COMMI

Request For Proposal

for

Providing TTC&R Transfer Orbit Support Services (TOSS) for ISRO's GSO Satellite Missions

MASTER CONTROL FACILITY(MCF),

ISRO, DEPT. OF SPACE

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List of Acronyms

Abbreviation	Full Form
ACU	Antenna Control Unit
AGC	Automatic Gain Control
AMF	Apogee Motor Firing
AOS	Acquisition of signal
AZ	Azimuth
BBU	Baseband Unit
bps	Bits Per Second
CCSDS	Consultative Committee for Space Data Standard
COP	Command Operation Procedure
CP	Circular Polarization
CSV	Comma Separated Values
E&M	Ear & Mouth
EIRP	Effective Isotropic Radiated Power
EL	Elevation
ESA	European Space Agency
NDR	Network Dress Rehearsal
FM	Frequency Modulation
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
G/T	Gain over Temperature
GEO	Geo-Stationary Orbit
GHz	Giga Hertz
GSO	Geo-Synchronous Orbit
ICD	Interface Control Document
IF	Intermediate Frequency
ISDN	Integrated Service Digital Network

Abbreviation	Full Form
ISRO	Indian Space Research Organization
Kbps	Kilo Bits Per Second
KMPH	Kilo Meter Per Hour
LAN	Local Area Network
LEB	Liquid Engine Burn
LEOP	Launch & Early Orbit Phase
LHCP	Left Hand Circular Polarization
LOS	Loss of Signal
LP	Linear Polarization
M&C	Monitoring and Control
Mbps	Mega Bits Per Second
MCF	Master Control Facility
MHz	Mega Hertz
ms	Millisecond
NCC	Network Control Centre
NDR	Network Dress Rehearsal
NRZ	Non Return to Zero
NSIL	New Space India Limited
PCM	Pulse Code Modulation
PM	Phase Modulation
PSK	Phase Shift Keying
RC	Rate Contract
RF	Radio Frequency
RFP	Request For Proposal
RHCP	Right Hand Circular Polarization
RSS	Root of Sum of Squares
RZ	Return to Zero
SCC	Satellite Control Centre

Abbreviation	Full Form
SOP	Specialized Operation Plan
TCP/IP	Transmission Control Protocol and Internet Protocol
TCU	Tele-command Unit
TLE	Two Line Element
TLM	Telemetry
TOSS	Transfer Orbit Support Services
TTC&R	Telemetry, Tracking, Commanding and Ranging
VPN	Virtual Private network
WAN	Wide Area Network

Contents

1. INTRODUCTION

The Master Control Facility (MCF), Hassan (Located in the state of Karnataka, India), is one of the Units of Indian Space Research Organization (ISRO), under the Department of Space, Government of India.

ISRO, India's Space Agency is responsible for realization of Satellite Bus Systems and Launch of CMS/EOS/NVS Series of Satellites towards meeting country's Communication, Navigation, Meteorological & Remote Sensing needs by facilitating delivery of end-to-end services in a demand driven model through parallel verticals viz. NSIL and IN-Space.

MCF is the nodal center for TTC Operations of India's GEO/GSO Satellites during Launch & Early Orbit Phase (LEOP), On-Orbit Phase until End-of Life (EOL) de-orbiting maneuvers.

MCF carries out these Operations through its TTC Facilities located at Hassan (Karnataka) and Bhopal (Madhya Pradesh).

Currently, around 30 GEO/GSO Satellites are being controlled by MCF. The number of Satellites controlled by MCF is likely to increase during coming years in view of growing demand within the country for space-based services across the various sectors, viz. Communication, Navigation & Strategic sectors. Hence, multiple GEO/GSO Missions are currently under various stages of approval & realization.

Therefore, to ensure un-interrupted Operations during the critical Launch & Early Orbit Phase (LEOP) Operations of future GEO/GSO Missions of India, MCF herewith invites proposals from prospective Ground TTC Service Providers towards Transfer Orbit Support Services (TOSS) for NSIL/ISRO's GEO/GSO Satellites.

In view of the above, MCF/ISRO envisages a Rate Contract (RC) with International partners/ TTC Network Service Providers to support Transfer Orbit Support Service (TOSS)/ LEOP of ISRO's GSO satellites. This Request for Proposal (RFP) is being targeted towards entering into RC for a period of **five years** with suitable TT&C Network Operator for catering to TOSS/ LEOP requirement of future GSO missions of ISRO.

If the service provider agrees to retain the cost prevailing in the fifth year, the RC can be extended with the same terms and conditions for an additional term of up to 1 calendar year with mutual consent.

DEFINITIONS: The term 'Purchaser' shall mean the President of India or his successors or assignees. The term 'Contractor' shall mean, the person, firm or company with whom or with which the order for the TOSS is placed and shall be deemed to include the Contractor's Successors, representatives, heirs, executors and administrators unless excluded by the Contract. The term 'Rate Contract' shall mean the communication signed on behalf of the Purchaser by an officer duly authorized intimating the acceptance on behalf of the Purchaser on the terms and conditions mentioned or referred to in the said communication accepting the Tender or offer of the Contractor for TOSS. The term 'TOSS' shall mean what the Contractor agrees to provide services in the RC & Purchase Order released under this for each mission.

Third Party Vendors: MCF acknowledges and agrees that bidder will be permitted to contract with third party suppliers for the provision of teleport or other associated services or facilities as necessary to support bidder's provision of TOSS hereunder. Bidder shall have the right to substitute comparable facilities as may be available to it in the event required to support overlapping missions (1 C-band & 1 Ku-band), address anomalies in in-orbit satellites, or in other unforeseen circumstances subject to compliance under provisions of Rule 144 (xi) of General Financial Rules. (Refer to the tender documents)

2. SCOPE OF WORK

Transfer Orbit Support Service (TOSS) is required during Launch & Early Orbit Phase (LEOP). MCF/ISROis looking forward for the TOSS service providers to support the MCF/ ISROLEOP operations. The number of external stations that are required for supporting TOSS mission of Satellite will vary as per mission requirement. It is expected that 2 to 3 external stations will be required for supporting the TOSS requirement.

3. MODALITY

The bidders shall submit bids on the ISRO e-Procurement Portal(www.eproc.isro.gov.in). The techno-commercial bids will be evaluated by MCF/ISRO from point of view of network stations, geographical location of stations, station configuration, suitability for meeting ISRO mission requirements, scope of future expansion and planned stations, past experience, acceptability to commercial terms. The firms which are found technically suitable on the above criteria will be shortlisted. The price bids of the shortlisted parties will be opened. Based on the acceptability of MCF/ISRO terms and conditions including price, a non-exclusive RC will be established between MCF/ISRO and service provider for a period of **five years**.

4. MCF LOCATION DETAIL

Location	Hassan, Karnataka State, India.
Nearest Highway	NH-75, 10 Km
Nearest Railway Station	Hassan, 12 Km
Nearest Airport	Bangalore, 200 Km
Latitude	13.07° North
Longitude	76.098° East
Altitude	980 Meters MSL
GEO Region visibility	1° E to 148° E @ 5° EL angle

5. CRITERIA FOR SERVICE PROVIDER

5.1 Vendor evaluation criteria

The following are the eligibility criteria for TOSS service providers. The service providers are requested to provide the following details:

5.1.1 Service provider shall have minimum 5 years' experience in TOSS operations. Supporting documents shall be provided.

5.1.2 Service provider should have successfully supported at least 5 TOSS operations in last 5 years. Supporting documents shall be provided.

5.1.3 Service provider shall indicate the capability to deploy technically skilled manpower having fluency in English for TOSS operations.

5.1.4 Service provider shall support the TOSS requirements with 99.95% reliable and 100% available Network Control Center (NCC) {Geographically diversified redundant NCC to be provided}. Supporting documents shall be provided.

5.1.5 Service provider shall have Network stations in Three regions i.e. American region, European region and Australian/Asia-Pacific region (own or partner network stations).

5.1.5.1 Service Provider shall mention at least One antenna meeting MCF/ISRO's technical specifications for C and/or Ku-band in each region (own or partner). i.e. bidder shall mandatorily quote for C-band antenna in all the three regions and/or Ku-band antenna in all the three regions.

5.1.5.2 If offered antenna in any region is not meeting tendered specification. MCF reserves right to reject the offer.

5.1.5.3 During the contract period, in case of exigency attributable to service provider, then alternate network station/ antenna & its interface tests (around T-3 months) shall be provided without additional cost implication.

5.1.5.4 These network stations shall be connected over highly reliable, secure communication link (One prime & One back up) to service provider's Prime & redundant NCC which in turn gets connected to MCF/ISRO for TOSS support.

5.1.6 The bidder shall obtain necessary licenses for network stations (own or partner) and Network Control Centers to support TOSS activity of ISRO missions.

5.1.7 Service Provider shall mention the antenna meeting MCF/ISRO's technical specifications separately for C-band and/or Ku-band in each region.

5.1.8 Participation of vendor in the pre-bid meeting (in person or in virtual mode) is mandatory whenever scheduled by MCF/ISRO. Failure in this will result in rejection of offer.

5.2 Price Evaluation criteria:

Following quantities shall be considered for price evaluation.

L1 will be calculated for C-band & Ku-band TOSS operations separately. One Launch per year is considered for calculating L1, i.e. total five launches in 5 years for both C-band & Ku-band.

Price per launch (typical TOSS operation) is calculated as per the below Table (same Table holds good for C & Ku-band).

Table 5.1: Per Launch Cost C/Ku-band

Sl. No	Item Description	Unit	Quantity
1	NRC per station, licensing &datacom in European region per mission	Lot	1
2	NRC per station, for rehearsals(T-1 Month, T-7 days & T-3 days) in European region per mission	Lot	1
3	NRC per station, licensing &datacom in American region per mission	Lot	1

4	NRC per station, for rehearsals(T-1 Month, T-7 days & T-3 days) in American region per mission	Lot	1
5	NRC per station, licensing &datacom in Australian/Asia-pacific region per mission	Lot	1
6	NRC per station, for rehearsals(T-1 Month, T-7 days & T-3 days) in Australian/Asia-pacific region per mission	Lot	1
7	Daily station fee per station in European region per mission	Days	4
8	Daily station fee per station in American region per mission	Days	4
9	Daily station fee per station in Australian/Asia-Pacific region per mission	Days	4
10	Other charges (provide details)	Lot	1
Total price per launch in 2024 (X1/Y1) = Sum of prices quoted for Sl. No 1 to 10			

NRC – Non-Recurring Charges

Note:- In the online price bid, prices for 1 day is sought.

Table 5.2: Total price for C-band Launch

Item description	Total price
Price per launch in 2024	X1
Price per launch in 2025	X2
Price per launch in 2026	X3
Price per launch in 2027	X4
Price per launch in 2028	X5
Total price C-band	**X1 + X2 + X3 + X4 + X5**

Table 5.3: Total price for Ku-band Launch

Item description	Total price
Price per launch in 2024	y1
Price per launch in 2025	y2
Price per launch in 2026	y3
Price per launch in 2027	y4
Price per launch in 2028	y5
Total price Ku-band	**y1 + y2 + y3 + y4 + y5**

6. C-BAND& Ku-BAND NETWORK SUPPORT

6.1 Support Requirement:

The TOSS Service Provider shall mandatorily quote for three regions for C and/or Ku mission. The choice of Type-1 (6.1.1) or Type-2 (6.1.2) rests with MCF/ISRO based on mission requirements.

6.1.1 **Type1:** Shall provide network stations in **THREE** regions, one each over American Region, European Region and Australian/ Asia-Pacific Region connected by highly reliable, secure leased link (One Prime and One back up) with Service Provider's Network Control Centre (NCC). The Satellite Control Centre of ISRO located at MCF, Hassan shall be interfaced to all the network stations through the Service provider's NCC.

6.1.2 **Type-2:** Shall provide network stations in **TWO** regions, one each over American Region and European Region connected by highly reliable, secure leased link (One Prime and One back up) with service provider's Network Control Centre (NCC). The satellite Control Centre of ISRO located at MCF, Hassan shall be interfaced to all the network stations through the Service provider's NCC.

6.2 Overall Mission Support Requirement:

6.2.1 The network stations and the Service Provider's NCC(s) shall be compliant to both CCSDS (non-COP) and non-CCSDS TTC&R operations.

6.2.2 During establishment of communication link(s) Service provider shall take all necessary precautions for data security by means of secured network infrastructure and configuration, use of suitable UTM/ firewall etc. to ensure ISRO traffic is safe from any cyber-attacks.

6.2.3 The TOSS Service Provider shall have Network Control Center(s) (NCCs) connected to each other and all network stations through 100% available links (One Prime and One back up) and NCC(s) shall be connected to MCF/ISRO over secure high-available data links.

6.2.4 The network stations offered by the TOSS service provider shall support the mission operations with prime and backup configurations/ systems.

6.2.5 Successful Bidder's ground station shall be equipped with the necessary dedicated equipment to execute TOSS mission requirements. Key elements of the ground station include a monopulse-tracking antenna with full acquisition pattern, search capability and redundant Baseband, RF conversion and RF power amplification equipment. It is Bidder's responsibility to maintain sufficient on-hand spares for RF and baseband systems such that failed redundant system components may be replaced within 4-hours. Four-hour replacement does not include the antenna subsystem or high-powered amplifiers (transmitters). It is expected that the antenna subsystem maintenance history will be taken into account and on-hand spares for previously problematic units or circuit boards will be available. The antenna subsystem includes drive motors, drive power electronics, antenna control unit, tracking downconverter and basic antenna structure.

6.2.6 During LEOP Satellite visibility:

6.2.6.1 Network stations shall carryout initial acquisition of the signal of the Satellite using the orbital information provided by MCF/ISRO and track the Satellite in Monopulse/Auto track mode continuously with program drive mode in background.

6.2.6.2 Network stations shall receive Satellite telemetry signals, demodulate and make the data available to MCF/ISRO over TCP/IP socket connection to Base Band Units (BBU).

6.2.6.3 Network stations shall transmit the tele-commands through MCF/ISRO provided command encoders/BBU TCU on authorization from MCF/ISRO.

6.2.6.4 Network stations shall be configured as per ISRO's TOSS requirement. Access to BBU M&C to be provided to perform ranging operation using 7-tone ESA-like format. In addition, time-tagged azimuth and elevation angles of antenna should be accessible directly from MCF/ISRO.

6.2.6.5 Network stations shall conduct a RF radiation survey/Noise Survey for longitudinal slots provided by MCF/ISRO for the critical operations as per mission requirement and detailed report including necessary spectrum plots with longitudinal information shall be submitted to MCF/ISRO. RF radiation survey has to be carried out as per MCF/ISRO requirement for any of the antenna to check interference with the satellite TTC frequency for a particular longitudinal slot in the satellite trajectory.

6.2.6.6 Network stations shall take the spectrum plots of downlink telemetry and range carriers during AOS, LOS, during critical operations and as per the mission requirement and to be provided to identified email-ids of MCF/ISRO in jpeg format or in any other format requested by MCF/ISRO. Network stations shall also take the spectrum plots of uplink carriers as per the mission requirement.

6.2.6.7 Network stations shall plot/record time tagged telemetry (TLM) AGC during AOS, LOS and critical operations and as per the mission requirements and shall be sent to identified email-ids of MCF/ISRO in jpeg format or in any other format requested by MCF/ISRO.

6.2.7 Service Provider shall establish Voice connectivity to all the network stations including the Service provider's NCC(s) and desirably MCF/ISRO shall be part of voice bridge or any online meeting platform.

6.2.8 Service Provider shall establish FTP/E-mail connectivity between MCF/ISRO and the NCC**.**

6.2.9 Service provider shall ensure that all the selected network stations for any mission are connected to the NCC through redundant links.

6.2.10 Service provider shall use proper encryption for data flow between MCF and service provider's NCC.

6.2.11 The azimuth and elevation angle blockage information with respect to each network station needs to be provided by the Service Provider to MCF/ISRO along with the coverage Region of GSO as a part of the technical document submitted along with the bid.

6.2.12 During pre-launch simulation activities and LEOP phase operations, the Service Provider shall ensure that the NCC to be manned with technically skilled personnel, having fluency in English, for smooth operations.

6.2.13 **The Service provider shall ensure that BBUs with CORTEX compatible ICD is deployed at the network stations for TOSS support.**

6.2.14 Service provider shall facilitate MCF/ISRO to access, monitor and record AGC and Eb/No of the BBUs located at network stations or shall provide the required data to MCF/ISRO.

6.2.15 If a single antenna cannot support the total Ku frequency band (12.75 - 13.25 GHz & 13.75 -14.5 GHz) then the bidder can provide solution with two different antenna in same region. However, in each region whole band shall be covered using either single/multiple terminals.

6.3 Interfaces:

6.3.1 Connectivity to Service Provider's NCCs with network stations shall be provided (for continuous Satellite coverage) with MCF/ISRO, Hassan, India through reliable, secured dual redundant data link(s). Data links established shall be leased links, over diversified routes, either terrestrial link (over OFC) or shall have maximum of one satellite hop. All the transactions between NCC and MCF/ISRO shall be over TCP/IP. The Service Provider shall deploy end equipment in redundant configuration at NCC and at MCF/ISRO.

6.3.2 For a LEOP mission, the data link(s) shall support the transmission of minimum SIX TCP/IP socket connections for telemetry data, one each for Tele-command, Range and angle data transfer from each network station along with voice connectivity with NCC as per the mission requirement. The Service Provider shall provide data link(s)bandwidth sufficient to support two overlapping LEOP operations. The minimum bandwidth required is 1Mbps.

6.3.3 The Service Provider shall deploy all the earth station network elements required for the mission in LEOP phase except for proprietary command encoders (which will be provided by MCF/ISRO). After entering into rate contract for non-CCSDS mission, MCF/ISRO will supply and install the command encoders at identified network stations. The Service Provider shall provide all the technical support during installation & operation of MCF/ISRO equipment.

6.3.4 The Service Provider shall provide necessary assistance in getting custom clearance for ISRO equipment being sent to Network provider's station for supporting ISRO missions.

6.3.5 The Service Provider shall assist in arranging permission/ clearance for MCF/ISRO engineers visit to Network provider's operation center for supporting launch missions/ any special operations (if required).

6.3.6 The Service provider shall support the mission from T to T + 3 days nominally where T is the launch day. In addition, the mission activities include following pre-launch simulations namely

- T-1 month Network test (for one day),
- Two Network Dress Rehearsals (one day each around T-7 and T-3 days) preceding the launch operations.

6.3.7 Based on the request from MCF/ISRO, the service provider shall be ready to stop the LEOP support for the given mission before the stipulated duration (T+3 days), and price shall be charged only for the actual number of days supported.

6.3.8 In case MCF/ISRO gives request for extending the mission support for beyond the stipulated duration (T+3 days), the service provider shall extend the support and pricing shall be for the actual number of days supported.

6.3.9 Service provider shall ensure proper network configuration to ensure inter-packet latency less than 2 seconds.

6.4 Telemetry

6.4.1 C-band Telemetry

Sl.No	Description	Value
1	Carrier frequency range	3700–4200 MHz
2	Modulation	PCM-NRZ-S/PSK/PM or CCSDS/PSK/PM, PSK sub carrier: 32 KHz, 128 KHz as per the satellite configuration
3	PCM telemetry bit rate	1 Kbps to 10 Kbps selectable
4	On-board polarization for downlink	CP(LHCP/RHCP) (diversity combiner shall be available to process CP signal, as per satellite orientation).
5	Downlink chains	Two independent downlink chains (C-band CP(LHCP/RHCP) - PM-PSK-NRZ-S)
6	Telemetry data transfer	Minimum Six streams of the Satellite telemetry data (over TCP/IP socket connection) from two independent downlink

		chains from each network station to MCF/ISRO in real-time

6.4.2 Ku-band telemetry

Sl.No.	Description	Value
1	Carrier Frequency range	10.70 - 12.00 GHz(desirable)
2	Modulation	PCM-NRZ-S/PSK/PM or CCSDS/PSK/PM, PSK sub carrier: 32 KHz, 128 KHz as per the satellite configuration
3	Bitrate	1 Kbps to 10 Kbps selectable
4	On-board polarization for downlink	CP (diversity combiner shall be available to process LHCP/RHCP signal, as per satellite orientation).
5	Downlink chains	Two independent downlink chains (Ku-band CP - PM-PSK-NRZ-S)
6	Telemetry data transfer	Minimum Six streams of the Satellite telemetry data (over TCP/IP socket connection) from two independent downlink chains from each network station to MCF/ISRO in real-time

6.5 Tele-command:

6.5.1 C-band Telecommand

Sl.No.	Description	Value
1	Carrier Frequency range	5850- 6425 MHz
2	Modulation	PCM-RZ/FSK/FM and/or CCSDS(non-COP)/PSK/FM
3	Maximum frequency deviation	+/- 400 KHz.
4	Bitrate	100 bps and/or 500 bps.
5	Tele-command polarization (on-board - for transfer orbit)	RHCP/LHCP
6	Command uplink capability	RHCP/LHCP from two independent chains on two tele-command uplink frequencies either simultaneously or through switching.
7	Tele-commanding	(FSK/FM and PSK/FM) to Satellite shall be through the network stations by interfacing

		computers at MCF/ISRO with ISRO proprietary command encoders/BBU TCU at each of the network stations.

6.5.2 Ku-band Tele-command:

Sl.No.	Description	Value
1	Carrier Frequency range	12.75 - 13.25 GHz & 13.75 -14.5 GHz
2	Modulation	PCM-RZ/FSK/FM and/or CCSDS(non-COP)/PSK/FM.
3	Maximum frequency deviation	+/- 400 KHz.
4	Bitrate	100 bps and/or 500 bps.
5	Tele-command polarization (on-board - for transfer orbit	CP
6	Command uplink capability	CP from two independent chains on two tele-command uplink frequencies either simultaneously or through switching.
7	Tele-commanding	(FSK/FM and PSK/FM) to Satellite shall be through the network stations by interfacing computers at MCF/ISRO with ISRO proprietary command encoders/BBU TCU at each of the network stations.

6.6 Ranging:

6.6.1 C-band Ranging

Sl.No.	Description	Value
1	Uplink frequency range	5850 - 6425 MHz
2	Downlink frequency range	3700 - 4200 MHz
3	Modulation	FM for uplink and PM for downlink.
4	Satellite ranging and range data transfer	7-tone ESA like format with/without spectral inversion as per MCF/ISRO requirement. The range processor shall support CORTEX compatible ICD format.
5	Zero range calibration	Facility to carryout Zero range calibration for range corrections.
6	Range/angle data	Time stamped range/angle data from network stations should be accessible by servers of MCF/ISRO

6.6.2 Ku-band Ranging

Sl.No.	Description	Value
1	Uplink frequency range	12.75 - 13.25 GHz & 13.75 -14.5 GHz
2	Downlink frequency range	10.70 - 12.00 GHz (desirable)
3	Modulation	FM for uplink and PM for downlink.
4	Satellite ranging and range data transfer	7-tone ESA like format with/without spectral inversion as per MCF/ISRO requirement. The range processor shall support CORTEX compatible ICD format.
5	Zero range calibration	Facility to carryout Zero range calibration for range corrections.
6	Range/angle data	Time stamped range/angle data from network stations should be accessible by servers of MCF/ISRO

6.7 Tracking:

6.7.1 Tracking of Satellite continuously by carrier lock in Monopulse/Autotrack mode with the program track mode running in background using TLE file. The TLE file will be provided by MCF/ISRO from time to time/

6.7.2 In case of non-nominal launch leading to deviated Satellite trajectory, the Service provider should have the capability to track the Satellite using antenna drive modes such as Search/Box scan.

6.7.3 Service provider shall generate and upload program drive file to network station antenna control unit (ACU), based on the TLE provided by MCF/ISRO (through FTP/E-mail) from time to time, during orbit raising period for acquisition and tracking the Satellite.

6.7.4 The service provider shall be responsible for driving the antenna and tracking the Satellite.

6.8 Ground System Requirements:

6.8.1 C-band ground system characteristics

Sl.No.	Description	Value
1	G/T	30 +/-0.5dB/°K or better at 5^0 elevation, during transfer orbit and on-orbit phase with polarization matched to the on-board

		systems
2	Antenna diameter	10 m or more
3	Antenna Drive Mode	Monopulse/Autotrack, Program track, Manual, and Slew; Search: Spiral & Box scan, Augmented Autotrack (Autotrack with back ground program track)
4	Antenna tracking	Capable to track CP signals as applicable to mission
5	EIRP	Up to 82dBW for tele-commanding/ranging in transfer orbit
6	Antenna velocity	0.5 deg/sec minimum in both Az & El

6.8.2 Ku-band ground system characteristics

Sl.No.	**Description**	**Value**
1	G/T	34 dB/°K or better at 10^0 elevation, during transfer orbit and on-orbit phase with polarization matched to the on-board systems
2	Antenna diameter	8-meter or more.
3	Antenna Drive Mode	Monopulse/Autotrack, Program track, Manual, and Slew; Search: Spiral & Box scan, Augmented Autotrack (Autotrack with back ground program track)
4	Antenna tracking	Capable to track CP signals as applicable to mission
5	EIRP	Up to 85dBW for tele-commanding/ranging in transfer orbit
6	Antenna velocity	0.5 deg/sec minimum in both Az & El

6.8.3 The transmission and reception characteristics shall match the on-board polarization.

6.8.4 MCF/ISRO shall access ACU parameters like tracking mode & time-stamped AZ and EL angle required for the mission, by means of queries over TCP/IP.

6.8.5 Each of the network stations shall have hot redundancies for all the hardware elements including power supply, uplink and downlink chains.

6.8.6 Network station shall support Uplinks for ranging and commanding on two independent uplink chains (independent uplink carriers) shall be supported either simultaneously or by switching.

6.8.7 Network station shall support simultaneous downlinks for receiving two downlink carriers of Satellite telemetry along with ranging tones.

6.8.8 All the ground elements required for the support shall be service provider's responsibility excluding the proprietary tele-command encoders of MCF/ISRO.

6.8.9 Service provider is responsible for providing TCU/BBU for CCSDS based commanding.

6.8.10 Downlink carrier from on-board will be modulated with any combination of Normal telemetry, Dwell telemetry and Ranging. Downlink shall be shared between telemetry and ranging.

6.8.11 Timing system accuracy of the network stations and NCC(s) shall be 10 ms or better.

6.8.12 Timing System: GPS/GNSS based frequency and timing distribution system with timing accuracy of 10 ms or better.

6.8.13 Network station shall support the availability of IRIG-B, NTP, 5/10 MHz reference for MCF/ISRO command encoder.

6.8.14 The service provider shall provide all the necessary Configuration documents of the network stations and NCC (Main & redundant), along with the proposal/ bid.

6.8.15 The service provider shall provide Standard Operation Procedure (SOP) document, necessary Interface Control Documents (ICD), on award of Purchase Order under this RC which will be issued three months before every mission. The documents shall contain detailed operational block diagrams of the network stations, connectivity with the service provider's NCC, the configuration settings of the hardware elements and the interface details of service provider's NCC with Satellite Control Center (SCC) of MCF/ISRO.

6.8.16 The service provider shall provide Contingency operation document, which includes procedures to be followed during contingency at NCC, at network stations and contingency pertaining to data/voice links.

6.8.17 One-time mandatory Compatibility test will be done for C-band & Ku-band stations in all Three regions before 4 months of first launch in each band after award of RC. Connectivity shall be established between service provider's NCC & MCF/ISRO to substantiate station capability for supporting TOSS operations of MCF/ISRO (To be jointly conducted by the Service Provider& MCF/ISRO). These tests shall exhaustively cover all the tests required for Voice & Data connectivity.

6.9 Documents to be Provided along with Proposal/ bid:

6.9.1 Profile of Service Provider indicating expertise, endeavors, experience and the details of successful missions supported in the last ten years. These documents shall include the supporting documents mentioned in the vendor eligibility criteria.

6.9.2 Configuration Documents along with version control consisting of:

- Station RF & Baseband Configuration, drawing, capability and specifications.
- NCC configuration and capabilities.
- Link/network configuration.
- Contingency recovery procedures.

6.10 Documents to be provided for each mission along with version control:

- Interface Control Document (ICD).
- Station RF & Baseband Configuration, drawing, capability & specifications.
- BBU & Converter settings.
- NCC configuration
- IP Address, LAN/WAN diagram.

6.11 Activities during TOSS Support of each Mission:

- Dataflow test with each Network Station
- Two Network Dress Rehearsals (NDRs). Repetition of the tests shall be carried out if results are not satisfactory based on MCF/ISRO request.
- Activities specified in Section 6.2 for Overall Mission Support Requirement.
- During Dataflow test &NDRs Network station to carry out the following activities as per MCF/ISRO requirement:

- Configuration check and testing of all network elements, RF, Baseband & servo equipment
- Antenna drive check
- Zero range calibration
- Telemetry playback
- TTC operation with ISRO Test satellite. (If ISRO test satellite is not visible from particular network station, then service provider shall put maximum effort in providing a test satellite for the dataflow test / NDRs).
- Intermediate Frequency (IF/RF) Terminated mode or radiated mode of commanding to take spectrum plots of modulation deviation.
- Other spectrum plots and AGC plots as per real-time requirement.
- Spectrum plots, AGC plots & Failure report / fault report / deviations shall be sent to the MCF/ISRO identified email-ids.
- Observation reports, in case of delay/failure in carrying out mission related events (eg. AOS), shall be provided within 2 hours. Detailed failure reports /fault reports shall follow.

7. DURATION OF CONTRACT

Ground Station/TTC network support rate contract will come into force from effective date for a period of FIVE years. Accordingly, the network provider shall provide prices which remain effective for FIVE years.

In case any unforeseen situations or unsatisfactory service from network provider side, MCF/ISRO reserves right to pre-maturely terminate this contract with three months of advance notice to the TTC network provider. In case of any unforeseen situations arising at TTC network provider side, which may lead to termination of this contract, network provider shall provide minimum of six months advance notice to MCF/ISRO.

8. PRICING AND PAYMENT SCHEDULE

The network service provider shall provide fixed prices (in price bid) which remain effective for five years or shall indicate prices for each year as applicable.

8.1 Payment Schedule

Mile stone	After release of applicable Purchase order	Percentage of Total Fee/Price
1	Payment towards Licensing.	20%
2	Payment towards preparation of Network stations (3 months prior to initially scheduled launch).	15%
3	Payment towards establishment of Datacom & carrying out rehearsal Tests (Typically T-30days).	15%
4	Payment on completion of Mission. However, payment shall be made as per actual number of days supported by each network station	50%
	Total	100%

8.1.1 A Purchase Order for each mission will be issued along with the technical parameters specific to the mission after the Rate Contract establishment around T-3 months once the launch date is confirmed.

8.1.2 For all the milestones Payment will be done within 30 days after the submission of invoice.

8.1.3 Insurance coverage for network stations is the responsibility of service provider, excluding the ISRO provided equipment.

8.1.4 In case the launch is cancelled/called off/failure and if MCF/ISRO has paid excess amount to the service provider, then service provider is bound to return the excess amount after adjusting the expenses within 30 days of notice.

8.1.5 Based on the ISRO Launch Manifest typically 15 launches (including C & Ku band) are expected in next 5 years. However, there is no commitment on number of launches during the contract period. The number of actual launches per year will vary (0-3) depending upon the ISRO's mission plan. During the contract period, in rare case, there may be One/more years where C-band launches are not scheduled or Ku-band launches are not scheduled.

8.1.6 Prices shall be governed by the launch date. In case the LEOP operations of a mission happening in the end of a calendar year and spill over to the next calendar year, the prices shall hold as for the preceding year.

8.1.7 Service provider shall quote for C-band and/or Ku-band missions (with own or partner antenna) in all three regions.

8.1.8 MCF/ISRO reserves the right to award separate rate contracts for C-band & Ku-band or a combined rate contract for both. As per L1 evaluation separate RC will be signed as per the outcome.

8.2 Service Fee: For each Mission, MCF shall pay Bidder the "Service Fee" specified in the applicable Purchase Order under Rate Contract which is firm and fixed.

8.3 Manner of Payment: MCF shall make all payments without offset, deduction or withholding and by bank wire transfer. In addition, MCF shall be responsible for any and all transfer, exchange, or other similar charges within India and similar charges outside India to the account of service provider. All payments shall be paid to the banking account information specified in the applicable invoice or to such other account as Bidder may instruct MCF in writing from time to time.

8.4 Taxes: Bidder shall quote prices inclusive of all applicable taxes and duties at their end.

9. GENERAL TERMS AND CONDITIONS:

9.1 The bidder shall provide point-by-point technical compliance matrix table against all the support requirements and specifications covered under this RFP. The bidder shall explicitly bring out all the points in the remark column wherever the MCF/ISRO requirements are not met or exceeded.

9.2 MCF/ISRO shall not be responsible for any loss, damage and safety of the network station equipment / employee of TTC network provider while executing TTC service for Indian satellite / LV missions.

9.3 TTC network provider shall not assign, sublet or delegate any part of this TTC support contract to any sub-network provider without MCF/ISRO written consent.

9.4 For all MCF/ISRO supplied equipment, Network provider shall ensure regulated electrical power and environmental conditions for equipment to perform as desired.

9.5 The bidder may obtain required clarifications, if any, before submitting the bid.

9.6 MCF/ISRO reserves right to offer total TTC service to one party or enter into parallel contracts with multiple parties.

9.7 During the contract period if there are any other TTC/ data reception service requirements arising out from future ISRO missions, the rate contract will be suitably amended with mutual agreement between two parties.

9.8 Pre-Bid Meeting:

- Bidder shall give his consent to participate in pre-bid meeting along with bid clarifications through e-procurement portal.
- Bidder may refer tender schedule for pre-bid meeting.
- The bidder must identify a contact person, phone number and mail ID to which any future correspondence may be addressed during the RFP stage of this solicitation.
- Pre-bid meeting shall be mandatorily attended in physical or virtual mode by the Techno-commercial team from bidder. If site visit is required during pre-bid meeting, Bidder shall intimate about the same to MCF. The finalized document after pre-bid meeting shall be the base-line document for the entire contract and will be binding on the bidder.
- Bidder can request for site survey during pre-bid period to have better clarity on the tender requirement.

9.9 The tentative timeline for RFP process is as follows:

Sl. No	Description	Tentative Timeline
1	Date of tender release	A
2	Vendor to seek clarifications (if any, through portal only)/provide consent for pre-bid meeting	A + 10 days
3	Pre-bid meeting	A + 12 days
4	Last date for Submission of bids	A +40 days
5	Tentative date of RC commencement	August 2024

9.10 Tender Instructions

- The Tenderers should submit quotations through ISRO e-Procurement portal complete in all respects with technical specifications, including pamphlets and catalogues.

- The authority of person signing the tender, if called for, shall be produced.

9.11 Limitation of Bidder Liability: Bidder's cumulative liability for any and all claims arising under or in connection with this RC in the aggregate, shall be limited to the Service Fee for the applicable Mission Purchase Order, except in the case of willful misconduct or gross negligence.

9.12 LICENSES, CLEARANCES AND PERMITS: Bidder shall use all reasonable efforts to obtain and maintain all licenses, clearances and permits necessary for it to provide TOSS in accordance with its obligations under this Rate Contract. Each Party shall use all reasonable efforts to cooperate with the other with respect to the timely completion of such efforts. Such clearances shall be obtained at least two months before the date of launch. It is clearly understood by the MCF that such services as envisaged herein shall be provided only after obtaining all the regulatory Governmental clearances/approvals/licenses.

9.13 FORCE MAJEURE: If the execution of contract is delayed due to reason of force majeure such as acts of god, acts of public enemy, acts of Government, fires, floods, epidemics, quarantine restriction, strikes, freight embargoes, etc., the Contractor shall give notice within 15 days to MCF in writing of his claim for an extension of time. MCF on receipt of such notice after verification, if necessary, may agree to extend the Contract delivery date as may be reasonable but without prejudice to other terms and conditions of the Contract.

9.14 SECURITY DEPOSIT: On signing of the RC, Contractor shall at the option of the Purchaser and within the period specified by him, in the form of Insurance Surety Bonds, Account Payee Demand Draft, FDR, online payment or Standby LC in an acceptable form, as the Purchaser may determine, security deposit of three percent (03%) of average per launch price over 5 years(Value of SD applicable separately for C & Ku band). Such deposits shall be interest free & valid for a period of 5 years plus 2 months claim period.

9.15 Applicable Law: The Contract shall be interpreted, construed and governed by the laws of India.

9.16 ARBITRATION: If at any time any question, dispute or difference whatsoever shall arise between the purchaser and the Contractor upon or in connection with this Contract, either party may forthwith give to the other notice in writing of the existence of such question, dispute or difference and the same shall be

referred to the adjudication of two arbitrators, one to be nominated by purchaser, other by a Contractor and in the event of any difference of opinion, the arbitrators will refer the matter to the umpire. The arbitration shall be conducted in accordance with the rules and procedure for arbitration of the International Chamber of Commerce at Paris. The expense of the arbitrators and umpire shall be paid as may be determined by them, the venue of such arbitration should be in India.

9.17 COUNTER TERMS AND CONDITIONS OF SUPPLIERS: Where counter terms and conditions/printed or cyclostyled conditions have been offered by the supplier, the same shall not be deemed to have been accepted by the purchaser unless specific written acceptance thereof is obtained.

9.18 LANGUAGE AND MEASURES: All documents pertaining to the Contract including specification, schedule, notice, correspondence, operating and maintenance instructions, drawings or any other writings shall be written in English language. The metric system of measurement shall be used exclusively in the Contract.