table 3. CDRL Document List**

Sl. No	CDRL Document List	Submission Stage
<b>A.</b>	<b>Project Documents</b>	
1	Master Project Schedule (MPS)	Kick-off Meeting
2	Product Breakdown Structure (PBS)	Kick-off Meeting
3	Work Breakdown Structure (WBS)	Kick-off Meeting
4	Project Management Plan (PMP)	Kick-off Meeting
5	Configuration Management Plan (CMP)	Kick-off Meeting
6	Risk Management Plan (RMP)	Kick-off Meeting
7	System Engineering Management Plan (SEMP)	Kick-off Meeting
8	Manufacturing and Procurement Plan (MPP)	Kick-off Meeting
9	Hardware Development Plan (HDP)	Kick-off Meeting
10	Firmware Development Plan (FDP)	Kick-off Meeting
11	Software Development Plan (SDP)	Kick-off Meeting
12	System Test Plan (SyTP)	Kick-off Meeting
13	Firmware Test Plan (FTP)	Kick-off Meeting
14	Software Test Plan (STP)	Kick-off Meeting
15	Interface General Information (IGI)	Kick-off Meeting
16	Quality Assurance Plan (QAP)	Kick-off Meeting
17	Qualification Test Plan (QTP)	Kick-off Meeting
18	Electrical - Interface Control Document	Kick-off Meeting
19	Mechanical - Interface Control Document	Kick-off Meeting
<b>B</b>	<b>Preliminary Design Document (PDD)</b>	
1	Radiating Element	PDR, (T0 + 3)
2	Octal Digital T/R Module (ODTRM)	PDR, (T0 + 3)
3	Space Control & Processing Unit (SCPU)	PDR, (T0 + 3)
4	Space Time Control & Processing Unit (STCPU)	PDR, (T0 + 3)
5	Power Distribution Box	PDR, (T0 + 3)
6	AAAU Interconnection Cables	PDR, (T0 + 3)
7	ATEs & Special Test Equipment	PDR, (T0 + 3)
8	Functional AAAU Building Block	PDR, (T0 + 3)
9	Collimation of AAAU BB & NFTR Fixture ( with 3-axis)	PDR, (T0 + 3)
10	Integrated ATE for ODTRM, SCPU, STCPU, PDU etc	PDR, (T0 + 3)
11	CAL/RTS System	PDR, (T0 + 3)
12	Sync & Time Equipment/Radar Synchronization Unit	PDR, (T0 + 3)
13	AAAU/Radar System Integration 3D video Model	PDR, (T0 + 3)
14	AAAU Pre- NFTR Plan	PDR, (T0 + 3)
15	NFTR Activity/Field Collimation	PDR, (T0 + 3)
16	Radar System Integration Ancillaries	PDR, (T0 + 3)



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17	Site Activation and System Integration	PDR, (T0 + 3)
18	Radar Technical Complex 3D model	PDR (T0 + 3)
19	System integrated 3D model	PDR (T0 + 3)
20	Antenna Post Mechanical Structure 3D model	PDR (T0 + 3)
21	Other subsystems 3D Models	PDR (T0 + 3)
22	Layout configuration 3D model	PDR (T0 + 3)
23	System design calculations	PDR (T0 + 3)
24	Site Activation Plan	PDR (T0 + 3)
25	Cooling network Interconnection ICD	PDR (T0 + 3)
26	Integration plan document	PDR (T0 + 3)
27	Master Part List	PDR (T0 + 3)
28	Performance Analysis (Simulation Studies)	PDR (T0 + 3)
29	Preliminary System Test Plan	PDR (T0 + 3)
30	Tools and Test Equipment List	PDR (T0 + 3)
31	Baseline Reliability Prediction	PDR (T0 + 3)
32	DFMEA/ DFMECA Document	PDR (T0 + 3)
33	HFI Plan Document	PDR (T0 + 3)
34	System Safety Approach Document	PDR (T0 + 3)
35	Test plan and methodology	PDR (T0 + 3)
36	Provisional Quality Assurance Plan	PDR (T0 + 3)
<b>C.</b>	<b>Detail Design Document (DDD) (System Requirement Specifications)</b>	
1.	AAAU/Radar System Integration 3D video Model	T0 + 6
2.	Pre- NFTR Activity with NFTR Fixture ( with 3-axis)	T0 + 6
3.	NFTR Activity/Field Collimation	T0 + 6
4.	Radar System Integration Ancillaries	T0 + 6
5.	Site Activation and System Integration	T0 + 6
6.	Radar Technical Complex	PDR (T0 + 6)
7.	Antenna Post Mechanical Structure	PDR (T0 + 6)
	2.1 Antenna Post Y Pedestal for AAAU	
	2.2 AAAU Frame with coolant network	
	2.3 Building block assembly and ancillaries	
	2.4 NFTR Fixture	
8.	Radome	PDR (T0 + 6)
	3.1 Detailed EM and Structural Analysis Report	
9.	Liquid to Refrigerant Cooling System (LRCS)	PDR (T0 + 6)
10.	Radar Power System (RPS)	PDR (T0 + 6)
11.	CAL/RTS Shelter	PDR (T0 + 6)
12.	Command and Control Post Shelter	PDR (T0 + 6)
13.	Maintenance Shelter	PDR (T0 + 6)
14.	Temperature and Humidity Control System (THCS)	PDR (T0 + 6)
15.	System Integration Configuration Plan	PDR (T0 + 6)
16.	Electrical - Interface Control Document	PDR (T0 + 6)
17.	Mechanical - Interface Control Document	PDR (T0 + 6)
18.	System Safety Plan & Grounding Scheme	PDR (T0 + 6)
19.	Reliability Demonstration, Accelerated Testing Plans	PDR (T0 + 6)
20.	DFMEA/ DFMECA Update	PDR (T0 + 6)
21.	Maintainability/ Testability Evaluation	PDR (T0 + 6)
22.	Integration of human element into design	PDR (T0 + 6)



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23.	System Safety Risk management Plan	PDR (T0 + 6)
24.	Quality Assurance Plan (sub systems)	PDR (T0 + 6)
<b>D</b>	<b>Design Document (PI/SI)</b>	<b>T0 + 6</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 6
2	Space Control & Processing Unit (SCPU)	T0 + 6
3	Space Time Control & Processing Unit (STCPU)	T0 + 6
4	Power Distribution Box	T0 + 6
<b>E</b>	<b>Design Document (Thermal)</b>	<b>T0 + 6</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 6
2	Space Control & Processing Unit (SCPU)	T0 + 6
3	Space Time Control & Processing Unit (STCPU)	T0 + 6
4	Power Distribution Box	T0 + 6
5	CAL/RTS System	T0 + 6
<b>F</b>	<b>Design Document (ICD)</b>	<b>T0 + 6</b>
1	Power Interconnection ICD	T0 + 6
2	Control & Ethernet Interconnection ICD	T0 + 6
3	Optical Interconnection ICD	T0 + 6
4	RF Interconnection ICD	T0 + 6
5	Cooling network Interconnection ICD	T0 + 6
6	Grounding Interconnection ICD	T0 + 6
7	Ancillary Systems Interconnection ICD	T0 + 6
<b>G</b>	<b>Design Document (IDD)</b>	<b>T0 + 6</b>
1	ODTRM Software & Firmware	T0 + 6
2	SCPU Software & Firmware	T0 + 6
3	STCPU Software & Firmware	T0 + 6
4	AAAU BIT/ Technical Operator System Software	T0 + 6
5	CAL/RTS System Software & Firmware	T0 + 6
<b>H</b>	<b>Design Document (SRS)</b>	<b>T0 + 6</b>
1	ODTRM Software & Firmware	T0 + 6
2	SCPU Software & Firmware	T0 + 6
3	STCPU Software & Firmware	T0 + 6
4	AAAU BIT/ Technical Operator System Software	T0 + 6
5	CAL/RTS System Software & Firmware	T0 + 6
<b>I</b>	<b>Design Document (SDD)</b>	<b>T0 + 6</b>
1	ODTRM Software & Firmware	T0 + 6
2	SCPU Software & Firmware	T0 + 6
3	STCPU Software & Firmware	T0 + 6
4	AAAU BIT/ Technical Operator System Software	T0 + 6
5	CAL/RTS System Software & Firmware	T0 + 6
<b>J</b>	<b>Design Document (FRS)</b>	<b>T0 + 6</b>
1	ODTRM Software & Firmware	T0 + 6
2	SCPU Software & Firmware	T0 + 6
3	STCPU Software & Firmware	T0 + 6
4	AAAU BIT/ Technical Operator System Software	T0 + 6
5	CAL/RTS System Software & Firmware	T0 + 6
<b>K</b>	<b>Design Document (FDD)</b>	<b>T0 + 12</b>
1	ODTRM Software & Firmware	T0 + 12



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2	SCPU Software & Firmware	T0 + 12
3	STCPU Software & Firmware	T0 + 12
4	AAAU BIT/ Technical Operator System Software	T0 + 12
5	CAL/RTS System Software & Firmware	T0 + 12
<b>L</b>	<b>Production Document (SOP)</b>	<b>T0 + 12</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 12
2	Space Control & Processing Unit (SCPU)	T0 + 12
3	Space Time Control & Processing Unit (STCPU)	T0 + 12
4	Power Distribution Box	T0 + 12
5	Interconnection cable set & Grounding Pit	T0 + 12
<b>M</b>	<b>Production Document (FAI)</b>	<b>T0 + 12</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 12
2	Space Control & Processing Unit (SCPU)	T0 + 12
3	Space Time Control & Processing Unit (STCPU)	T0 + 12
4	Power Distribution Box	T0 + 12
5	AAAU Interconnection Cables	T0 + 12
<b>N</b>	<b>Critical Design Document (CDD)</b>	<b>CDR (T0 + 18)</b>
1	Radiating Element	CDR (T0 + 18)
2	Octal Digital T/R Module (ODTRM)	CDR (T0 + 18)
3	Space Control & Processing Unit (SCPU)	CDR (T0 + 18)
4	Space Time Control & Processing Unit (STCPU)	CDR (T0 + 18)
5	Power Distribution Box	CDR (T0 + 18)
6	AAAU Interconnection Cables	CDR (T0 + 18)
7	RF Interconnection Cables	CDR (T0 + 18)
8	Optical Interconnection Cables	CDR (T0 + 18)
9	Control & Ethernet Interconnection Cables	CDR (T0 + 18)
10	Power Interconnection Cables	CDR (T0 + 18)
11	Radar system/subsystem earth/grounding cables	CDR (T0 + 18)
12	ATEs & Special Test Equipment	CDR (T0 + 18)
13	Functional AAAU BB for proof of concept (POC)	CDR (T0 + 18)
14	Collimation of AAAU BB & NFTR Fixture ( with 3-axis)	CDR (T0 + 18)
15	Integrated ATE for ODTRM, SCPU, STCPU, PDU etc	CDR (T0 + 18)
16	CAL/RTS System	CDR (T0 + 18)
17	CAL/RTS System Electronic Equipment's	CDR (T0 + 18)
18	CAL/RTS System Software & Firmware	CDR (T0 + 18)
19	CAL/RTS Antenna Set	CDR (T0 + 18)
20	Electro-Mechanical Telescopic Mast	CDR (T0 + 18)
21	All weather microwave absorbers	CDR (T0 + 18)
22	Multipath diffraction posts	CDR (T0 + 18)
23	Interconnection cable set & Grounding Pit	CDR (T0 + 18)
24	Radar Processing Hardware	CDR (T0 + 18)
25	Sync & Time Equipment/Radar Synchronization Unit	CDR (T0 + 18)
26	AAAU/Radar System Integration 3D video Model	CDR (T0 + 18)
27	Pre- NFTR Activity with NFTR Fixture with 3-axis Stabl.	CDR (T0 + 18)
28	NFTR Activity/Field Collimation	CDR (T0 + 18)
29	Radar System Integration Ancillaries	CDR (T0 + 18)
30	Site Activation and System Integration	CDR (T0 + 18)



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31	Antenna Post Mechanical Structure	CDR (T0 + 18)
32	Radar Technical Complex	CDR (T0 + 18)
33	System integrated 3D model	CDR (T0 + 18)
34	Antenna Post Mechanical Structure 3D model	CDR (T0 + 18)
35	Other subsystems 3d Models	CDR (T0 + 18)
36	Static Structural Analysis Report	CDR (T0 + 18)
37	Modal analysis report	CDR (T0 + 18)
38	Dynamic Structural Analysis report	CDR (T0 + 18)
39	Wind analysis report	CDR (T0 + 18)
40	Seismic Analysis report	CDR (T0 + 18)
41	Finite Element Models/ CFD Analysis	CDR (T0 + 18)
42	Thermal and flow analysis report	CDR (T0 + 18)
43	System design calculations	CDR (T0 + 18)
44	Coolant network	CDR (T0 + 18)
45	Interconnection cable routing and harnessing	CDR (T0 + 18)
46	Integration plan document	CDR (T0 + 18)
47	Fixtures and jigs 3D models	CDR (T0 + 18)
48	FE models for all structural analysis	CDR (T0 + 18)
49	Bill of Materials	CDR (T0 + 18)
50	Site Activation and System Integration plan	CDR (T0 + 18)
51	Electrical - Interface Control Document	CDR (T0 + 18)
52	Mechanical - Interface Control Document	CDR (T0 + 18)
53	System Safety Plan & Grounding Scheme	CDR (T0 + 18)
54	System Sub-system Design document	CDR (T0 + 18)
55	Power System Electrical Analysis (Load flow, Short circuit analysis, Relay coordination & EMC)	CDR (T0 + 18)
56	Final System Test Plan	CDR (T0 + 18)
57	System Testing/ Reliability Demonstration	CDR (T0 + 18)
58	ATP/ QTP/ LQTP	CDR (T0 + 18)
59	FRACAS/ Failure Analysis Board	CDR (T0 + 18)
60	System Safety Risk management Plan	CDR (T0 + 18)
61	Reliability Growth Analysis	CDR (T0 + 18)
62	Analysis of Life Cycle Cost	CDR (T0 + 18)
63	FRACAS/ Failure Analysis Board	CDR (T0 + 18)
64	Obsolescence Management	CDR (T0 + 18)
65	Detailed Installation Feasibility	CDR (T0 + 18)
66	Configuration Management/ Control	CDR (T0 + 18)
67	System Safety Risk management Plan	CDR (T0 + 18)
68	Master Quality Assurance Plan (MQAP)	CDR (T0 + 18)
<b>0</b>	<b>Production Document (Production Process Plan )</b>	<b>T0 + 18</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 18
2	Space Control & Processing Unit (SCPU)	T0 + 18
3	Space Time Control & Processing Unit (STCPU)	T0 + 18
4	Power Distribution Box	T0 + 18
5	AAAU Interconnection Cables & Grounding Pit	T0 + 18
6	Antenna Post Mechanical Structure	T0 + 18
7	Radar Technical Complex	T0 + 18
8	Fixtures and jigs	T0 + 18



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9	Cable routing and harness drawings	T0 + 18
10	Stage Inspection Plan	T0 + 18
11	Configuration Management/ Control	T0 + 18
12	Field Trials/ Reliability Demonstration	T0 + 18
13	Process FMEA	T0 + 18
14	Maintenance Plan	T0 + 18
15	Obsolescence Management	T0 + 18
16	PA/Supplier/ Vendor/Subcontractor Q&R Assurance	T0 + 18
17	Identification of human errors, accident analysis and recommendations	T0 + 18
18	System Safety Risk management Plan	T0 + 18
<b>P</b>	<b>Qualification Document (TS)</b>	<b>T0 + 18</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 18
2	Space Control & Processing Unit (SCPU)	T0 + 18
3	Space Time Control & Processing Unit (STCPU)	T0 + 18
4	Power Distribution Box	T0 + 18
5	AAAU Interconnection Cables & Grounding Pit	T0 + 18
6	CAL/RTS System	T0 + 18
<b>Q</b>	<b>Qualification Document (FTR)</b>	<b>T0 + 18</b>
1	Octal Digital T/R Module (ODTRM)	T0 + 18
2	Space Control & Processing Unit (SCPU)	T0 + 18
3	Space Time Control & Processing Unit (STCPU)	T0 + 18
4	Power Distribution Box	T0 + 18
5	Functional AAAU BB for proof of concept (POC)	T0 + 18
6	ATEs & Special Test Equipment	T0 + 18
7	CAL/RTS System	T0 + 18
<b>R</b>	<b>Qualification Document (ATP &amp; ATR)</b>	<b>T0 + 18</b>
1	Radiating Element	T0 + 18
2	Octal Digital T/R Module (ODTRM)	T0 + 18
3	Space Control & Processing Unit (SCPU)	T0 + 18
4	Space Time Control & Processing Unit (STCPU)	T0 + 18
5	Power Distribution Box	T0 + 18
6	AAAU Interconnection Cables & Grounding Pit	T0 + 18
7	ATEs & Special Test Equipment	T0 + 18
8	CAL/RTS System	T0 + 18
<b>S</b>	<b>Qualification Document (QTP) &amp; HASS &amp; QTR</b>	<b>T0 + 18</b>
1	Radiating Element	T0 + 18
2	Octal Digital T/R Module (ODTRM)	T0 + 18
3	Space Control & Processing Unit (SCPU)	T0 + 18
4	Space Time Control & Processing Unit (STCPU)	T0 + 18
5	Power Distribution Box	T0 + 18
<b>T</b>	<b>Qualification Document (QTP) &amp; HASS &amp; QTR</b>	<b>T0 + 18</b>
1	Radiating Element	T0 + 18
2	Octal Digital T/R Module (ODTRM)	T0 + 18
3	Space Control & Processing Unit (SCPU)	T0 + 18
4	Space Time Control & Processing Unit (STCPU)	T0 + 18
5	Power Distribution Box	T0 + 18



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<b>U</b>	<b>Build to Print drawings in *.dwg and *.pdf format</b>	
1.	Antenna Post Mechanical Structure	T0 + 18
2.	Radar Technical Complex	T0 + 18
3.	Fixtures and jigs	T0 + 18
4.	Cable routing and harness drawings	T0 + 18
5.	Radiating Element	T0 + 18
6.	Octal Digital T/R Module (ODTRM)	T0 + 18
7.	Space Control & Processing Unit (SCPU)	T0 + 18
8.	Space Time Control & Processing Unit (STCPU)	T0 + 18
9.	Power Distribution Box	T0 + 18
<b>V</b>	<b>Qualification Document (FTP, FTR, ATP, ATR, QTP, QTR, FEA, FMEA, FMECA, Safety Document)</b>	
1	Radar Technical Complex	(T0 + 36)
2	Antenna Post Mechanical Structure	(T0 + 36)
	2.1 Antenna Post Y Pedestal for AAAU	
	2.2 AAAU Frame with coolant network	
	2.3 Building block assembly and ancillaries	
	2.4 NFTR Fixture	
3	Liquid to Refrigerant Cooling System (LRCS)	(T0 + 36)
4	Radar Power System (RPS)	(T0 + 36)
5	CAL/RTS Shelter	(T0 + 36)
6	Command and Control Post Shelter	(T0 + 36)
7	Maintenance Shelter	(T0 + 36)
8	Temperature and Humidity Control System (THCS)	(T0 + 36)
9	Reliability Prediction (as per parts stress method - MILSTD-217FN2)	(T0 + 36)
10	FMECA as per MIL-STD1629 Task 101 and 102	(T0 + 36)
11	De-rating analysis as per MIL-STD-975M	(T0 + 36)
<b>W</b>	<b>Technical Manual, User Manual/User Handbook (UHB), Operation &amp; Maintenance Manual and Factory Acceptance Test (FAT) Report</b>	
1.	Radar Technical Complex	FAT (T0+36)
2.	Antenna Post Mechanical Structure	FAT (T0+27)
	2.1 Antenna Post Y Pedestal for AAAU	
	2.2 AAAU Frame with coolant network	
	2.3 Building block assembly and ancillaries	
	2.4 NFTR Fixture	
3.	Liquid to Refrigerant Cooling System (LRCS)	FAT (T0+27)
4.	Radar Power System (RPS)	FAT (T0+27)
5.	CAL/RTS Shelter	FAT (T0+36)
6.	Command and Control Post Shelter	FAT (T0+36)
7.	Maintenance Shelter	FAT (T0+36)
8.	Temperature and Humidity Control System (THCS)	FAT (T0+36)
9.	Electrical - Interface Control Document	FAT (T0+27)
10.	Mechanical - Interface Control Document	FAT (T0+27)
11.	System Safety Plan & Grounding Scheme	FAT (T0+27)
12.	PLC & SCADA programming back up in CD -initial	FAT (T0+27)
	ATEs & Special Test Equipment	
<b>X</b>	<b>Integration and Commissioning Document and Site Acceptance Test (SAT) Report</b>	<b>T0 + 36</b>

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1	Radar Technical Complex	SIR (T0+36)
	Antenna Post Mechanical Structure	SIR (T0+36)
	2.1 Antenna Post Y Pedestal for AAAU	
	2.2 AAAU Frame with coolant network	
	2.3 Building block assembly and ancillaries	
	2.4 NFTR Fixture	
2	Liquid to Refrigerant Cooling System (LRCS)	SIR (T0+36)
3	Radar Power System (RPS)	SIR (T0+36)
4	CAL/RTS Shelter	SIR (T0+36)
5	Command and Control Post Shelter	SIR (T0+36)
6	Maintenance Shelter	SIR (T0+36)
7	Temperature and Humidity Control System (THCS)	SIR (T0+36)
8	Electrical - Interface Control Document	SIR (T0+36)
9	Mechanical - Interface Control Document	SIR (T0+36)
10	System Safety Plan & Grounding Scheme	SIR (T0+36)
Y	Qualification Document (FMECA )	T0 + 36
1	AAAU & Radar System	T0 + 36
Z	Qualification Document (RAMS )	T0 + 36
1	AAAU & Radar System	T0 + 36

All documents in Editable Microsoft Visio / Excel / Word & PDF format shall be provided. One set of scanned signed copy of documents as mentioned below shall be delivered along with (editable native file format) soft copy in solid state portable storage media. Solid state portable storage media shall contain CDRL documents including PDR, CDR, ATR, ESS, QT, EMI/ EMC test reports, COC etc, review presentations and MOM.

**Abbreviations:**

PDR: Preliminary Design Review  
 CDR: Critical Design Review  
 FTR: Functional Test report  
 ATR: Acceptance Test Report  
 QTR: Qualification Test Report  
 FAT: Factory Acceptance Test

PRR: Production Readiness Review  
 FTP: Functional Test Plan  
 ATP: Acceptance Test Plan  
 QTP: Qualification Test Plan  
 SIR: System Integration review  
 SAT: Site Acceptance Test



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**Appendix-C****BFE / BFI and Buyer Support****C.1. Equipment Required during AAAU Assembly, pre-NFTR activities**

The following equipment shall be made available by Seller during AAAU assembly and pre-NFTR activities in LRDE premise :

1. AAAU Frame
2. NFTR Fixture
3. AAAU Transportation Fixture
4. AAAU assembly hanger at LRDE / Kolar
5. One number of handheld spectrum / network analyser.
6. One number of dual channel oscilloscope.
7. One number of arbitrary function generator
8. One number of digital multi meter
9. In case of apportionment of ODTRM as per LOD SI.No. 1.2 Octal Digital T/R Module (ODTRM), 30 % of the total quantity will be made available during the AAAU integration by LRDE.

**C.2. Information**

Table below shows the information that will be provided by the Buyer to the Seller.

SI. No	Information	Instances
1	Specification Document	RFP
2	Safety General Requirements	RFP
3	EMC General Requirements	RFP
4	Environmental Conditions General Requirements	RFP
5	Test Plan and Acceptance Criteria	RFP
6	Radar Interface Control Document (RICD)	PDR

**C.3. Support**

The following support will be provided by the Buyer to the Seller:

- Participate through experts, during the qualification and final acceptance process, and assist in analyzing failures and deviations from requirements that occurred in the items under test.
- Prepare a system test plan.
- The Buyer shall support the Seller during their review of the specification, through technical meetings and detailed discussions.

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- The Buyer will participate in the project formal reviews, system integration, formal acceptance tests, and training as specified in this SOW.
- The Buyer shall inspect and supervise (as and when required) the Seller and their Subcontractor, in order to ensure the project goals, performance, schedule and quality requirements are met in full.



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**Appendix-D****Project Milestones for L1 Industry Partner**

Project activities and milestones are mentioned in below table:

**Table 4. Project Timeline Milestones**

Sl. No	Activity	Project Timelines (Months)	Delivery Milestone
M1	Contract Placement /Project Kickoff	T0	NIL
M2	Preliminary Design Review (PDR)	T0 + 3	a) Delivery of CDRL Documents i.e., "Project Documents" and "PDD Document" as per LOD along with the PDR Committee Recommendation Report.
M3	Detailed Design Review (DDR), R&D Module Realization & Demonstration	T0 + 6	a) Delivery of AAAU LRUs R&D Module functional demonstration report for SL. No. 1.1 to SL. No. 1.2 as per LOD. b) Delivery of CDRL Documents i.e., "CDRL Documents - A,B,C, D, E, F, G,H, I and J" as per LOD along with the DDR Committee Recommendation Report.
M4	Iteration/Rework, Realization of FAI Units,	T0 + 12	a) Delivery of AAAU LRUs FAI Units functional test report for SL. No. 1.1 to SL. No. 1.5 as per LOD. b) Delivery and acceptance of Items as mentioned in SL. NO. 8.1 & 8.3 as per LOD. c) Delivery of CDRL Documents i.e., "CDRL Documents - K,L and M" as per LOD
M5	Qualification of FAI Units & Critical Design Review (CDR), Delivery of Technical Data Package for BTP	T0 + 18	a) Delivery of Qualification Report of AAAU LRUs FAI Units for SL. No. 1.1 to SL. No. 1.5 as per LOD. CDR Committee Recommendation Report. b) Delivery and acceptance of Items as mentioned in SL. NO. 7.0 as per LOD. Delivery of CDRL Documents i.e., "CDRL Document- N,O,P, Q, R, S and T" as per LOD
M6	Production Readiness Review (PRR) of AAAU Frame, Building Block (BB) Assembly, NFTR Fixture, LRCS, Radar Power system and demonstration of Single BB	T0 + 24	a) Delivery of AAAU LRUs functional test report for SL. No. 1.1 to SL. No. 1.5 and delivery of SL. No 9.3., 9.4, 9.5 as per LOD including satisfactory demonstration of Single BB along with the PRR Committee Recommendation Report. b) Delivery and acceptance of Items as mentioned in SL. NO. 1.6, 3.0, 8.2 and 9.2 as per LOD. c) Delivery of Line item 11.2, 11.3, 11.4, 13 and 14 of per List of Deliverables.

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M7	System Integration Review (SIR) & Pre-NFTR of Full AAAU	T0 + 30	<ul style="list-style-type: none"> <li>a) Acceptance of Line item 11.2, 11.3, 11.4, 13 and 14 of per List of Deliverables.</li> <li>b) Delivery and acceptance of SI.No. 1.1, 1.2, 1.3, 1.4 and 1.5 as per LOD.</li> <li>c) Integration completion with the 100% Qty. (L1 Qty.) of ODTRM in AAAU with the recommendation of SIR committee report.</li> <li>d) Acceptance of Pre-NFTR Test report for integrated AAAU as per LOD.</li> <li>e) Delivery and acceptance of Items as mentioned in SL. NO. 2, 4, 5, 6, 9.1, 9.6, 9.7, 9.8, 9.11, 16, 17 and 18 as per LOD.</li> <li>f) Delivery and acceptance of items as mentioned in SI. No. 10 and 15 as per LoD.</li> <li>g) Delivery and acceptance of SI. No. 19. <b>Technical Data Package (TDP) as per APPENDIX-B of LOD.</b></li> </ul>
M8	Final AAAU Collimation/Calibration in NFTR	T0 + 36	<ul style="list-style-type: none"> <li>a) Delivery and acceptance of Antenna Post Y Pedestal for AAAU and Radome. (SI. No. 11.1 and 12 as per LOD), and</li> <li>b) Delivery of Integrated AAAU (as per LOD), Acceptance of Integrated AAAU Collimation/Calibration NFTR Test report (SI. No. 9.8, 9.9). NFTR Committee Recommendation Report.</li> <li>c) Delivery of CDRL Documents i.e., "CDRL Documents - U, V, W, X, Y and Z" as per LOD</li> </ul>
M9	Field Collimation & RTS Demonstration and Acceptance of Integrated System	T0 + 42	<ul style="list-style-type: none"> <li>a) Erection, Installation, commissioning and Acceptance of Integrated System (9.10) along with SAT Committee Recommendation.</li> </ul>



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## Appendix-E

Payment Milestones for L1 Industry Partner: Project activities and payment milestones are mentioned in below table:

Table 6. Activity vs Project timelines, Payment Milestones and Delivery Milestone

Sl. No	Activity	Payment Timelines (Months)	Payment Milestone	Delivery Milestone
M1	Contract Placement /Project Kickoff	T0	Advance Payment of 30% of the Contract value excluding taxes against BG of 110% of the amount valid till 60 days beyond final Acceptance of item.	NIL
M2	Preliminary Design Review (PDR)	T0 + 3	NIL	a) Delivery of CDRL Documents i.e., "Project Documents" and "PDR Document" as per LOD along with the PDR Committee Recommendation Report.
M3	Detailed Design Review (DDR), R&D Module Realization & Demonstration	T0 + 6	NIL	a) Delivery of AAAU LRUs R&D Module functional demonstration report for SL. No. 1.1 to SL. No. 1.2 as per LOD. b) Delivery of CDRL Documents i.e., "CDRL Documents - A, B, C, D, E, F, G, H, I and J" as per LOD along with the DDR Committee Recommendation Report.
M4	Iteration/Rework, Realization of FAI Units,	T0 + 12	NIL	a) Delivery of AAAU LRUs FAI Units functional test report for SL. No. 1.1 to SL. No. 1.5 as per LOD. b) Delivery and acceptance of Items as



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				mentioned in SL. NO. 8.1 & 8.3 as per LOD. c) Delivery of CDRL Documents i.e., "CDRL Documents - K, L and M" as per LOD
M5	Qualification of FAI Units & Critical Design Review (CDR), Delivery of Technical Data Package for BTP	T0 + 18	NIL	a) Delivery of Qualification Report of AAAU LRUs FAI Units for SL. No. 1.1 to SL. No. 1.5 as per LOD. CDR Committee Recommendation Report. b) Delivery and acceptance of Items as mentioned in SL. NO. 7.0 as per LOD. Delivery of CDRL Documents i.e., "CDRL Document- N, O, P, Q, R, S and T" as per LOD
M6	Production Readiness Review (PRR) of AAAU Frame, Building Block (BB) Assembly, NFTR Fixture, LRCS, Radar Power system and demonstration of Single BB.	T0 + 24	20% of Contract Value including taxes	a) Delivery of AAAU LRUs functional test report for SL. No. 1.1 to SL. No. 1.5 and delivery of SL. No. 9.3., 9.4, 9.5 as per LOD including satisfactory demonstration of Single BB along with the PRR Committee Recommendation Report. b) Delivery and acceptance of Items as mentioned in SL. NO. 1.6, 3.0, 8.2 and 9.2 as per LOD. c) Delivery of Line item 11.2, 11.3, 11.4, 13 and 14 of per List of Deliverables.
M7	System Integration Review (SIR) & Pre-NFTR of Full AAAU	T0 + 30	30% of Contract Value including taxes	a) Acceptance of Line item 11.2, 11.3, 11.4, 13 and 14 of per List of Deliverables. b) Delivery and acceptance of SL. No. 1.1, 1.2, 1.3, 1.4 and 1.5 as per LOD. c) Delivery of apportioned Qty. of ODRM and integration completion with the 100% Qty. (L1 Qty.) of ODRM in AAAU with the recommendation of SIR

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			committee report. d) Acceptance of Pre-NFTR Test report for integrated AAAU as per LOD. e) Delivery and acceptance of items as mentioned in SL NO. 2, 4, 5, 6, 9.1, 9.6, 9.7, 9.8, 9.11, 16, 17 and 18 as per LOD. f) Delivery and acceptance of items as mentioned in Sl. No. 10 and 15 as per LOD. g) Delivery and acceptance of Sl. No. 19. <b>Technical Data Package (TDP) as per APPENDIX-B of LOD.</b>
M8	Final AAAU Collimation/ Calibration in NFTR	T0 + 36	<p>a) Delivery and acceptance of Antenna Post Y Pedestal for AAAU and Radome. (Sl. No. 11.1 and 12 as per LOD), and</p> <p>b) Delivery of Integrated AAAU (as per LOD), Acceptance of Integrated AAAU Collimation/ Calibration NFTR Test report (Sl. No. 9.8, 9.9). NFTR Committee Recommendation Report.</p> <p>c) Delivery of CDRL Documents i.e., "CDRL Documents - U, V, W, X, Y and Z" as per LOD</p>
M9	Field Collimation & RTS Demonstration and Acceptance of Integrated System	T0 + 42	<p>a) Erection, Installation, commissioning and Acceptance of Integrated System (9.10) along with SAT Committee Recommendation.</p>

Note: CDRL delivery shall be as per the timeline mentioned in **Appendix B**,



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## Appendix-F

### Modification Procedure

The following procedure refers only to modifications that have impact on system design, project schedule, cost and performance.

#### F.1 Seller Modification Request

During the project, the Seller may propose an alternative to a current product (equipment or component) when the original product is no longer supported. The Seller shall submit an Engineering Change Request (ECR) to the Buyer, requesting the Buyer's approval for the required change.

The ECR shall include:

- The motivation for the change
- Data concerning the compatibility of the alternative product with the original product
- The Implications of the change on the performance of the system

The Seller shall execute the change according to the ECR on receipt of approval from Buyer. The Seller shall update all system engineering documents related to the change and submit the same to Buyer for approval and updation of records.

#### F.2 Buyer Modification Request

During the project, the Buyer may ask for an engineering change. The Buyer shall submit an Engineering Change Request (ECR) to the Seller. The Seller shall reply to the ECR within 14 days. In the response, the Seller shall present his approach to the ECR, along with a technical analysis in order to justify for the proposed approach.

In case the Seller approves the change request, a change proposal shall be submitted for consideration and approval by the Buyer.

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## Appendix-G

### G. Special Terms and Conditions

#### Technical Capability

The contracting / selected Industry as IPs should have capability to develop defense systems such as radar, communication systems for ground/naval/airborne application it may be noted that experience and capability is must in the area of aerospace electronics, defense electronics / systems etc. Documents in support of these capabilities need to be furnished.

#### Quality & Reliability

- i. System shall be designed and realized such that it has High system availability, mission reliability and maintainability as per the reliability requirements mentioned in the technical specification document.

#### Ownership :

All the participating industries shall be wholly owned and managed by Indian Resident nationals.

#### Sureties/ Guaranties

Seller may be required to execute Performance cum Warranty Bond (PcWB) as guarantees / sureties as required towards contract performance and advance payments as per DRDO/ Government Procedures.

#### Contract Extension/ Renewal

DRDO, reserves the right to extend the contract for additional periods as required, with following conditions

1. The delivery period for the deliverable items shall be extended with LD if the delay is attributable to the Seller and without LD if the delay is due to reasons attributable to DRDO.
2. The contract may be extended, if required, even after delivery of all items, for continued support for integration, testing etc, if required.

#### Additional Tasks / works:

In the event of additional tasks, requirements, responsibilities are required to be added, then the same shall be added after mutual agreement and formal procurement process and negotiation. DRDO, will reserve its right to carry out due diligence for these additional work including cost discovery through other means including tendering, to arrive at reasonable



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cost. The contract shall be accordingly amended to include these new additional activities once the agreement is reached.

**Travel and transportation related Expenses:**

The Seller will be required to support the development and related activities in the nodal as well as the work centres of DRDO located in various places. This will be done through placement of dedicated teams at these centers as required. Travel/transportation expenses and insurance costs shall be borne by Sellers.

**Working Hours :**

Seller shall ensure dedicated personnel with necessary expertise for the job defined and also to ensure continuity of the personnel throughout the execution of the project. If any person leaves the job/shifted to any other job the Seller shall explicitly mention the same and ensure the same level of expertise for replacement.

The personnel of Seller shall observe the working hours of the Lab / establishment where they are positioned. Working during non-working hours / holidays will be strictly regulated by the security aspects of the lab.

The personal of Sellers shall be available on holidays / non-working hours when required.

**Place of working :**

As the work involved is of classified nature involving national security, all the work will be carried out strictly at the location / onsite. However, any unclassified work package may be allowed to be carried by Sellers personal with permission from Project director / or the supervisor / scientist in charge from DRDO lab in which the person is operating. However, the control of such work shall be ensured by the supervisor of the IPs.

**Security Requirements :**

**Security clearance for the personal:**

Every personal of the Seller, who is likely to be associated with the contract shall be cleared by requisite police and other agencies. The Seller shall submit the clearance certificate to the project director/contract manager before a personal is positioned / engaged / involved in the work related to contract in any manner.

ii. Security procedure to be followed:

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Every personnel of Sheller, shall follow the set day to day security process, procedures and instructions of the center / lab in which they are working / visiting / positioned. Any person deviating / breaking the security instructions is liable to be prosecuted as per the instructions of GOI and IPs shall indemnify DRDO in respect of any loss incurred by him or his personal due to such indiscretions.

#### **Personal Insurance / Accident Insurance:**

As the personal may be required to be carrying out work under conditions of risk such as handling high voltage electrical equipment's. The Industry Partner shall be responsible to insure these personal against accidents etc. with a suitable Indian Insurer for a suitable amount that will be discussed.

#### **Improvements / Upgrades during post-delivery support:**

- i. The Seller may take up the upgrades / improvements requested by the Buyer. However, as the intellectual property of design rests with the DRDO, the IPs shall obtain appropriate permissions / approval from DRDO.
- ii. In the event the Seller propose a solution, DRDO will have right to review such solutions and approve the implementation of the same.
- iii. The IPs, may directly contract such activities from the Buyer. However, a nominal agreed amount may have to be paid to DRDO designers for their participation in reviewing, vetting etc.
- iv. Further, the Seller will be required to follow the Buyer laid out processes and procedures for development , and integration of such upgrades and improvements , in terms of manufacturing, QA/QC, Configuration Management etc.
- v. Such systems and technologies once inducted shall be deemed to be part of the system. However, in case the Seller have designed and developed the same , the IPR for such items will be remaining with the Sheller, provided such improvements and upgrades are not over the existing designs / manufactured items under this contract for which the payment has been made by Buyer.
- vi. In case the systems improvements and upgrades requirements have been tasked with Buyer, then the Seller will be required to provide requisite support to Buyer similar to this contract.



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- vii. A detailed procedure will be evolved between Seller and Buyer at an appropriate juncture on this aspect.

**Services:**

It may be noted that, the responsibility / mandate of Seller are as follows:

- i. Provide services during the development stage till delivery, Assembly & Integration, proving the performance of the radar on deployed test site.
- ii. Get Seller's personnel duly trained and acquainted for the post-delivery support to the Buyer.
- iii. Provide Post-delivery support accordingly to the Buyer at the sites designated during the project.
- iv. Further it may also be note that, every activity of the Seller shall be in terms of providing end to end service in relation to such activity. Further it also may be noted that, each of the assigned activity may be time bound and will require the IPs to provide appropriate resources from his side at all times.

**Quality of Service:**

The quality of service shall be maintained and evaluated under each payment intervals. Any delays on critical aspects may attract LD. The quality of service provided by the vendor shall be evaluated under following categories for the payment.

The broad category of the performance evaluations shall be

- i. Quality of delivered items
- ii. Quality of services provided by vendor
- iii. Resources availability (Manpower, others etc.)
- iv. Quality of Resources Positioned
- v. Overall Performance in terms of meeting of set goals.

The performance goals shall be mutually decided between the local authority (from the work center) and the Seller supervisory authority for every payment period and agreed to. The payment for the period shall be based on the satisfactory QOS (a mark of 75% or more).

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### ANNEXURES

1. Appendix I- B1-Technical Specification (TS) for Technical specifications Development, Supply, Site Assembly, Integration and Installation of High-Resolution Radar Hardware
2. Appendix II- Technical specifications of Antenna Post Mechanical Structure
3. Appendix III- Technical specifications of LRCS
4. Appendix IV- Technical specifications of THCS
5. Appendix V- Technical specifications of Radar Power System
6. Appendix VI- Technical specifications of Radar Technical Complex
7. Appendix-7-Specifications of Radome

Note: Above Mentioned Appendix 1 to 7 will be provided during Pre Bid.