MCF/EOI/2020/02 – EOI for Supply & Installation of 11-meter Full motion Ka band Ground station terminal

Government of India
Department of Space
Master Control Facility-ISRO
Hassan-573201, Karnataka, India

Invitation for Expression of Interest (EOI)

Supply Installation Test & Commissioning (SITC) of Ground Payload Reception Facility (GPRF)

1. The Expression of Interest (EOI) is sought for Establishment of Ka band Ground station terminals at two places in the Indian mainland as part of augmentation of MCF (Master Control Facility, Hassan, India) for payload data reception from the Geo Synchronous satellite. These terminals track the satellites and receive data from the satellite for further processing.

2. Introduction:

Master Control Facility (MCF) is one of the Units of Indian Space Research Organization (ISRO) under the Department of Space, Government of India. The primary responsibility of MCF is to support TTC (Telemetry, Tracking & Command) operations to various Communication / Navigational / Scientific Application Satellites of ISRO namely GSAT / INSAT / IRNSS series of satellites. The center is also responsible to monitor the payload and receive data from satellite for further processing.

MCF plans to augment ground stations for the upcoming Geo-synchronous satellite operating in Ka-Band Frequencies. As part of this, about 06 nos of full-fledged 11m Ka band receive only antenna system with state-of-the-art electronics is planned to be installed and commissioned at two places (03 at each place). The entire work involving Design, Supply, Installation, Testing and Commissioning of the proposed system is envisaged to be completed on TURNKEY basis, in about 30 months from the Effective Date of Contract (EDC). The complete antenna system and the associated elements shall have comprehensive remote monitoring and control features to enable unmanned operations.

3. Brief Scope of the Project:

The Scope of Work for this project involves a “TURN KEY” solution concerning

   a) System Design
   b) Delivering the systems & equipment at site
   c) On-site Installation & Commissioning
   d) System & Sub-system level testing and Operationalization
   e) Customer Training
   f) Warranty & Long term Maintenance support

4. Ground Station terminal: This station shall have 03 Nos (Three) about 11m diameter Ka-Band receive only antenna system with monopulse tracking Feed with RF electronics and Baseband system for demodulating etc. Major specification of the Ground station terminal is as follows.
### Item description | Specification
--- | ---
Antenna Type | About 11 meter Solid Parabolic dish with dual reflector & shaped Cassegrain/Gregorian geometry.
Antenna Mount | Elevation Over Azimuth.
Feed type | Multimode Monopulse Tracking 4 port Frequency reuse LP feed having 02 Receive & 02 Tracking composite error port (Orthogonal ports) Selectable
Operating Freq. Receive Tracking (Monopulse) | 25.5 to 27 GHz.
Gain at Feed: Receive | 25.5 to 27 GHz.
Gain at Feed: Receive | 67 dBi +20 log (f/25.5 GHz) with efficiency ≥ 60%
G/T at 10deg elevation | 42.5 dB/K + 20 log (f/25.5GHz) dB
Polarization | LP-V and LP-H
Radiation Pattern | Meets ITU – R S.580-6
Drive Coverage | Elevation Azimuth Polarization
Drive Coverage | -1 to 91 Deg. +/- 270 Deg min.
Drive Coverage | +/- 100 Deg.
Drive Speeds | Max := 1deg/sec, Min: 0.01 deg/sec or less in both Axes
Azimuth / Elevation tracking drive speed: | >1 deg/Sec min in all drive modes.
Tracking Acceleration: | >1deg/Sec2 min in all drive modes.
POL speed: | About 10-15deg/minute

**Features:**
- Two Down link chains in Ka band including high data rate demodulator (HDRM). Technical demonstration shall be arranged for offered High data rate demodulator at MCF-Hassan/SAC-Ahmadabad before price bid opening to find suitability of HDRM. If required, the bidder needs to change the unit with suitable make without any cost effect.
- Performance & functionality of the reception system of the HDRM to be demonstrated with the built-in simulator and external compatible simulator as well.
- High Data Rate Demodulator (HDRM) major specification:

<table>
<thead>
<tr>
<th>Mainly</th>
<th>Three basic functions required,</th>
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<tbody>
<tr>
<td>1.</td>
<td>Demodulation and Bit Synchronization</td>
</tr>
<tr>
<td>2.</td>
<td>Frame Synchronization and Data Processing</td>
</tr>
<tr>
<td>3.</td>
<td>Data Simulation and Modulation</td>
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</table>

All functions including simulation shall be available simultaneously.

**Modules shall comply with CCSDS standards wherever applicable, and provision should exist to exclude/include CCSDS features**

**Provision for Clock & data output for BPSK, I, Q, I+Q (Bit synchronizer outputs) for QPSK and three data streams output and clock for 8PSK shall be available.**
<table>
<thead>
<tr>
<th><strong>Number of independent channels</strong></th>
<th><strong>Two</strong></th>
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<tr>
<td><strong>Input Frequency</strong></td>
<td>1.2GHz or 2.4GHz or as applicable for BDC/Converter planned</td>
</tr>
<tr>
<td><strong>Acquisition range</strong></td>
<td>Programmable up to +/- 1 MHz</td>
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<tr>
<td><strong>VSWR</strong></td>
<td>( \leq 1.5 )</td>
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<tr>
<td><strong>Dynamic Range</strong></td>
<td>-10 dBm to -50 dBm</td>
</tr>
<tr>
<td><strong>Acquisition Time</strong></td>
<td>&lt; 300 msec</td>
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<tr>
<td><strong>Dual Demodulation using Two separate IF inputs</strong></td>
<td>No degradation in BER performance with this feature</td>
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<tr>
<td><strong>Demodulation modes</strong></td>
<td>BPSK/QPSK/8PSK Selectable and all should work in both modes i.e with and without De-randomizer, De-compression, RS decoding, Differential decoding, Viterbi decoding, (selectable), pulse shaping filter etc</td>
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<tr>
<td><strong>Sync. Threshold</strong></td>
<td>Eb/No better than 3.5 dB</td>
</tr>
<tr>
<td><strong>Filter Type</strong></td>
<td>FIR, symmetrical up to 60 taps, programmable</td>
</tr>
<tr>
<td><strong>Response</strong></td>
<td>Raised cosine, root raised cosine, Gaussian, User defined characteristics in ASCII file</td>
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<tr>
<td><strong>Bitrate</strong></td>
<td>Minimum Data Rate 10 Msp (Mega symbols per second) for all demodulations per chain</td>
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<tr>
<td></td>
<td>Maximum Data Rate as given below :</td>
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<tr>
<td><strong>For BPSK Modulation:</strong></td>
<td></td>
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<tr>
<td></td>
<td>320 Mbps (1X 320 Mbps) or more (desirable) for each chain simultaneously</td>
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<tr>
<td><strong>For QPSK Modulation:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>640 Mbps (2X320 Mbps) or more (desirable) for each chain simultaneously</td>
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<tr>
<td><strong>Data format</strong></td>
<td>Selectable from NRZ-L, NRZ-M, NRZ-S.</td>
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<tr>
<td><strong>Bit sync Coasting</strong></td>
<td>Shall be able to hold lock for data containing 128 bits (for NRZ type) of continuous zeros or ones.</td>
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<tr>
<td><strong>Viterbi Decoding</strong></td>
<td>Enable / Disable</td>
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<tr>
<td><strong>RS Decoder</strong></td>
<td>CCSDS recommended encoder configuration RS (255, 239) with Virtual fill and Interleaving. One RS Decoder/ IF chain The specification of Generator polynomial, Virtual fill and interleaving for encoder are as specified by CCSDS &quot;TM Synchronization and Channel Coding &quot;recommended Standard CCSDS 131.0-B-2 Blue Book Aug 2011 Optional : CCSDS recommended RS(255, 223) encoder (including virtual fill and interleave ) to be quoted as option as per Reed-Solomon Encoder (255,239) Encoding (CCSIDS-131-0-B-2 Aug 2011)</td>
</tr>
<tr>
<td><strong>Provision to feed basic band data I, Q, C and Clock externally to the BPSK, QPSK and 8PSK modulator</strong></td>
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<td><strong>Data simulator output (Data, Clock) that is going to modulator shall be available externally</strong></td>
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- The antenna system shall have Mono pulse tracking facility
- Instrumentation for monitoring and calibration purpose
- Weather monitoring system, M&C system, Timing System
All the active systems shall have required redundancy capability.

**Note:** It is advisable to HDRM manufacturer to evaluate the HDRM through SAC-Ahmedabad (INDIA) as early as possible.

5. **Eligibility Criteria.**

MCF-ISRO is looking for prospective vendors who have a proven record of establishing 11-meter Full Motion Ka Band Ground Station in unattended automated operations with satisfactory performance.

System Integrators or Original Equipment Manufacturers (OEMs) or their authorized representatives with following eligibility criteria are invited to provide Eoi for this project.

i. The Bidder (OEM/SI) shall have at least 5 years of experience in installation and commissioning of ground station (of similar nature) for satellite communication. Bidder shall provide the details of purchase orders, completion certificates and completion schedule with relevant references/ contact details that are executed by them in last 5 years to prove that the bidder has executed the project involving Design, supply, installation and commissioning of the satellite ground terminals. Satisfactory completion certificate from the customer is a must to substantiate the experience.

ii. The Bidder/OEM for Antenna, must submit customer satisfaction certificate with respect to the successful completion of installation and commissioning of at least two numbers of 8 m or above size monopulse antenna in either Ka-Band or Higher bands during last 5 years. The offered system for this requirement should have the same Make for servo system, mechanical system and feed system, as supplied to the customer whose customer satisfaction certificate has been included for eligibility.

iii. The response not containing the successful completion certificate obtained from the customer in respect of installation and commissioning of at least two numbers of 8 m or above size monopulse antenna system shall be treated as non-compliance and bidder will be disqualified. Customer address and contact numbers are to be mentioned in the certificate for verification of bidder claim with regard to successful completion of the project. Experience with only step track/program track is treated as not compliant. With regard to this the bidder need to mandatorily fill up the following table 1-1 with relevant information failing which the Eoi will be rejected. The Experience of OEM (whose antenna system is being offered) shall also be considered for this if bidder does not have this experience.

<table>
<thead>
<tr>
<th>SL No</th>
<th>Customer name</th>
<th>Customer address</th>
<th>Antenna size</th>
<th>Frequency band</th>
<th>Make of Servo System and Feed equipment</th>
<th>Mechanical system and Feed equipment</th>
<th>Monopulse system (Yes/No)</th>
<th>Type of Technique used for a monopulse antenna (true, pseudo, non-monopulse etc.)</th>
<th>Whether customer satisfaction certificate with regard to completion and commissioning is enclosed (Yes/No)</th>
<th>Time taken to complete the project after obtaining the order</th>
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Table 1-1
iv. Bidder shall provide details of financial profile of the company (SI/OEM), product range (as OEM), manpower profile, turn-over status and experience in the field of satellite communication of the company for the last 05 years. To substantiate such claim must be supported by documentary proof.

v. Bidder should have had average annual financial turnover not less than 150 Crore (Equivalent in FE) during the last three years ending 31.03.2019. Chartered Accountant's Certificate for the Annual financial turnover and balance sheet showing Profit & Loss statement to be provided.

vi. Bidder should not have incurred any loss in last three years ending 31.03.2019.

vii. SI/OEM shall have satisfactorily executed three orders (Maximum for calculating the order value) of cumulative value amounting to Rs 60 Crores (or equivalent in FE) in Satcom field in last 05 years. Such claim shall be substantiated with documentary proof.

The EOI shall address delivery of equipment, software, firmware, hardware and transportation. Installation services, testing, training, documentation and warranty support for a period of 3 years and CAMC for 5 years after expiry of warranty.

6. Selection Process:

The selection process would be of following steps.

Step-1: Based on the experience proof/ bidder eligibility furnished by the vendors as per the eligibility criteria mentioned above, the vendors will be shortlisted.

Step-2: Subsequent evaluation of the competency and other technical & financial capability of the shortlisted vendors will be done by a team of Technical Evaluation Committee of MCF-ISRO by calling for technical presentation etc., if necessary.

TEC will evaluate the bidder based on the capability, concept & schedule to the satisfaction that work allotted will be done at satisfied level without any hindrance and slippage of schedule by bidder.

Those vendors who qualify after step 2 mentioned above, will be provided with Request For Proposal document (RFP) & the bidder have to submit a Non-Discloser Agreement (NDA). There will be a pre-bid meeting with these vendors to ensure that the requirements of MCF are properly understood and that the offer is made compliant to MCF technical and commercial terms & conditions on Limited Tender Basis to enable them to submit Two Part Tender consisting of:

Part-A: Techno Commercial Bid containing technical specifications, deliverables, detailed description of sub-systems, time schedule, commercial terms etc.

Part-B: Price bid containing price details.

Only Techno-commercial bid will be opened first and the same shall be evaluated with reference to our technical requirements and vendors will be short-listed. Subsequently the price bids of the short-listed vendors will be opened and contract will be finalized.

7. Submission of Expression of Interest (EOI)

Firms meeting the eligibility criteria and interested in this project shall submit their application along with copies of all relevant documents (to establish their eligibility) to the Purchase & Stores Officer, Master Control Facility, Hassan Karnataka in a sealed envelop superscribing "MCF/EOI/2020/02 - Expression of Interest for Supply &
Installation of 11-meter Full motion Ka band Ground station terminal so as to reach Purchase & Stores Officer MCF on or before 30.03.2020 hours on 1630. MCF reserves the right to reject any or all EOIs without assigning any reason thereof.

Fig. 1: Indicative Block Diagram of Ka-Band Monopulse Tracking Receive
Only Full Motion Antenna System