Request for Proposal

Weather Radar AI Accelerated Now casting System

ISRO TELEMETRY TRACKING AND COMMAND NETWORK

INDIAN SPACE RESEARCH ORGANISATION

DEPARTMENT OF SPACE, GOVT. OF INDIA

BANGALORE -560058

Table of Contents

List of Figures

List of Tables

CHAPTER-1

1 INTRODUCTION & OBJECTIVE

1.1. Introduction:

The ISRO Telemetry Tracking and Command Network (ISTRAC) the Purchaser has issued this Tender Enquiry document for purchase of goods/stores/articles and related services as mentioned in "Request for Proposal (TENDER DOCUMENT)" which also indicates, inter alia, the required stores, delivery schedule, terms and conditions and place of delivery etc.

This chapter provides the relevant information as well as instructions to assist the prospective vendors in preparation and submission of tenders.

Technical Acceptance shall be unconditional and vendors shall have no claim and right in future on their terms, if any.

The vendor shall be responsible for the Design, Development, Realization and installation of Weather Radar AI Accelerated Now casting System. The detailed Technical Specifications are provided in Chapters 2.

1.2. Language of Tender:

The tender submitted by the vendor and all subsequent correspondence and documents relating to the tender exchanged between the vendor and the purchaser, shall be written in English language.

1.3. Eligibility:

Vendors who fulfill all the following Eligibility only will be considered for Technical Evaluation of bids.

a) **Indigenous Design and Development:** The Xilinx Ultra Scale Plus board must be indigenously designed and developed. The vendor must provide documentary proof of the design and development process being conducted within the country.

b) **High-Speed Communication IP Cores**:

- The vendor must demonstrate the capability of the system to support high-speed communication IP cores with the following specifications:

i. 10 Gbps

ii. 25 Gbps

iii. 100 Gbps

- Detailed test results and performance benchmarks must be provided to validate these capabilities.

c) **Technical Competence**: Vendor must showcase technical expertise in high-speed communication technologies and FPGA design. Evidence of previous projects and successful implementations shall be submitted.

d) **Proven Track Record**: The vendor must have a proven track record of successfully delivering projects involving high-speed communication IP cores and FPGA board designs. References or case studies from previous clients should be submitted to substantiate this experience.

e) **Project Management Capability**: The vendor must present a detailed project management plan, including timelines, milestones, and deliverables. The plan should highlight the vendor's capability to manage and deliver the project on schedule and within budget.

f) **Support and Maintenance**: The vendor must detail the support and maintenance services available post-delivery. This should encompass response times, service level agreements, and technical support availability.

1.4. Tendering Expense:

The vendor shall bear all the costs and expenditure incurred and/or to be incurred by them in preparation, and uploading their tender including attending the pre-bid meeting and arranging demonstration of Product/Services or Field trials that may be deemed necessary by the Purchaser.

1.5. Amendments to Tender enquiry (TE) documents:

At any time, prior to the deadline for submission of Tender, the purchaser may, for any reason deemed fit by it, modify the Tender Enquiry document by issuing suitable amendment(s) to it. The amendment will be uploaded on e-procure portal only.

In order to provide reasonable time to the prospective vendors to take necessary action in preparing their tenders as per the amendment, the purchaser may, at its discretion extend the deadline for the submission of tenders and other allied time frames, which are linked with that deadline

1.6. Documents Comprising the Tender:

The tender is to be submitted in Two Bid System. The "***Techno - Commercial Bid***" and "***Price Bid***" prepared by the vendor shall comprise the followings:

1.5.1 Techno - Commercial Bid (Un-priced Bid)

Following documents are to be furnished by the vendor with Techno-Commercial Bid as per the eligibility conditions applicable. Vendor shall upload following documents on e-procure portal.

a) Registration certificate of bidding firm with any state and central government body of India. Credential/document shall be attached.
b) Documentary evidence for fulfillment of Eligibility/Qualification criteria.
c) Tender terms & Conditions Acceptance Form duly signed.
d) Technical Bid duly signed.
e) Vendors are required to furnish clause by clause compliance of all specifications as per compliance statement template attached in Annexure I Table 6.Otherwise their bid will not be accepted.
f) List of deliverable (un-priced/without price) shall be submitted with details of model being offered etc. All should be identical to the items in price bid.
g) The above documents must be signed, stamped and scanned & shall be attached in the beginning of technical bid.

1.5.2 Price Bid:

a) In case any charges not mentioned in the price bid, it will be treated, as all the charges are inclusive for that item.
b) If there is a discrepancy between the amount expressed in words and figures, the amount in words shall prevail.

c) If price information is disclosed anywhere in the techno-commercial bid, bid will be disqualified.

1.7. Signing and Submission of Tender:

a) Properly signed and stamped tender on the company's letterhead shall be uploaded online through ISTRAC e- Portal. Hard copy of bids shall not be accepted for submission.
b) The tender shall not contain any over writing.
c) Only PDF format of the tender shall be uploaded on the portal.

1.8. Tender Evaluation:

1.8.1 Technical Evaluation:

a) Tenders shall be evaluated to assess the technical suitability of the bid with respect to the terms and conditions of the RFP.
b) If during the preliminary examination, the purchaser finds any minor deviations and/or non-conformity regarding technical evaluation in a tender, the purchaser has the right to accept or reject the same provided it does not constitute any material deviation, system performance and has no financial impact and, also, does not prejudice or affect the ranking order of the vendors.
c) Wherever necessary, the purchaser will convey its observation on such 'minor' issues to the vendor seeking vendor's response by a specified date. If the vendor does not respond by the specified date or provides evasive/incomplete reply without clarifying the exact point in clear terms, that tender will be liable to be ignored for further processing.
d) Technical presentation in the presence of the committee shall be held in ISTRAC, Bangalore, if required. The ISTRAC will seek proof of capabilities claimed in the compliance matrix provided by the respective vendor. ISTRAC will seek clarifications on the design, performance and other technical points during the presentation.

1.8.2 Financial evaluation:

a) After Technical Evaluation, the Price Bids of only the technically qualified vendors and meeting eligibility criteria shall be opened for further scrutiny and evaluation on a date notified after completion of evaluation of the

techno commercial tender.

b) Charges towards integration of subsystem, warranty, Insurance, Freight and transportation of goods up to delivery at sites etc. applicable from time to time for taking purchase decision shall also be added. These should be clearly indicated by the vendor.

c) If any charges are not indicated specifically and separately in the bid, it will be treated as inclusive.

d) All prices shall be quoted in Indian Rupee only.

e) The purchaser shall evaluate the technically qualified financial bids for deciding lowest vendor (L-1) based on total landing costs including all applicable taxes/levies/duties/warranty etc.

1.9. Packing and Marking:

The packing for the goods provided by the Vendor (manufacturer) should be strong and durable enough to withstand, without limitation, the entire journey during transit including trans-shipment (if any), rough handling, open storage etc. without any damage, deterioration etc.

1.10. Delivery Period and Schedule:

Supply and installation shall be completed within 15 months period from the date of PO. Contract can be cancelled by ISTRAC in case items are not received within the contracted delivery period. Extension of contracted delivery period will be at the sole discretion of the Buyer, with applicability of LD clause. Vendor shall mandatory follow the timeline given below, else ISTRAC reserve right to close the PO at any stage.

Table 1 Schedule

1.	Purchase order release	T0
2.	Preliminary Design Review(PDR)	T0+3 Months
4.	Application demonstration in Evaluation Kit , Factory Acceptance Test(FAT) and Delivery of the system	T0+11 Months
5.	Installation, Integration & Demonstration	T0+14 Months
6.	Site Acceptance Test(SAT)	T0+15Months

1.11. PDR, Inspection, Testing and Factory acceptance test (FAT):

a) PDR shall be held within 3 months from the date of issue of purchase order, where the design of system will be discussed at ISTRAC, Bangalore. Any suggestion by the committee during PDR/CDR, vendor shall implement the same with mutual consent.

b) ISTRAC will conduct Technical Reviews/Meetings as and when required at various stages of development. The status report shall be submitted to ISTRAC periodically.

c) Each phase of the software/firmware development life cycle will be reviewed by ISTRAC team / committee with all necessary documents and results at ISTRAC as per ISRO process document standard (ISPD / IEEE-12207).

d) The purchaser/consignee reserves the right to inspect goods at factory site / Vendor site before their dispatch if required and mentioned in technical requirement (TENDER DOCUMENT)

e) The purchaser/consignee reserves the right to verify goods or software systems during development stage as on when required by purchaser/consignee.

f) FAT shall be undertaken by ISTRAC based on mutually agreed acceptance test procedure (ATP).

g) FAT documents shall be submitted to ISTRAC two weeks before FAT test.

h) Goods accepted by the purchaser/consignee and/or its inspector at initial inspection shall in no way dilute purchaser's/consignee's right to reject the same later, if found deficient in terms of the clauses of the contract.

i) Purchaser may not undertake any pre-dispatch inspection, unless mentioned, for imported stores in the country of origin and the equipment will then be dispatched to the purchaser on the basis of Vendor’s own inspection at the premises with guarantee and warranty.

j) Any damage during transportation shall be borne by vendor.

k) SAT documents shall be submitted to ISTRAC two weeks before SAT test.

l) The equipment will be accepted subject to final inspection and acceptance test by ISTRAC team / committee for meeting all requirements mentioned in the tender specifications before handing over the equipment to consignee at the site. As per the mutually agreed test procedures, SAT document shall be prepared by vendor and Site Acceptance Test (SAT) shall be conducted at

ISTRAC Bangalore for system acceptance.

1.12. Place of Delivery:

All items shall be delivered at ISTRAC Peenya Bangalore.

1.13. PAYMENT TERMS

a) 70% Payment on completion of FAT and Delivery at ISTRAC Bangalore
b) Balance 30% payment shall be made after completion of Site Acceptance test at ISTRAC and total scope of work as per RFP Document.

1.14. Warranty:

a) The warranty shall be **on-site warranty for 03 years** from the date of acceptance of the system by ISTRAC.
b) Vendor shall operate and maintain the system at ISTRAC till the warranty period.
c) All items supplied to stores should be free from all defects and faults in material workmanship and manufacture.
d) All components shall be of industrial grade and consistent with the established and generally accepted standards for material of the type used and in full conformity with the specifications, drawings, or samples and shall, if operable, operate properly.
e) The Vendor shall be bound to furnish a clear written warranty.
f) The Vendor will be required to replace defective goods, free of cost inclusive of all freight and handling charges during warranty period.
g) The Vendor shall take over the replaced parts/ goods after providing their replacements and no claim, whatsoever shall lie on the purchaser for such replaced parts/goods thereafter.
h) Custom duty charges, if any, for re-export/re-import of defective parts/repaired parts or replaced parts to the foreign supplier country for repairs etc. shall be borneby Vendor only.
i) Transportation cost for sending defective parts for repairs and sending back repaired or replaced one shall be borne by Vendor itself.

1.15. List of Deliverables:

a) The vendor shall submit the final list of Deliverables as given at **Table 2** for all the Hardware, Firmware, Software items, sub-units etc. and all other services which vendor is going to offer in their technical proposal to meet the requirements under "Technical specifications-Chapter-2", of this tender document.

b) The list of deliverable shall be identical to that submitted in the price bid. The price bid shall not be considered if it is not matching with the list of deliverable submitted with technical bids.

c) Vendor shall mention all deliverables in the offer.

Table 2 List of Deliverables

S.no	List of Deliverables:
1.	AI FPGA Accelerated Card and Accessories (Specifications as per Table 3) - 2 No's Xilinx IP Core EF-DI-25GEMAC-SITE and accessories 1 Lot
2.	Ethernet Switch Module (Specifications as per Table 3 S.No 41) - 2 No's
3.	Xilinx VERSAL AI Core Series VCK190 evaluation kit and accessories (as per 3.13) – 1 No
4.	Firmware and Software application as per Chapter 2 Section 2.2 – 1 Lot
5.	PCB Hardware Design Project Files including Schematics, Layout, Gerber's, Plots, films, Signal & Power Integrity Analysis, Thermal Analysis, BOM etc. Parts List: Detailed parts list with part numbers shall be provided.
6.	FPGA Design Firmware Project Files with source code compatible with Vivado/Vitis and executable, Flowcharts, Simulations & Analysis Design files, etc. in digital format
7.	Source code of all application shall be provided.
8.	Design Software, GUI Project Files and executable, third party device /software's used in the System with license etc.

9.	User/Operational Manual, ATP, Test Reports, Technical Datasheets, Technical Manual, Programming Manual, SRS, Software/Firmware Design Document, Troubleshooting Documents, any other pertinent information of functional modules used, Interface connectivity document etc. in Digital format.
10.	Detailed documentation of all the proprietary data formats, bit-by-bit information on the header and data patterns should be provided in digital format.
11.	Mechanical CAD Drawings and Project Files etc.

CHAPTER-2

2 SYSTEM TECHNICAL SPECIFICATIONS

2.1 AI FPGA ACCELERATED CARD

2.1.1 The Vendor shall carry out Development, Implementation, and Realisation & Testing of the AI FPGA Accelerated Card.

2.1.2 The vendor shall develop the AI FPGA Accelerated Card as per the block diagram(tentative) shown below, Vendor can Design the hardware with better specifications and performance as mentioned in the tender with supportive proposal document

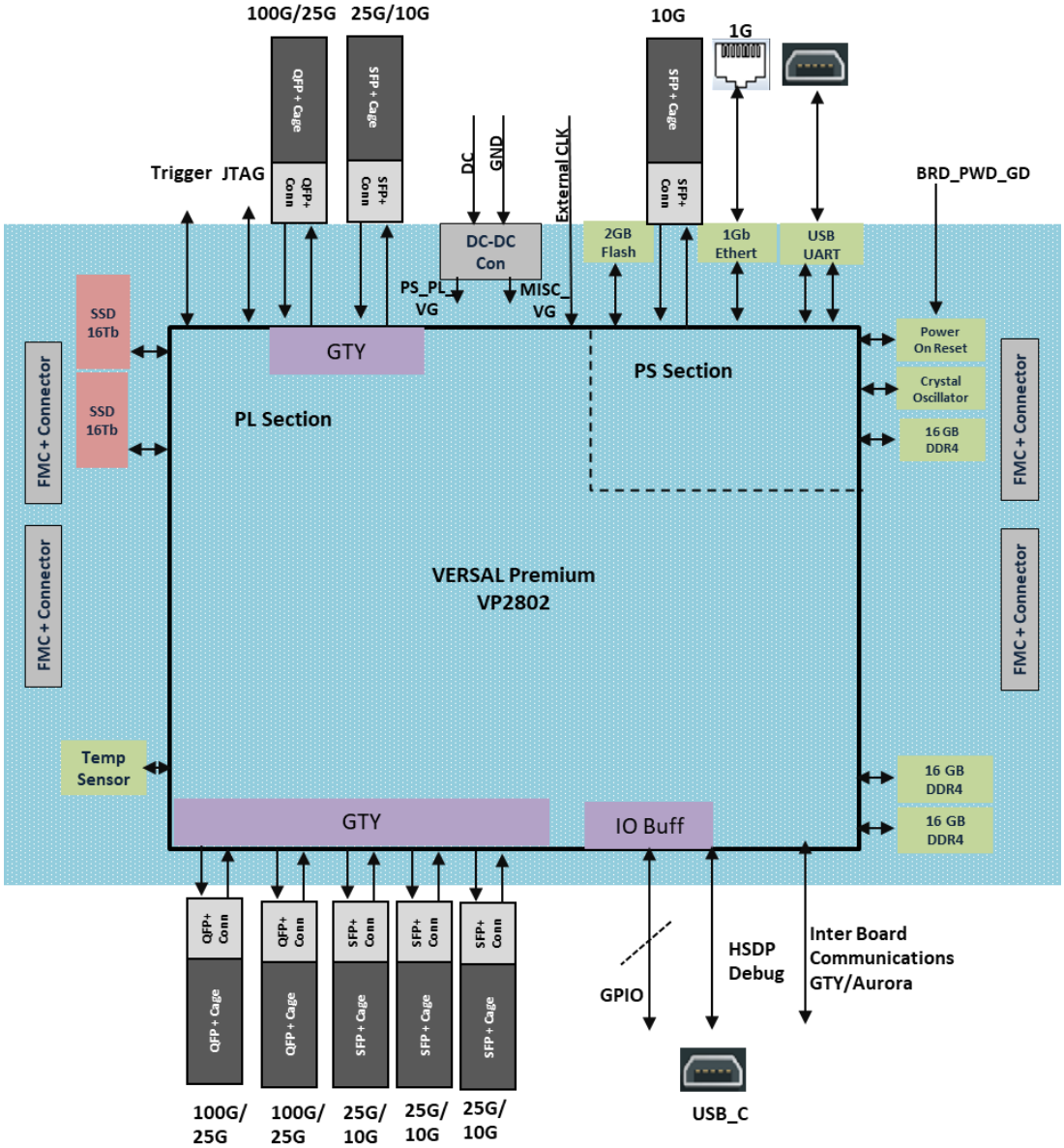

Figure 1. VERSAL ACAP Hardware Board Block Diagram (Tentative)

2.1.3 The hardware specifications are as follows:

Table 3. AI FPGA Accelerated Card Specifications

S.no	Parameter	Specification
1.	FPGA	Xilinx Versal ACAP Premium VP2802
	PL Peripherals	
2.	DDR Memory for FPGA	2 no's of DDR4 SDRAM 16GB, 64-bit, @ 2,400 MT/s
3.	USB-C	Debugging Port HSDP connections
4.	Programming port	1x JTAG
5.	Storage Interface	2X SATA interface with SSD (16TB each) or better. Vendor shall supply 2 nos of SSD with capacity of 16TB or better.
	PS Peripherals	
6.	DDR Memory	1 no's of DDR4 SDRAM 16GB, 64-bit, @ 2,400 MT/s
7.	Debugging Port	1x UART
8.	USB-C	Debug port
9.	Flash Memory for FPGA	2 GB OSPI flash or better
	Data Transfer	
10.	100Gb/25Gb Ethernet	3 No's through QSFP(PL)
11.	25Gb/10Gb Ethernet	4 No's through SFP (PL)
12.	10G/25G Ethernet	1 No's (PS) through RJ-45
13.	1G Ethernet	1 No's (PS) through RJ-45
14.	GTY/GTM(High speed communication)	Remaining no's of GTY/GTM (PL) shall be terminated with appropriate connector and used for Inter Board Serial Communications
	IO	
15.	GPIO(External I/O Timing signals)	20 No's at 5ns or better resolution with Proper buffering/signal conditioning Using micro D differential pins shall be provided.(PL Side)
16.	High Speed Connector	4 no's of FMC+ HSPC / HSPCe Connector or better
	RF Data Convertor	
17.	Multi-Channel RF Data Convertor Card	1nos of 18 Channel of Analog to Digital RF Data Convertor
18.	ADC	Each ADC 6 Channel RF data Convertor using TI AFE7906
19.	Input Frequency	Up to X-band
20.	NCO	Configurable

21.	ADC Sampling Rate	Configurable
22.	Interface	Multi-Channel RF Data Convertor Card shall be interfaced with FMC+ Connector
	General	
23.	Utility Signals	Clock (100MHz), Power, Trigger
24.	External Ref Clock Input	100MHz All the required Clocks for the Board shall be generated through PLL which is synchronised with External Ref Clock Input
25.	Built-in Test (BIT)	Vendor shall develop Built-in Test (BIT) consisting of diagnostic routines to support for health management of the system.
26.	Thermal Design	Sufficient Cooling/Thermal Management to be designed and implemented. Detailed thermal analysis to be carried out.
27.	Board Cooling	Conduction Cooling & Provision for forced air-cooling. In addition to that Vendor shall realise All-in-one Cooling unit for the FPGA device and deliver the same.
28.	Power Supply	Standard DC power Supply for board. Vendor shall supply 230 AC Power supply convertor to Standard DC power Supply separately.
29.	Operating Temperature Range	10º C to 40º C
30.	Humidity	50-95 % RH non-condensing
31.	Hazardous Material	All material used shall be Lead-free and RoHS complaint
32.	Packaging	Rugged packaging for moving platform
33.	Environmental Tests for AI FPGA Accelerated Card	Card has to be designed to qualify for following Environmental Tests.
		a) EMI/ EMC tests as per MILSTD 461-E (CS116, RS103)
		b) Card should be able to sustain the vibrations & shocks as per Vibration test:- 1 octave/min, one sweep in all three Axes frequency level 5 to 15 Hz +/- 1 mm

		15 to 20 Hz +/- 2 mm 20 to 50 Hz 0.5 g 50 to 70 Hz 0.5 g 70 to 500 Hz 0.5 g
		c) Shocks test: sine pulse width 11ms, Amplitude 0.5g Shock along each axis
	Clock Module	
34.	OCXO	Ultra Low Noise OCXO (Internal
35.	External clock	100 MHz External clock with switching provision Between internal OCXO / external clock
36.	Output frequency	100 MHz
37.	Output Power	+13 dBm
38.	Phase Noise	-100 dBc/Hz @ 10Hz ; -120 dBc/Hz @ 1KHz
39.	Short term stability	<5E-11
40.	No of Output	2 No's of 10MHz 2 No's of 100MHz
41.	**Ethernet Switch Module**	
a)	Switch should be 19" Rack Mountable with 48 ports of 1G/10G/25GbE (SFP/SFP+/SFP28 ports and 8 ports of 40G/100GbE (QSFP+/QSFP28).	
b)	Switch shall be provided with 24 x25G multimode, 2x40G multimode, 2x100G multimode Transceivers and 1x100G, 1x25G DAC cables.	
c)	Switch should have non-blocking architecture and shall have minimum switching capacity of minimum 4 Tbps, 16GB DRAM, 32 GB Flash/SSD, 32MB Packet buffer, at least 96K MAC addresses. Support 60K IPv4 and 30K IPv6 entries, 6K multicast routes	
d)	Switch should support IEEE802.1p, IEEE802.1Q, Flow control, 802.1D, 802.1w, 802.1s, Jumbo frames (9K bytes), 802.3ad, private VLAN, UDLD/DLDP/DULD, ERPS/RRRP or equivalent, LLDP Ethernet routing and multicast protocols like BGPv4, MP-BGP, OSPF (v2, v3), RIPv2/ng, Static routes, VXLAN, EVPN, PIM-DM, PIM-SM/SSM, MSDP, BFD, DCBX, ECN, VRRP/HSRP, VRF, Policy based routing, ACLs for both IPv4 and IPv6 and Control Plane ACLs	
e)	Switch should support IP SLA or equivalent for monitoring quality of voice traffic using UDP Jitter for VoIP tests, SSH, SSL/HTTPS, SNMPv3, sFlow or equivalent, RADIUS, TACACS+, RadSec, SSH v2 and SNMPv3	
f)	The switch should have safety/emissions certifications including UL/CUL 60950, EN 55024, VCCI Class A or equivalent and should have RoHS compliance	
g)	OEM will be preferred with consistent presence in Leaders quadrant of Gartner's Magic Quadrant for Wired and Wireless LAN Access Infrastructure for the last five years, Warranty- 3-year 24x7 support	
h)	Proposed network switches and transceivers should from same OEM for	

	interoperability and ease of management. Manufacturers Authorization Letter should be provided

2.1.4 Vendor shall develop the AI FPGA Accelerated Card as per the specifications mentioned in Table 3.

2.1.5 Vendor shall develop the firmware, test and qualify for the following:

- 100G/25G/10G Ethernet between board to board
- 25G/10G Ethernet between board and PC.
- DDR4 Memory Interface
- SATA Interface and data transfer between FPGA & SSD.
- Board-to-Board Communication via GTY/GTM lines (Aurora).

2.1.6 The vendor shall design, develop and supply the required firmware application to test, verify and qualify for all the functionalities of the Hardware System Peripherals.

2.1.7 Vendor shall test and qualify the data transfer at specified rate (100G, 25G, and 10G) via Ethernet loopback mode and DDR.

2.1.8 The Vendor shall provide OCXO of 100MHz Clock Source (as per Table 3 S.no 34-40).

2.2 WEATHER RADAR NOWCASTING APPLICATION SPECFICATIONS

2.2.1. The vendor shall implement Neural Network (NN) based now casting on weather radar data in near real-time, and produce accurate now casts. The now cast shall be for t0+5 min to t0+120 min with time interval of 10 min.

2.2.2. The Data Products generated by weather radar (few scans before the current scan) shall be used as input to Nowcasting algorithms for generating Nowcasting output. These data files shall be provided by ISTRAC.

2.2.3. The Now casting model shall take any of Gridded composite reflectivity data ,Gridded CAPPI reflectivity data, Gridded rainfall rate (SRI) ,Gridded accumulated rainfall of last 10 min (PAC) of 1km X 1km X 10 min resolution as input in NetCDF or relevant formats.

2.2.4. The vendor shall implement application for receiving the trained data coefficients and inference phase shall be implemented on AI FPGA Accelerated Card.

2.2.5. The Vendor shall develop the application for sending, receiving and archiving the Input data from the archival Machine via 25G/10G.

2.2.6. The vendor shall digitize the RF Signal from the weather Radar and generate the base product & derived products and shall generate the Nowcasting data.

2.2.7. The vendor shall develop firmware application to receive the weather radar data via 25G/10G by AI FPGA Accelerated Card & transfer the data to Accelerated processing.

2.2.8. The vendor shall develop the application for sending nowcast output data from AI FPGA Accelerated Card.

2.2.9. The following are the existing open source Nowcasting algorithms which shall be implemented by the vendor in FPGA Accelerator using AI engines:

- U Net based Precipitation Nowcasting: RainNet
- Deep learning based Precipitation Nowcasting: Deep Mind Model

Table 4. NN based nowcasting models in a nutshell

Model Name	**Input Radar images**	**Product used**	**Spatio –temporal resolution of radar data**
Rain Net	4 (928×928×4)	Rainfall –depth composite	Spatial -1km ×1km Temporal -5 min
Deep Mind	4 (1536 × 1280 ×4)	Precipitation rate	Spatial -1km ×1km Temporal -5 min

2.2.10. Vendor shall demonstrate the Now casting application in the Xilinx VERSAL AI Core Series VCK190 evaluation kit initially and prove the same application on the AI Accelerated FPGA board.Vendor shall supply the Xilinx VERSAL AI Core Series VCK190 evaluation kit, Xilinx IP Core EF-DI-25GEMAC-SITE and accessories along with other deliverables.

2.2.11. Now casting application in FPGA shall be evaluated by bench marking with respect to the same algorithm running in Works station.

2.2.12. The now casting data should be correlated more than 80% with real data. This has to be evaluated by the vendor for multiple iterations.

2.2.13. AI FPGA Accelerated Card with Weather Radar Now casting application shall be capable of round- the clock continuous 24/7 operations during its useful life. State of art technology shall be incorporated in the design and development of the hardware. All the component of hardware shall be of industry standard or better. The Vendor is required to submit a complete analysis of MTBF (Mean

Time between Failures) and MTTR (Mean Time to Repair). The MTBF of the hardware system should be greater than 5000 hours .The MTBF of the entire component should be greater than 50000 hours.

CHAPTER-3

3 GENERAL GUIDELINES TO VENDORS

3.1. System Life & Reliability:

The projected useful life of the system is 15 years after acceptance at ISTRAC. The system shall be capable of round-the-clock continuous operation during its useful life. All components of the system shall be of industrial standard or better. The system shall be designed on a modular concept. When a fault has been located in a module, its replacement shall be possible without realignment and adjustment of the system. The vendor shall submit an analysis of all single point failures the system may prone to and submit a detailed failure mode/contingency operation plan. The vendor is required to submit a complete analysis of MTBF (Mean Time between Failures) and MTTR (Mean Time to Repair) of System.

3.2. Acceptance Testing:

The vendor shall submit detailed test plans for Factory Acceptance Testing (FAT) prior to shipment and Site acceptance test (SAT) after installation & at ISTRAC. The test plan shall require approval by ISRO. The object of the tests shall be the verifications of performance of the system as per the specifications and functional requirements. As per the mutually agreed test procedures, FAT shall be carried out at the vendor's premises prior to shipment. The equipment shall be shipped only after satisfactory conclusion of the pre-shipment acceptance testing. As per the mutually agreed test procedures, site acceptance test should be carried out at ISTRAC. The vendor shall arrange for necessary test equipment.

3.3. Training

The Vendor shall provide training in design, operation, maintenance and servicing of the systems delivered to persons from ISTRAC/ISRO. The training shall include lecture on the system design, hardware, software and such other aspects, which are considered essential for optimum utilization of the system including changing any components and subsystems,if required. The

Vendor should provide intensive training to ISTRAC/ISRO in the use, modification and up gradation of the source code. The Vendor shall provide minimum training of 10 days for 6 persons nominated from ISTRAC/ISRO at ISTRAC Bangalore.

3.4. **Software & Documentation:**

Vendor shall provide detailed technical manuals, operational manuals, service and maintenance manuals, troubleshooting manuals, etc. The documentation shall cover layout diagrams of all sub-systems and components for systematic fault diagnostic. The documentation shall cover all systems, components and software (including source). Documents on the software should also include algorithms and flow charts. These documents should be sufficiently explainable and should be prepared after discussions with ISTRAC. All supplied software should be such that ISTRAC users should be able to develop and modify, if needed. Hardware design & Fabrication files (PCB design files and Gerber files) to be supplied by the party. Schematic Diagrams of all assemblies, modules shall be provided. All the schematic diagrams shall be of same size. Schematics/layout of circuits/modules procured from other Vendors also shall be provided.

3.5. **Part list:**

Detailed parts list shall be provided. It shall contain each and every item, mechanical, electrical etc. used in the System. Suitable coding of the parts may be done (e.g. MP-Mechanical Part) for easy identification. Each part shall be identified with-

- Module / Unit Number.
- Part Number in the module.
- Full description (resistance, I C. etc.)
- Its value, tolerance, size, wattage, etc.
- Commercial nomenclature.
- Manufacturer's name (if commercial)
- Company's part number (if made in house)

A separate list of all electrical/electronic parts with full description of specifications and number of times used in the system shall be appended to parts list.

It shall be the responsibility of the Vendor to provide detailed parts list of modules etc. procures from outside. Only such items may be used in the system whose full technical details (schematic diagrams, theory, part lists) are made available by the manufacturer.

3.6. **Other Specifications/Requirements:**

ISTRAC reserves the right to witness the tests and review the progress of work at various milestones of the program at any point of time during the contract tenure.

The design, development and testing of the system will be reviewed by an expert committee/responsible engineers' of ISTRAC at all stages and any suggestion by the committee/technical experts should be incorporated. ISTRAC reserves the right to witness the tests and review the progress of work at various milestones of the program at any point of time during the contract tenure. Any deviation in the design, material, configuration, component, etc. from the approved proposal/design will be subject to the approval of the ISTRAC expert committee.

The system shall be capable of round-the-clock continuous operation during its useful life. All components/devices shall be of industrial grade or better with high quality and reliability. Only SMD components shall be used. No evaluation kits shall be used.

All the components used in the system should be of high quality and reliability to support long-term operation of the system. They should be from highly reliable and reputed manufacturers with proven track record. Make, model numbers and detailed technical specifications of all the components should be provided.

Vendor shall submit the full details of the hardware, including model numbers and the software proposed to be employed for meeting the requirements given herein. It shall be the responsibility of the vendor to providedetailed parts list of modules sourced. List of items imported and incorporated in the system

should also be provided separately. Only such items may be used in the system whose technical details are made available by the manufacturer.

All software source codes and installation kit containing actual deliverable software shall be provided.

All transportation charges are the responsibility of the vendor.

Vendor shall not engage third party for the development of software/firmware and claim that the required software is from third party and not to deliver the source code. If third party is developing the software/firmware, a clear agreement shall be executed with the party in consultation with ISTRAC. In this scenario, agreement shall be executed to hand over the source code and executable to be delivered under this development along with the final deliverables. Any standard drivers available in the market used for the development will not come under this clause and that shall be specified in advance.

Complete technical details, design document, software, third party device drivers and other blueprints about the system/subsystem shall be handed over to ISTRAC/ISRO under non-disclosure agreement to the third party.

Vendors are required to furnish clause-by-clause compliance of specifications bringing out clearly the deviations from specifications, if any. Otherwise, their bid will not be accepted. During evaluation and comparison of bids, ISTRAC may, at its discretion, ask the vendor for clarification of his bid. ISTRAC reserves the right to change or vary any part thereof at any stage.

The vendor shall give an assurance for continued supply of accessories, spares and consumables for a period of 10 years minimum from the date of acceptance. The vendor shall do necessary modifications in the design based on PDR committee suggestions & recommendations. All the sub-systems/components should meet or be better than the technical specifications provided in tender document.

3.7. **Quality Assurance:**

The item should be of the latest production lot, conforming to the current production standard and having 100% defined life at the time of delivery.

3.8. **Inspection Authority:**

ISTRAC/ISRO

3.9. **Intellectual Property Rights:**

All Intellectual Property Rights such as patents, copyrights, design rights etc. shall be owned by ISTRAC only.

3.10. **ISTRAC/ISRO Prerogative:**

Since ISRO supports the technological guidance, all system/ subsystem/documents jointly hold the rights and have logo of both the parties.

Complete technical details, design document, software, third party device drivers and other blueprints about the system/subsystem shall be handed over to ISTRAC/ISRO. ISRO have the right to modify the software/application for their purpose as and when required for the operation of the nowcasting system/improving its performance/error rectification

3.11. **RESPONSIBILITY MATRIX:**

Table 5. Responsibility Matrix

Responsibility of Vendor:	
1.	The Vendor shall carry out Development, Implementation, Realization & Testing of the AI FPGA Accelerated Card. as per the Specification in Chapter- 2
2.	Vendor shall develop the firmware, test and qualify as per the Chapter- 2 Section 2.2
3.	Supply of Ethernet switch as per Chapter-2 Table 3
Responsibility of ISTRAC:	
4.	The data files input for the Now casting application will be provided as per clause 2.2.2
5.	Work station for sending input data and Archival system(NAS) will be provided as per clause 2.2.5
6.	Trained coefficients will be provided as per clause 2.2.4

Annexure 1: Compliance Sheet

Table 6 Annexure 1: Compliance Sheet

S.no	Clause	Compliance (Yes/No)	Remarks from Vendor
1.	CHAPTER1: INTRODUCTION & OBJECTIVE		
2.	Clause 1.1.		
3.	Clause 1.2.		
4.	Clause 1.3.		
5.	Clause 1.3a)		
6.	Clause 1.3b)		
7.	Clause 1.3c)		
8.	Clause 1.3d)		
9.	Clause 1.3e)		
10.	Clause 1.3f)		
11.	Clause 1.4.		
12.	Clause 1.5.		
13.	Clause 1.6.		
14.	Clause 1.6.1		
15.	Clause 1.6.1 a)		
16.	Clause 1.6.1 b)		
17.	Clause 1.6.1 c)		
18.	Clause 1.6.1 d)		
19.	Clause 1.6.1 e)		
20.	Clause 1.6.1 f)		
21.	Clause 1.6.1 g)		
22.	Clause 1.6.2		
23.	Clause 1.6.2 a)		
24.	Clause 1.6.2 b)		
25.	Clause 1.6.2 c)		
26.	Clause 1.7. a) b) c)		
27.	Clause 1.8.		
28.	Clause 1.8.1 a)		
29.	Clause 1.8.1 b)		
30.	Clause 1.8.1 c)		
31.	Clause 1.8.1 d)		
32.	Clause 1.8.2 a)		
33.	Clause 1.8.2 b)		
34.	Clause 1.8.2 c)		
35.	Clause 1.8.2 d)		
36.	Clause 1.8.2 e)		
37.	Clause 1.9.		
38.	Clause 1.10.		

	Table.1.S.No 1 S.No 2 S.No 3 S.No 4 S.No 5 S.No 6		
39.	Clause 1.11.		
40.	Clause 1.11 a)		
41.	Clause 1.11 b)		
42.	Clause 1.11 c)		
43.	Clause 1.11 d)		
44.	Clause 1.11 e)		
45.	Clause 1.11 f)		
46.	Clause 1.11 g)		
47.	Clause 1.11 h)		
48.	Clause 1.11 i)		
49.	Clause 1.11 j)		
50.	Clause 1.11 k)		
51.	Clause 1.11 l)		
52.	Clause 1.12.		
53.	Clause 1.13.		
54.	Clause 1.13 a)		
55.	Clause 1.13 b)		
56.	Clause 1.14.		
57.	Clause 1.14 a)		
58.	Clause 1.14 b)		
59.	Clause 1.14 c)		
60.	Clause 1.14 d)		
61.	Clause 1.14 e)		
62.	Clause 1.14 f)		
63.	Clause 1.14 g)		
64.	Clause 1.14 h)		
65.	Clause 1.14 i)		
66.	Clause 1.15.		
67.	Clause 1.15 a)		
68.	Clause 1.15 b)		
69.	Clause 1.15 c)		
70.	Table 2 S.No 1.		
71.	Table 2 S.No 2.		
72.	Table 2 S.No 3.		
73.	Table 2 S.No 4.		
74.	Table 2 S.No 5.		
75.	Table 2 S.No 6.		
76.	Table 2 S.No 7.		
77.	Table 2 S.No 8.		
78.	Table 2 S.No 9.		
79.	Table 2 S.No 10.		
80.	Table 2 S.No 11.		

81.	CHAPTER2: TECHNICAL SPECIFICATIONS FOR AI FPGA ACCELERATED CARD		
82.	Clause 2.1		
83.	Clause 2.1.1.		
84.	Clause 2.1.2.		
85.	Clause 2.1.3.		
86.	Clause 2.1.3 S.No 1.		
87.	Clause 2.1.3 S.No 2.		
88.	Clause 2.1.3 S.No 3.		
89.	Clause 2.1.3 S.No 4.		
90.	Clause 2.1.3 S.No 5.		
91.	Clause 2.1.3 S.No 6.		
92.	Clause 2.1.3 S.No 7.		
93.	Clause 2.1.3 S.No 8.		
94.	Clause 2.1.3 S.No 9.		
95.	Clause 2.1.3 S.No 10.		
96.	Clause 2.1.3 S.No 11.		
97.	Clause 2.1.3 S.No 12.		
98.	Clause 2.1.3 S.No 13.		
99.	Clause 2.1.3 S.No 14.		
100.	Clause 2.1.3 S.No 15.		
101.	Clause 2.1.3 S.No 16.		
102.	Clause 2.1.3 S.No 17.		
103.	Clause 2.1.3 S.No 18.		
104.	Clause 2.1.3 S.No 19.		
105.	Clause 2.1.3 S.No 20.		
106.	Clause 2.1.3 S.No 21.		
107.	Clause 2.1.3 S.No 22.		
108.	Clause 2.1.3 S.No 23.		
109.	Clause 2.1.3 S.No 24.		
110.	Clause 2.1.3 S.No 25.		
111.	Clause 2.1.3 S.No 26.		
112.	Clause 2.1.3 S.No 27.		
113.	Clause 2.1.3 S.No 28.		
114.	Clause 2.1.3 S.No 29.		
115.	Clause 2.1.3 S.No 30.		
116.	Clause 2.1.3 S.No 31.		
117.	Clause 2.1.3 S.No 32.		
118.	Clause 2.1.3 S.No 33.		
119.	Clause 2.1.3 S.No 34.		
120.	Clause 2.1.3 S.No 35.		
121.	Clause 2.1.3 S.No 36.		
122.	Clause 2.1.3 S.No 37.		
123.	Clause 2.1.3 S.No 38.		
124.	Clause 2.1.3 S.No 39.		
125.	Clause 2.1.3 S.No 40.		

126.	Clause 2.1.3 S.No 41.		
127.	Clause 2.1.4.		
128.	Clause 2.1.5.		
129.	Clause 2.1.6.		
130.	Clause 2.1.7.		
131.	Clause 2.1.8.		
132.	Clause 2.2		
133.	Clause 2.2.1.		
134.	Clause 2.2.2.		
135.	Clause 2.2.3.		
136.	Clause 2.2.4.		
137.	Clause 2.2.5.		
138.	Clause 2.2.6.		
139.	Clause 2.2.7.		
140.	Clause 2.2.8.		
141.	Clause 2.2.9.		
142.	CHAPTER 3: SCOPE OF WORK		
143.	Clause 3.1.		
144.	Clause 3.2.		
145.	Clause 3.3.		
146.	Clause 3.4.		
147.	Clause 3.5.		
148.	Clause 3.6.		
149.	Clause 3.7.		
150.	Clause 3.8.		
151.	Clause 3.9.		
152.	Clause 3.10.		
153.	Clause 3.11.		
154.	Table 5 S.No 1. `		
155.	Table 5 S.No 2.		
156.	Table 5 S.No 3.		
157.	Table 5 S.No 4.		
158.	Table 5 S.No 5.		
159.	Table 5 S.No 6.		