

Ref No : PUR/GT/GSMT-TMT/23/2016-17.

October 10 , 2016.

M/s.

Dear Sir/s,

The Director, Indian Institute of Astrophysics, Bangalore, invites Sealed Tenders (both price bid & technical bid) for the proposal for **“Procuring, Polishing and Testing of Reference Sphere for Thirty Meter Telescope Project as per the request for proposal (RFP)attached”**. The terms and conditions may be noted from IIA Website and if you are in a position to quote for the supply in accordance with the requirements, please submit your quotation. The Tender documents and other details are available on IIA web site www.iiap.res.in/tenders.htm

The Tender bids must be in foreign currency only. Your completed Tender bids (both Price bid & technical bid) must reach our office on or before 19/12/2016 by 3:30 pm. The bids must be in a separate Sealed envelopes duly superscribed with the name of the supply, the Due Date and all the envelopes kept in a bid envelopes mentioning Quotation for “Procuring, Polishing and Testing of Reference Sphere for TMT Project” must reach this Office within the Due Date and time. The Technical bids will be opened in the presence of the bidders or their authorized representative of the Company on 19/12/2016 at 4:00 pm. The Price bids will be opened only those vendors qualify in Technical Evaluation, on 02/01/2017 at 03: 30 pm. Incomplete Bids are liable for rejection.

For any Technical clarifications you may contact during Office hours Shri S.Sriram (Phone No.22541227) and for commercial clarifications can be had from Shri K.P.Vishnu Vardhan, Stores & Purchase Officer (Phone No.22541244) and Shri.C.H.Basavaraju, Consultant Administration (Phone : 2254 1313).

Thanking you,

Yours faithfully,

K.P.Vishnu Vardhan
Stores & Purchase Officer

FORM-I
(Format of the Cover letter)
(To be printed on the organization's letter head)

TENDER FORM

Request for Proposal for Procuring, Polishing and Testing of TMT Reference Sphere

THE DIRECTOR
Indian Institute of Astrophysics,
Bangalore - 560 034.

Sir,

In response to the request for Request for Proposal for the "Procuring, Polishing and Testing of Reference Sphere", we are submitting herewith our tender.

We have carefully read all the terms and conditions of the RFP and undertake to abide by them. The information/documents furnished as part of the RFP are true to the best of our knowledge and belief. We are not involved in any major litigation that may have an impact affecting or compromising the delivery of services as required under this RFP. We are not blacklisted by any Central/State Government/Public Sector Undertaking in India.

We are well aware of the fact that furnishing of any false information/fabricated documents would lead to the rejection of RFP.

Authorized Signatory

Signature and company seal

Place:

Date:

Contact details of the signatory
(Provide postal and email addresses and phone numbers)

FORM-II
(Format of the Undertaking)
(To be printed on the organization's letter head)

UNDERTAKING

1. I,.....Son/Daughter/wife
of.....
Proprietor/Director/Authorized signatory of the Company/Organization mentioned above, am
competent to sign this declaration and execute this RFP tender document.

2. I have carefully read and understood all the terms and conditions of the RFP and undertake to
abide by them.

3. The information/documents furnished along with the RFP are true and authentic to the best of
my knowledge and belief. I am well aware of the fact that furnishing of any false
information/fabricated documents would lead to the rejection of my RFP/tender at any stage,
besides liabilities towards prosecution under appropriate law.

Place : Authorized Signatory

Date : (Company's seal)

Contact details of the signatory

(Provide postal and email addresses and phone numbers)

FORM-III

**(Format of the Checklist for Submission of Documents
(To be printed on the organization's letter head))**

(Please choose 'Y' or 'N' as applicable)

List out all documents submitted with the Tender

Sl.No.	Document	Submitted
1.	Xxxxxx	Y/N

Authorized Signatory

Company's seal

Place :

Ref: Global Tender Notice No. AO/23/GSMT-TMT/2016-17

ANNOUNCEMENT OF OPPORTUNITY

For

Procuring, Polishing and Testing of Reference Sphere

For the

Thirty Meter Telescope Project

October 2016

**Indian Institute of Astrophysics
India TMT Coordination Centre
Bengaluru, India-560 034**

1.0 Brief Statement of the work

The primary mirror (“M1”) of the Thirty Meter Telescope (TMT) is comprised of 492 hexagonal mirror Segments. Each mirror segment is a hexagon measuring 1.44 meters measured across corners. The manufacturing of these mirrors has to be carried out over a timeframe of 2-3 years. This will require a very efficient polishing process and metrology process. TMT decided to follow segment mirror polishing approach for manufacturing these mirrors.

SMP starts with a Plano or spherical form (curvature constant across the surface). A bending fixture applies forces and moments in a controlled manner, causing the surface to assume the inverse of the form desired. The assumed form does not need to be axis symmetric, and in the case of TMT, none are axis symmetric. A large tool efficiently removes material from the intended surface. Since volumetric removal rates are proportional to tool area, the method assumes most rapid finishing. Once the mirror has been optically finished to the process goal while held in the bending fixture, it is released from the fixture and will elastically assume the desired form.

To support the rapid segment mirror polishing approach an in-situ measurement of the surface shape with respect to reference sphere is required. This reference sphere is basically zero-expansion glass material required to be grinded and polished to a desired accuracy aspherically.

This Announcement of Opportunity is for Procurement of a reference blank including polishing and testing of the same, to be used for in-situ measurement of the surface shape of primary mirror segments during the SMP process. The specifications are detailed in the Scope of Works (Section A), followed by the Methodology of Bid submission in Section B, and Terms and Conditions in Section C.

2.0 BACKGROUND INFORMATION

The Thirty Meter Telescope (TMT) project, executed by the TMT International Observatory, partnered by the California Institute of Technology, Universities of California, Canada, Japan, China and India, proposes to build a 30m diameter optical–infra-red telescope on the summit of Mauna Kea in Hawaii, USA, at an altitude of ~4200m. The telescope is envisaged to be operational in 2022.

The India-TMT group is led by the Indian Institute of Astrophysics (IIA), Bangalore, the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune and the Aryabhata Research Institute for Observational Sciences, (ARIES), Nainital. The activities of India-TMT are coordinated by the India TMT Coordination Centre (ITCC) that is hosted at IIA, Bengaluru.

As part of India's contribution to the TMT project, ITCC, in consultation with the TMT Board, intends to deliver a portion of polished M1 segments. The TMT project prefers to utilize segment production methods used successfully on segmented mirror telescopes, such as that employed for the Keck telescope primary mirror segments. This process includes Stressed Mirror Polishing (SMP) of circular mirror blanks, followed by hex-cutting, mounting onto a support system, and finally, Ion Beam Figuring (IBF).

In pursuance of the above, the Director, Indian Institute of Astrophysics, Bengaluru, India invites proposal for the Procuring the mirror substrate, and polishing and testing of a reference sphere for in situ measurements of the surface shape of the primary mirror segments, during the SMP process.

3.0 Submission of Proposal

Proposals are invited from companies in India and outside India with proven technical expertise, track record, past experience and capability

for precision shaping and polishing of large optical elements. The companies willing to submit proposals are invited to put a detailed proposal as per the procedure given below.

Submission of bids in two parts:

(a) Technical Bid

(b) Price Bid

Guidelines for submission, including the details of documents required, are provided in Section B.

Bidders should be advised that, as described in Section 10, price bid will be opened only for the technically qualified bids. And lowest price bid (L1) shall be chosen to execute the work, should IIA/ITCC elect to proceed.

4.0 Process Schedule:

Date of this Announcement	10 October 2016
Deadline for receiving Proposals	19 December 2016 3:30 pm
Opening of Technical Bids at ITCC/IIA, Bengaluru	19 December 2016 4:00 pm
Opening of Price Bids at ITCC/IIA, Bengaluru (of Technically Qualified Bidders only)	02 January 2017 3.30 pm
Delivery of Reference Sphere	9 months from the date of award of contract

Note: These dates may be revised by IIA/ITCC by notification on its website.

1. Contacts:

Technical Clarifications:

Shri S.Sriram,
Engineer,
Indian Institute of Astrophysics,
Koramangala, 2nd Block, Bengaluru, India-56034
(ssr@iiap.res.in)

Administrative Clarifications:

Shri Vishnu Vardhan K. P.
Stores and Purchase Officer
Indian Institute of Astrophysics/ITCC,
Koramangala, Bengaluru, India-560 034
(vishnu.vardhan@iiap.res.in)

Shri C.H.Basavaraju,
Consultant, Administration,
Indian Institute of Astrophysics/ITCC,
Koramangala, Bengaluru, India-560 034
(basavaraju@iiap.res.in)

6. Abbreviations

TMT	Thirty Meter Telescope
SMP	Stress Mirror Polishing
IIA	Indian Institute of Astrophysics
IUCAA	Inter-University Centre for Astronomy and Astrophysics
ITCC	India TMT Coordination Centre
ARIES	Aryabhata Research Institute for Observational Sciences
IBF	Ion Beam Figuring
ROC	Radius of Curvature
M1CS	Primary Mirror Control System
SSA	Segment Support Assembly

CTE Coefficient of Thermal Expansion
PPB Parts Per Billion

Section A

Scope of Work

A brief overview of the TMT optical design, M1 segmentation, stress mirror polishing (SMP) technology and short description of reference sphere is provided in this Section.

2. Technical Background

6.1 TMT Optical Design

The TMT optical design is based on Ritchey Chrétien system. Both the primary (M1) and the secondary mirrors (M2) are hyperboloid. The focal length of the primary mirror is 30-m and the final F-ratio of telescope system is F/15. A tertiary mirror (M3) is used to fold and steer the light beam to any of the eight instruments will be mounted on the two main Nasmyth platforms. The telescope has an unvignetted

field of view of 15 arcmin. The M1 is segmented hyperboloid (Paraxial ROC = 60.0m, $k=-1.000953$, sag = 1.8m, asphericity = 29.3 mm) of an effective diameter 30-m. The secondary is a single piece convex hyperboloid (Paraxial ROC = -6.228, $k=-1.31823$, sag = 196 mm, asphericity = 850 μm) with 3.2-m diameter. The diffraction limited resolution of TMT will be three times better than the existing 10m class telescopes and wavelength coverage would range from 310nm to 28 μm . To achieve the desired performance, the surface finish of each segment has to be $\lambda/20$ or better at the specified wavelength.

6.2 M1 Segmentation

The TMT primary mirror is made of 492 hexagonal segments, each having a size of 1.44 m across corners. Figure 1 shows the top view of the M1 segmentation pattern. The entire M1 is divided into 6 identical sectors (A-F). There are 82 hexagonal segments in each sector. The segment arrangement pattern has a six-fold symmetry about the optical axis. That is, the entire M1 can be obtained by rotating any of the sectors in 60 degree steps about the optical axes. Since an array of identical regular hexagonal cannot uniformly fill a curved surface, the shape and asphericity for each of 1-82 segments is uniquely defined. For example, the outermost segment (Type-82) has greatest aspheric departure $\sim 226 \mu\text{m}$ PV while the inner most (Type-2) has only $\sim 6 \mu\text{m}$ PV.

The TMT requires a total of 574 segments comprising 7 sets of the 82 unique segments. 492 of these segments will form M1 and remaining 82 extra segments are used to facilitate re-coating of the primary mirror, and for use as spares. The segments are closely placed with nominal gaps of 2.5 mm to maximize the fill factor. Each Segment will be mounted on a Segment Support Assembly (SSA) that provides passive support to the mirror using three whiffletrees and a central diaphragm support. The SSA passively controls the three in-plane degrees of freedom of the segment while the overall shape of the M1 mirror is actively controlled (tip, tilt and piston) by the Primary Mirror Control System (M1CS) which compensates continuously for the alignment

errors caused by the wind disturbance, gravity loading, and structural deformations of the telescope resulting from temperature changes.

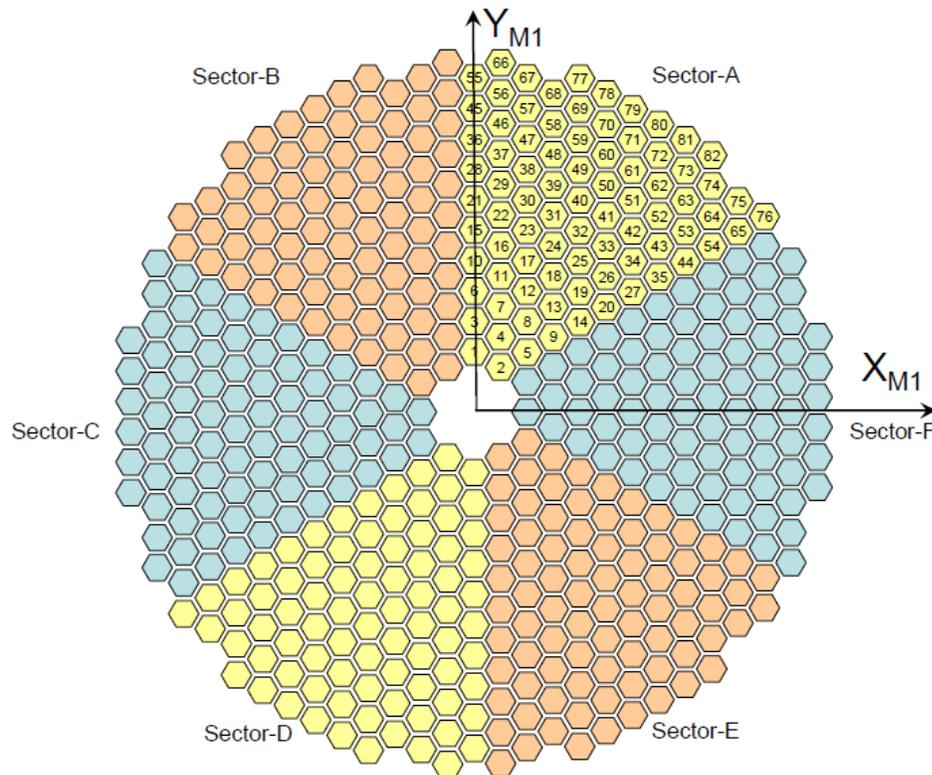


Figure1: Arrangement of M1 Segments with 6-fold symmetry.

6.3 Stress Mirror Polishing (SMP) Technology

The Stressed Mirror Polishing (SMP) process is a proven technology and is used during polishing of mirror segments for the Keck telescopes. In this technique, appropriate stresses are applied to a mirror blank that would have the effect of elastically deforming a desired surface into a sphere. After polishing, the applied stresses are removed and the part springs back to a desired aspheric surface shape. After the SMP process on the mirror blanks, the segments are edged to their final shape and mirror surface is then finished with Ion Beam Figuring (IBF).

The main advantage of the SMP technique is that high spatial frequency (HiF) ripples that are associated with the generation of aspherical surfaces by robotic small tool approaches could be avoided. The full size tool polishing naturally produces smooth surfaces and does not generate such HiF errors. Minimizing HiF errors on the optical surfaces allows for a strong reduction of diffractive effects in the optical train and in this way, a minimization of residual speckles in the focal plane. Also, spherical processing is much faster than alternative aspheric (small tool) processes because much larger tools are used and the entire surface is worked at once.

6.4 Reference Sphere

In the stress mirror polishing process material is precisely removed from a work piece to produce a desired dimension, surface finish and shape. The overall performance of the TMT will ultimately depend on the performance of the segmented primary mirror. The most challenging task is the fabrication of a large number of off-axis segments that meet the TMT requirements. The polishing process has to be rapid, efficient and cost effective, producing smooth, accurate aspheric surfaces. Additionally, it has to be supported by fast, accurate and repeatable metrology that can be used in-situ to control polishing. The metrology system for the SMP process includes 2D profilometer instrument. The 2D profilometer instrument will be calibrated against a zero expansion, polished and tested reference sphere. The Reference Sphere will be produced on a stiff, stable substrate with a polished spherical first surface (S1), and a ground, flat second surface (S2).

This announcement of opportunity calls for the proposals to procure a zero expansion glass blank; polish it to the desired level of accuracy, including performing the necessary testing to ensure it meets all the specifications. After manufacturing, this reference sphere has to be delivered at Indian Institute of Astrophysics/India TMT Co-Ordination Centre, Koramangala, Bengaluru. In case of any change in the delivery location, the same will be decided and intimated later. The delivered Reference Sphere shall meet the Substrate Requirements stated in Table

1 and the Polishing Requirements stated in Table 2 and the dimensional details as in Figure 2.

Table 1: Reference Sphere Substrate Requirements

Characteristic	Requirement
Material Type	Zero-expansion Glass or Glass Ceramic
Coefficient of Thermal Expansion (CTE)	$-20 \text{ PPB}/^\circ\text{C} < \text{CTE} < +20 \text{ PPB}/^\circ\text{C}$
Stress Birefringence	<0.4 MPa Measured at center and 12 equally spaced points at R=0.670mm
Outside Diameter	1540mm – 1545mm
Thickness	See polishing requirements
S2 Flatness (Un-polished flat surface)	1.0 mm
Squareness (Cylidricity)	2.0 mm
S1 and S2 Edge Bevels 45°	2.0 – 4.0 mm
Finish of Cylinder and S2	D120 or finer
INTERNAL QUALITY	
Cracks & Chips on polished	None permitted

S1	
Cracks & Chips on S2 & Cylinder	Shall be ground-out in a spherical shape, Ø20mm max after grinding
Internal Cracks	None permitted
Bubbles and Inclusions inside Critical Zone (CZ) (CZ is Ø1500mm within 5mm of polished S1)	Max size: Ø1.0mm Max number Ø0.3 - Ø1.0mm: 5 Detection limit: Ø0.3mm
Bubbles and Inclusions outside CZ	Max size: Ø5.0mm Max number Ø0.5 - Ø5.0mm: 500 Max number within any 100cm ³ volume: 10 Detection limit: 0.5mm

Table 2: Reference Sphere Polishing Requirements

Characteristic	Requirement
General	S1 Polished Sphere S2 Un-polished flat Used in reflection, no transmission requirements
Micro roughness	< 2nm RMS
Scratch/dig	<120/70 over 100% of the Clear Aperture; <80/50 over 99.7% of the Clear Aperture. all per MIL-PRF-13830B
Surface figure	<63 nm RMS when the gravity vector is parallel to the optical axis (polished surface facing up).

Clear aperture diameter	Min. 1500 mm
Polished aperture diameter	1530 - 1540 mm
Concave S1 ROC	61,700mm+/- 500 mm
Concave S1 ROC knowledge	+/- 3.0mm (one sigma)
Edge thickness differential concave to flat surface	< 2mm TIR
Edge thickness	303-307 mm

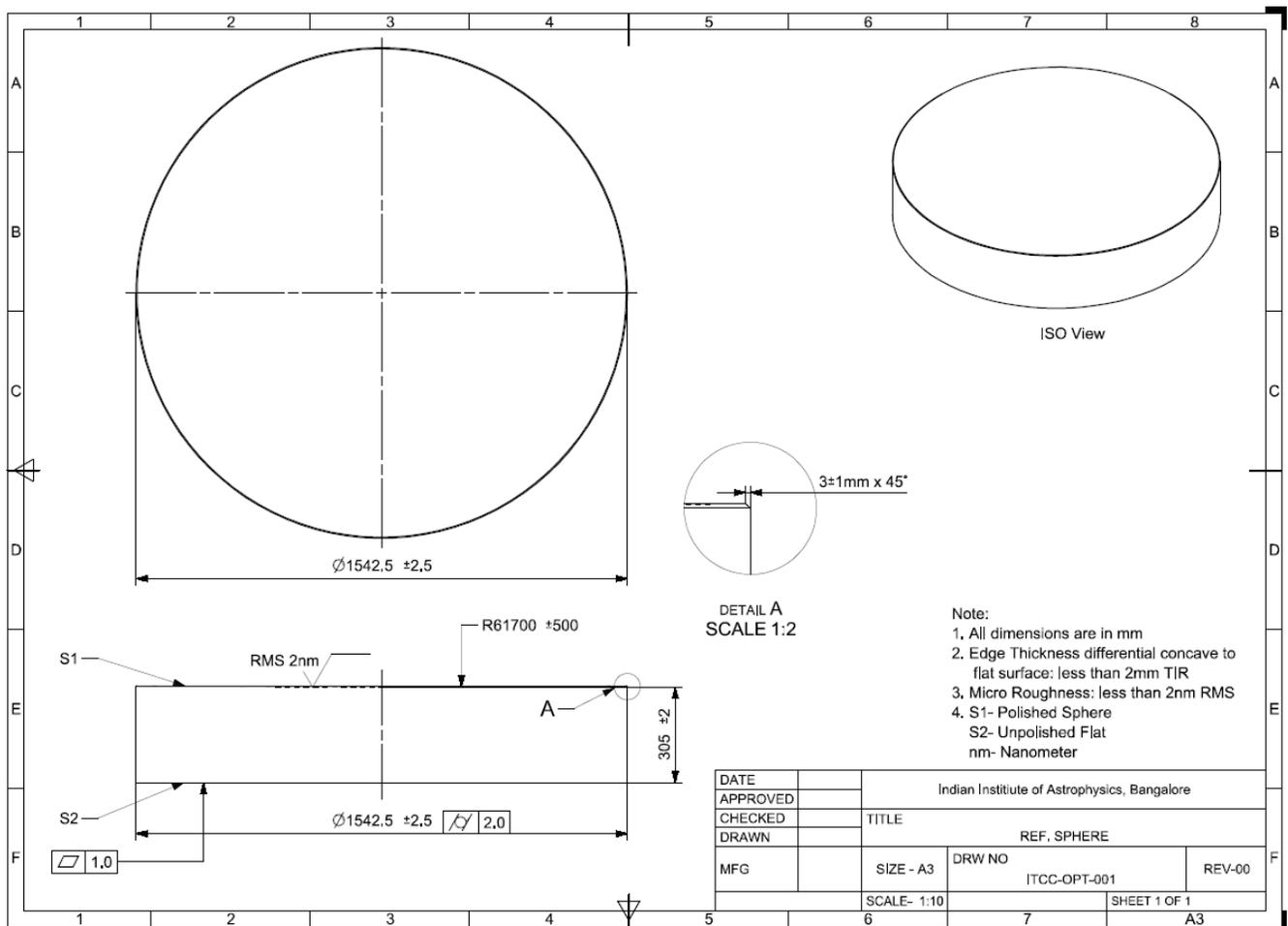


Figure 2: Drawing for dimensional details of Reference sphere

6.5 Deliverables

- One Reference Sphere meeting all of the specifications as mentioned in section 6.4.
- A written inspection report documenting compliance with all requirements defined in Section 6.4. Report shall include test reports for both in-process as well as the final optical metrology tests of the polished mirror, using as a minimum, the metrology methods specified in Section 6.6.
- The final acceptance test data in print and electronic format.

6.6 Required Metrology

Vendor shall perform, as a minimum, the following tests of the finished Reference Sphere:

- Full aperture interferometric test (1k x 1k minimum pixels) from the center of curvature using sufficient number of orientations and rotations as required to remove mount-induced gravity print-thru.
- Measurement of the RoC using a laser tracker and interferometer.
- Micro-roughness measurement of the actual surface or by replication using 0.5mm max pixel size.
- If all the above metrology is done with the gravity axis perpendicular to the reference sphere axis, the impact on the metrology data when the reference sphere axis is parallel the gravity (final usage configuration) shall be provided with 1sigma accuracy.
- Suitable metrology shall be carried out to check internal cracks. To verify some of the parameter e.g. bubbles and inclusions inside and outside the critical zone, melt data supplied by the blank manufacturer shall be delivered along with metrology data.

6.7 Guidelines and General Approach

- The Vendor shall identify and communicate with India-TMT any clarification or incomplete information.
- At various stages e.g. procurement of blank, polishing and testing, the vendor is expected to work closely with the

technical team constituted by India-TMT.

- Vendor shall provide updates related to the work in terms of test reports/ documentation/ meetings at various, agreed upon, stages to India-TMT.
- Reference sphere will be subjected to comprehensive acceptance testing performed by vendor at Vendor's premises. Detailed report of the same is to be delivered, as mentioned in Section 6.5 above.

I. Section B

Methodology of Submission and Qualification

7.0 Submission of Technical and Price Bids

7.1 Sealed quotations in two part bid system, enclosing documents listed below and any other documents is hereby invited, which will form part of qualification criteria:-

i) The profile of the company should include the following:-

- a) Company's Quality Policy and Programme, organizational setup for Quality Surveillance and Quality Assurance, Quality Audit programme, non-conformity control and reporting and testing and inspection facilities.
- b) The bidder should have a minimum average annual turnover of INR 10 Crores or equivalent during the last five years and should be of sound financial status (supporting documents must be included).
- c) The bidder should have executed at least two projects involving similar precision optics fabrication costing above INR 2 Crores or equivalent in the past ten years (supporting documents must be included).
- d) The bidder must have the necessary infrastructure, in-house facilities and experience for design, manufacture, integration, testing and packaging the product (supporting documents must be included).
- e) If some manufacturing, testing and inspection facilities are not available with the company, the Bidder should clearly state the means of their access to such required facilities, with relevant proofs for the said access.
- f) The bidder should have a well defined plan for manufacturing the product, and organizational structure for project planning,

monitoring, schedule tracking, corrective measures etc.

- g) Audited balance sheets for the last three years
- h) Solvency certificate for atleast INR 20 crores or equivalent during the last 5 years issued by scheduled/nationalized bank with which the bidder holds the current account.
- i) Copy of Registration, LST/CST/WCT No., PAN No. and TIN No. allotted by concerned authorities.
- j) Appreciation/Reward letters from clients
- k) Description of the proposed technological approach to be followed for making the product.
- l) Strategy to be followed for the execution of the project including tools and technologies to be used.
- m) Project execution and management details, including details of the project team, escalation paths etc.
- n) Details of the resources, infrastructure or data expected to be provided by IIA/ITCC, on behalf of TMT-India, to the successful bidder for undertaking the project.
- o) Risk identification and mitigation plans.
- p) Quality audit, control and assurance plans.
- q) Detailed descriptions of the methods and instruments to be used to verify compliance with the requirements, including estimates of measurement uncertainty. Bidders should also describe their experience making such measurements on other projects.
- r) State the source of the substrate (supplier, type and grade) and the properties for the material proposed.
- s) Detailed time schedule for the project
- t) Commercial terms and conditions.
- u) Acceptance criteria and test plans in the factory and on-site.
- v) A copy of the Price Bid without indicating the quoted Price
- w) Earnest money deposit (EMD) for INR 3,00,000 by way of Demand Draft drawn on a Nationalized Bank only in favor of Director, IIA (Foreign Vendors, MSME/NSIC firms are exempted from EMD)

7.2 General terms:

- 7.2 The Bidder shall prepare original and two copies of the Bid, clearly marking each as "Original Bid" and "Copy of Bid," as appropriate. In the event of any discrepancy between them, the Original shall govern.
- 7.3 Both the Original and Copies of the Bid shall be signed by the Bidder or a person or persons duly authorized by the Bidder. The latter's authorization shall be indicated by written Power of Attorney accompanying the Bid.
- 7.4 The bid must be submitted in an organized and structured manner. No brochures/leaflets etc. should be submitted in loose form. Please indicate page nos. on your quotations. For e.g., if the quotation is containing 25 pages, please indicate as 1/25, 2/25, 3/25,..... 25/25.
- 7.5 The contents must be clearly typed without any cancellation/corrections or overwriting. Each page of the bid and cutting/corrections (if any) shall be duly signed and stamped by the bidder. Failure to comply with this requirement may result in the bid being rejected.
- 7.6 All pages of the Bid (except for un-amended printed literature) shall be initialed by the person or persons signing the Bid. The Bidder's name stated on the proposal shall be the exact legal name of the firm.
- 7.7 The Technical and Price Bids shall be sealed in separate envelopes. The envelopes shall bear the following: "Procuring, Polishing and Testing of Reference Sphere for the Thirty Meter Telescope Project", and "Technical Bid" or "Price Bid" as appropriate.

- 7.8 Both the envelopes shall bear the name and address of the vendor.
- 7.9 The two sealed envelopes shall be placed in a third sealed envelope. The envelopes shall bear the following: “Procuring, Polishing and Testing of Reference Sphere for the Thirty Meter Telescope Project: Technical and Commercial Bids”, bear the name and address of the vendor, and shall be addressed to:

THE DIRECTOR,
Indian Institute of Astrophysics,
Koramangala, 2nd Block, Bengaluru, India-560 034

If the envelopes are not sealed and marked as required, IIA/ITCC will not take any responsibility for the bid’s misplacement or premature opening, whatsoever the reason may be.

- 7.10 The bidder has the option of sending the bid by registered post/courier or submitting the bid in person so as to reach IIA/ITCC by the date and time indicated. IIA/ITCC will not be responsible for late, delayed bids and loss of bids in transit, whatsoever the reason may be.
- 7.11 Director, IIA reserves the right to accept/reject any or all bids without assigning any reasons.
- 7.12 Any other condition or guideline for submission of the bids shall be notified by IIA/ITCC, if it finds necessary.
- 7.13 IIA/ITCC may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Documents, in which case all rights and obligations of IIA/ITCC and Bidder previously subject to the deadline will thereafter be subject to the deadline as extended.
- 7.14 At any time prior to the deadline for submission of Bids, IIA/ITCC may, for any reason, whether at its own initiative or in

response to a clarification requested by a prospective bidder, notify changes in the bidding documents through an amendment.

- 7.15 In order to allow reasonable time for the prospective bidders for taking the amendment into account in preparation of their bids, IIA/ITCC may, at its discretion, extend the deadline for the submission of the bids.
- 7.16 The amendments, if any, shall be notified in writing at IIA/ITCC website and the amendments shall be binding on all the bidders. Hence the bidders shall view the notification in complete before submitting their bids.
- 7.17 The company responding to announcement shall be deemed to have read and understood the documents in complete. Where counter terms and conditions have been offered by the company, the same shall not be deemed to have been accepted by IIA/ITCC, unless a specific written acceptance thereof is obtained.
- 7.18 Any effort by a bidder to influence IIA/ITCC in the bid Evaluation, bid Comparison or contract award decisions may result in the rejection of their bid.
- 7.19 Any clarifications pertaining to this document may be obtained from IIA/ITCC by the bidders by writing at the following address at least fifteen days prior to the due date for submission of bids.

The Director,
Indian Institute of Astrophysics,
Koramangala, 2nd Block, Bengaluru, India-56034

Contact for Technical Queries:

Shri S.Sriram,
Engineer,
Indian Institute of Astrophysics,
Koramangala, 2nd Block, Bengaluru, India-56034
(ssr@iiap.res.in)

Contact for Commercial/Administrative Queries:

Shri Vishnu Vardhan K. P.
Stores and Purchase Officer
Indian Institute of Astrophysics
Koramangala, Bengaluru, India-560 034
(vishnu.vardhan@iiap.res.in)

Shri C.H.Basavaraju,
Consultant, Administration,
Indian Institute of Astrophysics/ITCC,
Koramangala, Bengaluru, India-560 034
(basavaraju@iiap.res.in)

8.0 Technical Bid : Details

- 8.1 A compliance sheet clearly indicating any deviation with reference to the terms and specifications shall be included. Limitations and assumptions, if any, should be clearly mentioned. Scope description may explicitly state anything which is not covered.

9.0 Price Bid : Details

- 9.1 The Price bids shall include the following:
- a) An item wise break-up of cost shall be clearly mentioned.
 - b) Applicable taxes, duties or other statutory payments.
 - c) Packing, transportation and transit insurance – delivery to IIA/ITCC, Bengaluru

d) Total cost along with proposed payment stages, schedule and percentage to be paid at each stage.

9.2 The offer should be complete to indicate that all products and services asked for are quoted.

9.3 Price bids shall be valid for a period of 180 days from the date of opening of bids. IIA/ITCC may ask for the bidder's consent to extend the period of validity. Such request and the response shall be made in writing only. A bidder agreeing to the request of IIA/ITCC for extension of the bid will not be permitted to modify the bid.

10.0 **Qualification Process**

The vendor is required to submit a detail report on each of the parameters indicated at clause 7 above. During the assessment of bids apart from meeting the requirements as at clause 7, specific weightage will be given to the following parameters:-

- a) Innovative suggestions on fabrication feasibility;
- b) Cost optimization and schedule control
- c) Optimization of Manufacturing
- d) Shipping criteria
- e) Assembly
- f) Prior experience with similar projects
- g) Commitment and risk evaluation
- h) Polishing approach and metrology methods

10.3 Technical Bid shall be opened on the date specified by IIA/ITCC. Bidders or their authorized agents may be present at their own interest when the Bids are being opened.

10.4 To assist in the evaluation of bids, IIA/ITCC may at its discretion ask the bidder for a clarification of its bid. IIA/ITCC may call for

meetings with bidders to seek clarification at appropriate times in its premises at IIA / ITCC office. The bidders shall attend the meeting at their own cost. The request for clarification and the response shall be in writing.

- 10.5 Following the evaluation of technical bids, the price bids of technically qualified bidders shall be opened to choose the bidder to execute the Project. Bidders should be advised that, price bid will be opened only in respect of technically qualified bids. And, the lowest price bid (L1) shall be chosen to execute the work.
- 10.6 During the assessment of the bids, specific weightage will be given to the bidders for innovative suggestions on fabrication feasibility, cost optimization and schedule control. Selection of the successful bidder will be mainly based on procurement optimization from an integrated point of view, involving optimization of manufacturing, shipping, assembly, schedule and cost. Prior experience with similar projects, commitment and risk evaluation will also play an important role in the selection process.

II. Section C

11.0 Terms and Conditions (Part-I)

The successful Vendor who is awarded the contract shall be subjected to the following terms and conditions:-

11.1 Subcontracts

- a. The Vendor is an independent contractor.
- b. The Vendor shall provide as an independent contractor and not agent of IIA/ITCC, all necessary personnel, materials, equipment and facilities to perform the Work.
- c. The Vendor shall not assign its rights or obligations to a third party without the prior written approval of IIA/ITCC.
- d. Notwithstanding any subcontract under this Agreement, whether approved by IIA/ITCC or not, the Vendor shall remain fully liable and responsible to ARIES for the satisfactory and timely completion of the Work.

11.2 Payment

- a. IIA/ITCC shall pay the Vendor the price in accordance with a milestone schedule.
- b. Upon completion of each milestone, the Vendor shall submit to IIA/ITCC an Invoice for the amount corresponding to that milestone in Schedule.

- c. The Vendor shall submit reasonable documentary evidence, including but not limited to photographs and illustrations, as verification of completion of each Milestone. IIA/ITCC may at its own discretion verify and substantiate that the milestone has indeed been performed or completed as invoiced by the Vendor. Such verification may require Vendor to submit to IIA/ITCC, additional documentation with regard to quality control normally expected during process of manufacture, and/or inspection by IIA/ITCC representatives. Any request for substantiation under this clause shall be made by IIA/ITCC within fourteen (14) days of its receipt of the corresponding Invoice.
- d. For any advance payment, the Bidder shall provide bank guarantee / letter of credit in favour of IIA/ITCC for the equal amount.

11.3 Inspection, Testing and documentation

- a) A pre-shipment inspection by a committee formed by IIA/ITCC will be conducted at the vendor's venue to verify the specifications of the reference sphere, refer Table 3, to the TMT project office for calibration and inter-calibration purposes.

Table 3: Inspection/Acceptance compliance matrix

Description	Requirement as per RFP	Compliance Actual/Years/No	Remarks
Material Type	Zero-expansion Glass or Glass Ceramic		

Coefficient of Thermal Expansion (CTE)	-20 PPB/°C < CTE < +20 PPB/°C		
Stress Birefringence	<0.4 MPa Measured at center and 12 equally spaced points at R=0.670mm		
Outside Diameter	1540mm – 1545mm		
Thickness	See polishing requirements		
S2 Flatness (Un-polished flat surface)	1.0 mm		
Squareness/Cylindricity	2.0 mm		
S1 and S2 Edge Bevels 45°	2.0 – 4.0 mm		
Finish of Cylinder and S2	D120 or finer		
INTERNAL QUALITY			
Cracks & Chips on polished S1	None permitted		
Cracks & Chips on S2 & Cylinder	Shall be ground-out ?in a spherical shape?, Ø20mm max after grinding		
Internal Cracks	None permitted		
Bubbles and Inclusions inside Critical Zone (CZ) (CZ is	Max size: Ø1.0mm Max number Ø0.3 - Ø1.0mm: 5 Detection limit: Ø0.3mm		

Ø1500mm within 5mm of polished S1)			
Bubbles and Inclusions outside CZ	<p>Max size: Ø5.0mm</p> <p>Max number Ø0.5 - Ø5.0mm: 500</p> <p>Max number within any 100cm³ volume: 10</p> <p>Detection limit: 0.5mm</p>		
Micro roughness	< 2nm RMS		
Scratch/dig	<p><120/70 over 100% of the Clear Aperture;</p> <p><80/50 over 99.7% of the Clear Aperture.</p> <p>all per MIL-PRF-13830B</p>		
Surface figure	<63 nm RMS when the gravity vector is parallel to the optical axis (polished surface facing up).		
Clear aperture diameter	Min. 1500 mm		
Polished aperture diameter	1530 - 1540 mm		
Concave S1 ROC	61,700mm+/- 500 mm		
Concave S1 ROC knowledge	+/- 3.0mm (one sigma)		
Edge thickness differential concave to flat surface	< 2mm TIR		
Edge thickness	303-307 mm		

11.4 Packaging, Transportation and Insurance

- a) The packing of the product for shipment shall be appropriate depending upon the nature of transportation and handling hazards. The stores shall be packed securely to avoid any damage to the consignment in transit, loading, unloading and storage. The package shall contain a packing note quoting contract number and date, copy of shipping release and one set of test certificates. The package shall be marked with name and address of the contractor, lifting points and special handling instructions, if any.
- b) The Bidder is responsible for its delivery at Indian Institute of Astrophysics/India TMT Co-Ordination Centre, Koramangala, Bengaluru, including transportation charges and transit insurance. In case of any change in the delivery location, the same will be decided and intimated later. The difference in cost of packing, transportation and transit insurance will be borne by IIA/ITCC as per actuals, if the delivery location is other than IIA/ITCC, Bengaluru.

11.5 Access to work

- a. Work in progress and data and documentation related to the work, including design and test data necessary to understand the ability of the work to meet the specifications are subject to examination, evaluation, and inspection by IIA/ITCC, on behalf of TMT-India, at reasonable times and with reasonable notice to the Vendor.
- b. The Vendor shall provide IIA/ITCC, access to such documentation and to those of its premises where work on or in connection with the subject of this contract is being performed during normal business hours and subject to prior arrangement.
- c. IIA/ITCC may depute Engineers/Scientists of its choice from time to time who will be allowed by the Vendor to participate in the Work in respect of the disciplines in which they are specialized.

11.6 Vesting of Title and Assumption of risk

- a. On each item to be delivered by the Vendor, including an item of work in progress, in respect of which payments have been made, ITCC shall have a security interest in such items which shall be deemed to be released only at the time when the applicable deliverable Item is finally accepted by ITCC/ and delivered at Indian Institute of Astrophysics/India TMT Co-Ordination Centre, Koramangala, Bengaluru. In case of any change in the delivery location, the same will be decided and intimated later. However, the difference in cost of packing and shipping and transit insurance charges will be borne by IIA/ITCC as per actuals, if the delivery location is other than IIA/ITCC, Bengaluru.
- b. Risk for loss or damage to deliverable Items provided by the Vendor shall rest with the Vendor, until final acceptance by /IIA/ITCC and delivery at Indian Institute of Astrophysics/India TMT Co-Ordination Centre, Koramangala, Bengaluru. In case of any change in the delivery location, the same will be decided and intimated later.
- c. Title to all deliverable Items provided by the Vendor shall pass from the Vendor to IIA//ITCC upon final acceptance or the final payment, whichever last occurs.
- d. ITCC shall not accept any liability for the Vendor and its subcontractors, their subsidiaries and/or their officers, employees or agents, servants, and assignees, or any of them or for their property. The Vendor shall indemnify and keep harmless IIA/ITCC, its officers, employees consultants, servants, agents and assignees, or any of them, against any loss or liability, costs or claims, action or proceedings which they or any of them may incur by reasons of damage to property or injury, including death,

caused to the employees of the Vendor, its subsidiaries and/or their officers, employees or agents, servants and assignees, or any of them in connection with the performance of Work under this Agreement, and caused by an act of commission or omission by the Vendor, its subsidiaries and/or their officers, employees or agents, servants and assignees, or all or any of them.

11.7 Deliverable documentation and Standards

The Deliverable Documentation shall include a complete polishing report, Testing procedures, Surface Figure Testing Report (both in-process and final), and Metrological Errors Budget. All documentation shall be written in clear and concise English language. The author should also adhere to consistent terminology and use acronyms that are well defined in the document.

11.8 Progress reports

The Vendor shall provide IIA/ITCC with detailed reports on progress of the Work and notify any deviations on the schedule, at least monthly highlights and bi-monthly detailed reports on the progress of the work, up to the delivery date.

11.9 Warranty

- a. The Vendor warrants that all Deliverable Items shall be free and clear of all liens and encumbrances pertaining to title at the time of acceptance by IIA/ITCC, India. The Vendor's liability and IIA/ITCC's sole remedy under this warranty shall be limited to the Vendor procuring the removal of any such lien or encumbrance or the replacement of the goods and parts thereof that has been identified as defective of title. The Vendor will provide a one year warranty from date of acceptance of the deliverables by IIA/ITCC.

And the Vendor warrants that:

- b. All deliverable Items that are procured or furnished by the Vendor or its subcontractors or suppliers shall be new and shall conform in grade and quality to all the requirements of the contract; where the grade or quality is not specifically defined therein, they shall be of a grade or quality suitable for their intended use;
- c. All workmanship employed in the manufacture of deliverable Items shall be of good quality, free from faults and defects, and shall conform to the relevant specifications applicable to the said manufacture; and
- d. All deliverable Items shall be free from defects arising out of the use of defective equipment or materials that would result in a total or partial failure of any deliverable item or which would render a deliverable item unsafe for its intended use.

11.10 Performance guarantee

IIA/ITCC shall withhold 5% part of each Milestone Payment towards performance guarantee and pay the total sum on completion of 12 months since delivery, subject to the deliverable items meeting the final acceptance Tests.

12.0 Other Terms and Conditions (Part-II)

The successful Vendor who is awarded the contract shall be subjected to the Terms and Conditions that include, but not limited to the following. A detailed Contract Agreement will be drawn and signed by both the parties before the award of the contract.

12.1 Intellectual Property rights

- a. All Intellectual Property Rights existing in a party prior to the Contract (“**Existing Intellectual Property Rights**”) shall remain with that party. Except to the extent necessary to complete the Work or expressly stated otherwise, neither party grants any rights in its Existing Intellectual Property Rights to the other party.
- b. All Intellectual Property Rights arising directly from the Work (“**Work Intellectual Property Rights**”) shall, upon completion of the Work, vest in IIA/ITCC and TMT project.

12.2 Confidential Information

- a. The Receiving Party shall protect the confidential information and keep it secure, and shall not at any time (except with the prior written consent of the disclosing Party):
 - (i) Directly or indirectly disclose or distribute the confidential information to a representative, employee, agent or advisor of the receiving party except where such disclosure is necessary for the purpose of the Work.
 - (ii) Use or copy the confidential information except for the purpose of the work.
- b. Where the receiving party discloses confidential information to a representative, employee, agent or advisor, the receiving party shall ensure that such person is aware of the confidential nature of that confidential information and is bound by suitable obligations of confidentiality to ensure that that person protects and keeps secure that confidential information and does not use the confidential information for any reason other than the purpose of the Work.

- c. The receiving party shall, on demand by the disclosing party, or where the purpose of this agreement has been served, promptly return to the disclosing party all confidential information (including copies or reproductions of the same) which is reasonably capable of being returned which is in the possession or control of the receiving party.
- d. This agreement is not intended to restrict the use or disclosure of confidential information by the receiving party to the extent that it is required to be disclosed by law provided that the receiving party has taken such steps as are available under law (but not the institution of legal action) to protect such confidential information and notifies the disclosing party hereunder of its obligation to make such disclosure prior to the time such disclosure is made.
- e. The provisions of this Clause 12.4 are subject to the provisions of Clause 12.4 (d)

12.3 Settlement of disputes

- a. All disputes arising in connection with the interpretation or implementation of the contract shall be amicably settled by IIA/ITCC and the Vendor, by direct discussion.
- b. If IIA/ITCC and the Vendor are unable to resolve a dispute within 30 working days of the dispute being referred to them in accordance with Clause 12.3(a), the parties may agree to refer the dispute to mediation.
- c. ITCC and the Vendor appoint a mediation committee comprising of two nominees by IIA/ITCC and two nominees by the Vendor. IIA/ITCC and the Vendor will seek the opinion of this mediation committee to amicably settle the disputes.
- d. In the event of a dispute or difference which cannot be resolved by mediation, the same shall be referred to an Arbitration Tribunal consisting of three members. Either party shall give notice to the other regarding its decision to refer the matter to arbitration. Within

30 days of such notice, one Arbitrator shall be nominated by each party and the third Arbitrator shall be nominated by agreement between the parties to this agreement. The venue of the arbitration will be Bengaluru, India. Subject to the aforesaid, the Indian Arbitration and Conciliation Act, 1996 and the rules there under and any statutory modification thereof for the time being in force shall be deemed to apply to the Arbitration proceedings.

12.4 Force Majeure

- a. Neither party shall be held responsible for any losses, if the fulfillment of any terms and conditions of this contract are delayed or prevented by acts of lawful Government, revolutions and other disorders, wars (declared or undeclared), acts of enemies, strikes, fires, floods, acts of God and, without limiting the foregoing, any other cause not within the control of the party whose performance is interfered with and which, by the exercise of reasonable diligence, they are unable to prevent.
- b. Each party will promptly notify the other in writing when a condition of Force Majeure described in Clause 12.4(a) arises. Neither party will be liable for any failure to perform its obligations hereunder if prevented from doing so by reason of Force Majeure, provided that it will have used all reasonable endeavours to perform its obligations notwithstanding such situation or event.
- c. As soon as practicable after the lodging of such notice the Vendor and IIA/ITCC shall jointly determine whether the situation constitutes Force Majeure and if so the appropriate measures to meet the situation. Either party shall not be liable for any penalty or damage resulting in delays to perform its obligations as a consequence of Force Majeure.

12.5 Termination

- a. IIA/ITCC may terminate the Work with sixty (60) days prior written notice any time without assigning any reason or cause by notifying the Vendor in writing. In the event that the Work is so terminated by IIA/ITCC then ITCC shall pay the Vendor total amount of the costs and liabilities incurred by the Vendor up to the date of termination.
- b. IIA/ITCC may at any time terminate the contract by giving written notice with immediate effect in any of the following cases.
- c. If the Vendor is adjudged insolvent or if its financial position is such that within the framework of its national law, legal action leading towards bankruptcy is taken against it by its creditors or its Government, or
- d. If it is determined through appropriate proceedings that the Vendor has resorted to fraudulent or corrupt practices in connection with its securing or implementation of this Agreement.

12.6 Patents, Copyrights and other Proprietary rights

The Vendor warrants that any deliverable Item provided to IIA/ITCC shall to the best of its knowledge and belief be free of any rightful claim of any third party for infringement of patent, copyright, or other proprietary right.

12.7 Governing law

This Agreement shall be governed by, and construed in accordance with, the law for the time being in force in India.