Ref: Global Tender Notice No.PUR/IMP/TMT/MG&PM/CAP/014/2013-14

Dated 14 February 2014

ANNOUNCEMENT OF OPPORTUNITY

for

Transfer of Technology

and

Supply of Equipment and Installation

for

Mirror Polishing Using Stressed Mirror Polishing Method

for

M1 Segments of the Thirty Meter Telescope

2014 February

Indian Institute of Astrophysics

II Block, Koramangala

Bangalore 560 034

India

Introduction

The Thirty Meter Telescope (TMT) has a 30m diameter primary mirror (M1) composed of 492 hexagonal segments made of low expansion glass material. Each hexagonal segment has a nominal size of 1.44m across the corners. This announcement of opportunity is for Transfer of Technology and the supply and installation of mirror grinding and polishing equipment (2 Nos.) and tools for an optics polishing laboratory to be set up at one of the campuses of the Indian Institute of Astrophysics (IIA), on behalf of the India TMT Coordination Centre (ITCC). The scope of the proposal is (a) transfer of technology related to mirror polishing using the SMP technique to IIA/ITCC, (b) supply of equipment for grinding and polishing full-scale (1.5m) roundels using the Stressed Mirror Polishing (SMP) technique that includes custom built / manufactured grinding and polishing machines, required tools and fixtures, metrology instruments, and installation. The technical specifications are detailed in the Statement of Work in Section A, the Methodology of Submission of Proposal are detailed in Section B and Terms and Conditions are detailed in Section C.

The goal for the programme described by this RFP is for the Bidder to deliver to IIA all equipment required to set up a mirror grinding and polishing facility. The equipment will have been built and tested at Bidder's works, with IIA/ITCC staff trained to operate and maintain the equipment, and having gained the experience by polishing actual TMT mirrors. Upon Transfer of Technology, delivery, installation, and commissioning of the custom built SMP equipment, IIA/ITCC shall be able to begin Low Rate Initial Production, followed by a ramp-up to full production (2.5 mirrors per month, on average).

1. BACKGROUND INFORMATION

The optical and infra-red astronomical community in India had proposed to the Department of Science and Technology, Government of India, India's participation in the international Thirty Meter Telescope (TMT) project. The proposal to partner in the TMT project obtained the approval of the Government of India on 24th July 2010, with the announcement of India's decision to join the Thirty Meter Telescope (TMT) project as an observer with a strong intention of becoming a full partner in due course of time. 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 Aryabhatta 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.

The TMT project, 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 at Mauna Kea in Hawaii, USA. The TMT project work is scheduled to start by the middle of 2014 on the summit at an altitude of 4200m at Mauna Kea, and the telescope is envisaged to be operational in 2020.

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) [1]. The SMP method has been proven to be the fastest and lowest cost polishing method for large aspherical mirror segments. Additionally, the SMP technique produces mirror surfaces that are very smooth, enabling the telescope to meet science requirements.

ITCC proposes to set up a polishing facility, either within one of IIA's campuses. Towards delivery of the polished segments, ITCC, through IIA, proposes to acquire the necessary technology for the SMP technique, by the process of procurement of the SMP process equipment, metrology instruments, and associated controllers and software from a Bidder who has already demonstrated the SMP technique for polishing mirrors of size 1.5m diameter, or larger. ITCC also seeks to obtain training of IIA/ITCC personnel in the SMP technique by the Bidder, followed by jointly performed polishing of several prototype and production mirrors. The mirror polishing facility set up by IIA/ITCC in this process will only be used for non-commercial purpose, to fulfill the requirements of the TMT project as well the requirements of any other Indian Government funded projects only.

In pursuance of the above, the Director, Indian Institute of Astrophysics, Bangalore, on behalf of ITCC, invites proposal for custom build / manufacture and supply of proven, production-ready warping fixture equipment (2 Nos.), related large tool polishing machines (2 Nos.), including all tools for grinding and polishing 1.5m circular mirror blanks (roundels). The Bidder shall also assist in the installation and set-up of the delivered equipment at the IIA/ITCC polishing facility, and transfer the required process technology related to the SMP method of mirror grinding and polishing and metrology.

2. Submission of Proposal

Proposals are invited from companies with proven technical expertise, track record and experience in polishing thin, aspheric low expansion glass / glass-ceramic mirrors (aspect ratio ~1/30) of size 1.5m (dia), or larger, using the SMP technique. The companies willing to submit proposals are invited to submit their Proposal as specified below:

Submission of Proposal in two stages: Part 1 and 2.

Part 1: Submission of a letter of Expression of Interest (EOI).

Part 2: Submission of offer in two parts:

(a) Technical Bid

(b) Price Bid

Only those Bidders qualified through Part 1 process will be requested to submit the Technical Bid and Price Bid as per the procedure given in Part 2.

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

3. Process Schedule:

Date of this Announcement	14 February 2014
Deadline for receiving Expressions of Interest	28 February 2014 (3:30 pm IST)
Opening of EOI at IIA, Bangalore	28 February 2014 (4:30 pm IST)
Pre-qualification and intimation to qualified in EOI Bidders	10 March 2014
Deadline for receiving Proposals Technical Bid &Price Bid	31 March 2014 (3:30 pm IST)
Opening of Technical Bids at IIA, Bangalore	31 March 2014 (4:30 pm IST)
Opening of Price Bids at IIA, Bangalore	21 April 2014 (11 am IST)
(of Technically Qualified Bidders)	
Delivery and installation	22 months from Award of Contract

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

1. The Bidders or their authorized representatives may be present at the opening of the EOI on the date mentioned above.

2. Bidders interested in pre-bid technical discussions are welcome to visit IIA on a mutually convenient date during 17-18 March 2014.

3. The Bidders (or their authorized representatives) qualified through Part1 (EOI) and requested to submit the detailed proposals may be present at the opening of the Technical Bid on the date mentioned above.

4. The Bidders (or their authorized representatives) qualified through Part2a (Technical Bid) may be present at the opening of the Price Bid on the date mentioned above.

5. The intimation will be sent to qualified Bidders.

4. Contacts:

Technical Clarification: Dr. G.C. Anupama, Professor, IIA (gca@iiap.res.in)

Dr. J.P. Lancelot, Engineer (E), IIA (jpl@iiap.res.in)

Mr. S. Sriram, Engineer (D), IIA (ssr@iiap.res.in)

I. Section A

Scope of Work

5. Preamble

A brief overview of the TMT Optical Design, M1 Segmentation is provided here. Additional technical information related to M1 production process and specifications can be found on the TMT website http:// www.tmt.org/documents.

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 flat tertiary mirror (M3) is used to fold and steer the light beam to any of the eight instruments that will be mounted on the two main Nasmyth platforms. The telescope has an unvignetted field of view of 15 arcmin. The M1 is a segmented hyperboloid (Paraxial ROC = -60.0m, k=-1.000953, sag = 1.8m, asphericity = 29.3mm) of an effective diameter 30-m. The secondary is a single piece convex hyperboloid (Paraxial ROC = -6.228m, k =-1.31823, sag = 196 mm, asphericity = 850 μm) with 3.1-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 mm. To achieve the desired performance, the surface finish of each segment has to be l/20 or better at the specified wavelength.

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 six-fold symmetry about the vertical 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 ~226 μm PV while the inner most (Type-2) has only ~6 μm PV [2]. The detailed optical prescription of 82 segments can be found in [3].

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.

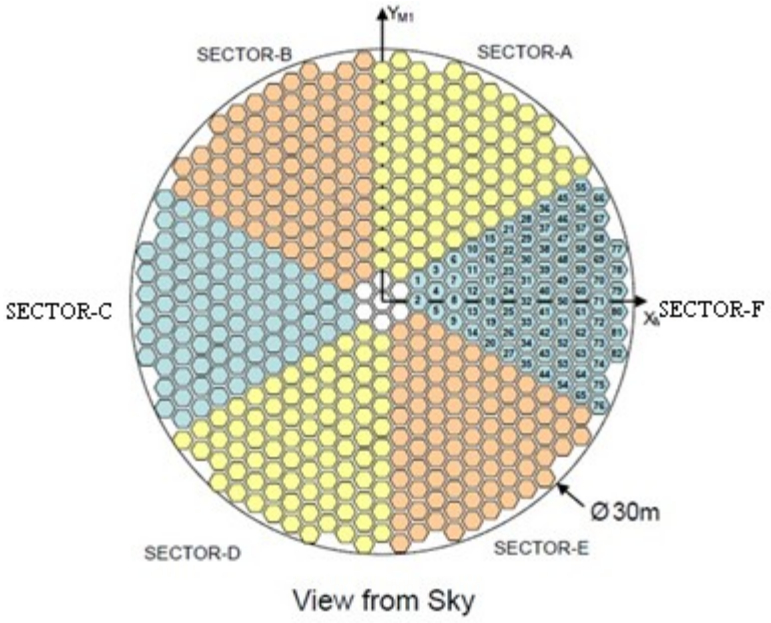

Figure 1: An illustration of M1 mirror array of 492 segments broken into six identical sectors, each having 82 unique segments

5.1 Statement of Work:

The SMP programme described herein includes, but is not limited to, the delivery of production-ready SMP polishing equipment, metrology instruments, ancillary tools, personnel training, process knowledge, technical assistance, and the polishing of four Nos. (minimum) TMT mirrors (glass provided by ITCC).

5.1.1 Transfer of SMP Technology to IIA/ITCC

- Bidder shall provide initial hands on training to IIA/ITCC Engineers/Technicians (hereinafter referred to as I-Personnel) on grinding, polishing and testing of at least 2 mirror blanks using the SMP technique. This training process shall be undertaken by the Bidder, at their works, using Bidder's already existing SMP equipment. Initial training shall commence within 30 days of contract start. In parallel with the initial training, Bidder shall be building the deliverable hardware described herein. During the fabrication and assembly of the delivered hardware, Bidder shall permit I-Personnel the opportunity to observe and assist in the work so as to gain a complete understanding of the operation and maintenance of the equipment.

- Training shall include, but is not limited to:

  (a) polishing of two (2) ITCC provided mirror blanks to the prescriptions specified by ITCC (could be any of the 82 TMT prescription)

(b) testing of the polished mirrors to demonstrate that they meet the requirements specified in the TMT Polished Segment Specification [4] and 5.1.4.

(c) demonstration of warping fixture performance by warping a mirror blank and then measuring the warped surface shape to verify that the fixture warping accuracy meets requirements stated herein. Warping demonstrations shall be performed for minimum 5 TMT prescriptions covering the full range of the 82 TMT segment Types.

(d) training of I-Personnel in the best safe practices for handling TMT mirror blanks, including lifting and flipping

(e) training of I-Personnel on how to assemble, commission, and maintain the SMP equipment.

¬ ***Time Period – 16 weeks (approx)***

5.1.2 SMP process equipment, metrology, and associated tooling

Bidder shall build and deliver operational mirror grinding and polishing equipment (2 Nos.) with custom built fixtures and tools for grinding and polishing Ø1.520m x 46mm thick OHARA ClearCeram Z HS glass ceramic or similar glass using the Stressed Mirror Polishing (SMP) technique Deliverables are defined in section 5.2.

5.1.2.1 Bidder shall deliver Warping fixtures (2 Nos.) that shall be capable of warping for purposes of SMP any of the 82 TMT segment Types.

5.1.2.2 Bidder shall deliver Polishing machines (2 Nos.) fully compatible with the Warping Fixture that shall be capable of performing SMP as per requirements of Section 5.3.

5.1.2.3 Bidder shall deliver Metrology instruments of four types for testing the polished mirrors during processing and during acceptance testing. These instruments are:

- One 2D area profilometer and associated software. Profilometer system shall meet the requirements specified in Section 5.3.
- One high-resolution sub aperture interferometric Fizeau test station that can be used to measure any 80mm (minimum) sub aperture across the entire mirror at a resolution of 0.25mm spatial periods
- One commercially available optical surface roughness measurement instrument that can measure the micro-roughness (with a resolution <2nm) anywhere across the mirror, including at the edge of the mirror.
- One large three ball spherometer that allows measurement of radius of curvature of the back surface.

5.1.2.4 Bidder shall deliver polishing laps, bond pads, bond pad install/removal tools, and mirror handling equipment.

5.1.3 Qualify the equipment (both numbers) built for IIA/ITCC

The equipment built for IIA/ITCC shall be qualified at the Bidder's works. Qualification of each equipment shall be through the means of I-Personnel grinding and polishing roundels as per specifications below:

Grind and polish at least two roundels of Type-number to be specified by ITCC, one on each of the IIA/ITCC equipment built.

- The back surfaces (S2) to be processed to 62.5+/-3m radius of curvature (ROC). Polish level shall be free of sub-surface damage.
- The front surfaces (S1) should be polished to paraxial radius of curvature (ROC) of M1 which is 60m.
- Segment should be off-axis polished to meet the prescription corresponding to the TMT Type-number specified by ITCC.
- Should demonstrate smoothness, convergence and low-order shape removal rates.
- Low-order shape errors < 2 microns PV
- Mid- High-spatial frequency errors less than 4.5nm RMS as calculated per Section 3.11.2 of TMT Specification [4].
- Roughness < 2nm RMS

5.1.4 Acceptance Criteria

Acceptance of the equipment shall be based on demonstration of the following:

(a) S2 Surface:

(i) ROC measurement of 62.5+/-3m as measured using a calibrated spherometer.

(ii) Surface shall be free of sub-surface damage as described in Note 5b on TMT Polished Segment Drawing [5].

(b) S1 Surface:

(i) Surface Figure/ Segment Shape <2micron PV - Demonstrated using a 1D/2D profilometer, and cross check with CMM

(ii) Surface Roughness Measurement <20A RMS average for 1mm scan with 120micron HPF on 5 spots from center to edge –
Demonstrated by calibrated surface profiler

(iii) Sub aperture (~100mm) surface measurements <3nm RMS average for a spatial period 2 to 25mm over 5 spots from center to edge –
Demonstrated by calibrated sub-aperture interferometer

(c) Warping fixture performance:

(i) warping a mirror blank and then measuring the warped surface shape to verify the fixture warping accuracy

(ii) demonstration shall be performed for minimum 5 TMT prescriptions covering the full range of the 82 TMT segment types

5.1.5 The mirror blanks to be provided by ITCC conforming to TMT Specification [6].

5.1.6 Installation at site

a. Provide domain expertise and support to I-Personnel in installation and setting up the mirror grinding and polishing facility at IIA.

b. Demonstrate the warping fixture performance. Warping demonstrations shall be performed for minimum 5 TMT prescriptions covering the full range of the 82 TMT segment Types.
c. Continued support for at least 3 years post-installation through electronic modes of communication.

5.2 Deliverables

5.2.1 Transfer of SMP technology to IIA/ITCC.

5.2.2 Four full-scale polished roundels as per specifications in Section 5.1 and subsections within.

- Two are polished during training phase (Section 5.1.1)
- Two are polished on deliverable SMP equipment set number-1 and 2 (Section 5.1.3)

5.2.3 Supply, installation and commissioning of the following deliverables, meeting the requirements of Section 5.3:

1. Custom built integrated Grinding, Polishing, and Metrology system for producing polished aspheric round mirror blanks
    a. 2 nos. SMP Warping Fixture (either passive mechanical or actively controlled)
    b. Apparatus for measuring the stiffness of the locked hydraulic pads shall be provided
    c. Test set-up for calibrating load cells (if system has active elements)
    d. Spare parts: two hydraulic pads and two actuators, if any
    e. Three sets of Invar bond pads
    f. One bond-pad installation station
    g. One bond-pad removal station with tools for removing bond pads (induction heater, for example)
    h. 2 nos. full-tool polishing machines with slurry distribution system and associated grinding and polishing laps
        h.i. Two pitch polishing laps
        h.ii. One grinding lap
    i. One multi-probe, LVDT based, 2-D profilometer system.
    j. One final test buy-off station with hydraulic whiffletree and interfaces to 2D profilometer for final testing mirrors.

k. One high-resolution sub-aperture interferometric optical test station capable of measuring 80mm min diameter sub apertures anywhere across the mirror surface.

l. One optical surface roughness measurement instrument capable of measuring micro-roughness with a resolution <2nm anywhere across the mirror, including at the edge of the mirror.

m. One large three ball spherometer.

n. S2 serialization tool that shall allow S2 side to be serialized with fiducials to be used/referenced in mirror metrology.

2. Equipment for lifting and handling of the mirrors

    a. One no. Vacuum lifter

    b. One mirror flipping box

3. Other process equipment required for complete SMP process

    a. One oven suitable for preparing pitch lap

    b. Etch station for preparing mirror surface prior to bonding Invar pads onto mirror

4. Materials and consumables sufficient to polish 5 mirrors shall be delivered, including:

    a. Cerium oxide polishing medium

    b. Grinding materials

    c. Pitch

    d. Adhesives for bond pads

    e. Lubricants (if any)

    f. Other consumables

5. Process recipe and operating instructions shall be delivered.

6. Operating and maintenance manuals (hard and soft copies) shall be delivered.

7. List of spares required for operation and maintenance of the delivered equipment during the production phase shall be provided.

5.3 Requirements for Delivered Hardware, Training and Procedures

5.3.1 Environment, Health and Safety:

- All delivered hardware shall be designed and manufactured to meet environment, health and safety standards for the Bidders local jurisdiction, as well as the standards for the IIA/ITCC polishing facility site jurisdiction.

- In particular, pinch hazards, hazards associated with large reciprocating and rotating equipment shall be considered.

- Mirror handling equipment and processes shall be based on best industrial practices. Training shall inform I-Personnel of dos and don’ts associated with handling large optics.

5.3.2 Electrical Power:
All hardware shall be capable of operating at 50Hz and 60 Hz.

5.3.3 SMP System Process Performance

- The two delivered SMP systems, metrology instruments and ancillary tools and components shall together be capable of polishing 2.5 mirrors per month (on average) to TMT figure requirements defined in [4] during mass production (after all learning curve improvements are established), assuming two 8 hour shifts per day, 5 days per week.

5.3.4 Warping Fixture Requirements & Performance

Warping fixtures shall meet the following requirements as a minimum:

- Fixture shall be capable of warping the TMT segment blanks to any of the 82 TMT prescriptions (0-226 microns PV) as a minimum

- The warping process shall converge within 25 minutes after initiation using normal care and effort

- Fixture shall permit rapid (5 minutes) release of warping forces in order to facilitate in-process testing of mirror, using normal care and effort.

- Warped shape accuracy shall be 150nm RMS or better of commanded shape

- Warping repeatability shall be 100nm RMS or better

- Warping fixture shall have a hydraulic axial support.

    - Hydraulic support shall have 37 hydraulic bellowfram pads as a minimum. Hydraulic pads shall be plumbed into three zones, making 3 whiffletrees. When hydraulic valves are open, the mirror shall float on 3 whiffletrees.

    - Each hydraulic pad shall include a hydraulic ball valve in direct proximity to the pad such that the whiffletree can be rigidized (valves closed) and floated (valves unlocked) within 1 minute.

    - Hydraulic support shall be designed and constructed such that it can be easily bled to remove air from pads during servicing

    - Stiffness of all hydraulic pads shall not vary by more than 10% at time of delivery.

- Hydraulic system shall include device to permit raising and lowering of mirror to facilitate loading and unloading of mirror during processing.
- Hydraulic pads shall not include any sliding friction features or components
- Hydraulic pads shall not constrain the lateral motion of the mirror during polishing

- The warping fixture shall have a lateral restraint system for the mirror
  - The lateral restraint system shall be capable of reacting the transverse surface tractions introduced into the mirror by the grinding/polishing tools
  - The lateral restraint system shall be sufficiently athermal so as not to cause damage to the mirror or fixture when the temperature of the fixture changes by +/-10C

- The warping fixture shall have a system (either automated or passive gravity based) for applying the requisite warping forces and moments to the perimeter of the mirror via a set of Invar-36 bond-pads/blocks
  - The warping system shall be designed such that the warping forces are introduced into the mirror at a minimum of 24 equally spaced locations around the perimeter
  - The warping-force setting accuracy of an individual “actuator” (whether gravity based or automated) shall be sufficient to meet stated accuracy and repeatability requirements for the fixture as a whole.
  - If automated, actuators shall be easily removable for calibration and service
  - If automated, actuator force settings shall be stable over all operating conditions
  - Actuators force setting shall be continuously adjustable over the required load range.
  - If automated, actuators shall have features that prevent overloading of the mirror that could cause damage.
  - Actuator mechanisms shall have low friction, as required to assure polishing convergence

5.3.5 Polishing Machine Requirements

- Polishing machines shall be based on a classical Center over Center large tool polishing machine design
- Polishing machines shall have sufficient precision, stability, and drive axis power to meet the requirements for polishing performance and throughput stated elsewhere within this document.
- Polishing machines shall have a slurry distribution and management system as required

to process the mirrors to meet the requirements for polishing performance and throughput stated elsewhere within this document.

- Polishing machines shall be fully compatible with the Warping Fixture that shall be capable of performing SMP as per requirement.

5.3.6 Metrology System Requirements

- The Metrology System shall include four instruments:
    - 2D area profilometer for measuring low- mid-spatial frequency shape
    - High-resolution sub-aperture optical measurement system for measuring mid-high- frequency errors
    - Optical surface roughness measurement instrument
    - Three ball spherometer
- Together the delivered metrology tools shall be able to measure the S2 surface ROC and S1 surface errors over the spatial frequency range from full aperture to micro-roughness, such that a PSD can be directly constructed from the data.
- 2D Area Profilometer
    - 2D area profilometer shall have an absolute accuracy of 100nm RMS
    - 2D area profilometer shall have a repeatability of 50nm RMS
    - 2D area profilometer shall have 61 LVDT probes as a minimum.
    - The 2D profilometer shall be portable and be able to be brought to the mirror being polished for testing.
    - 2D profilometer shall also be designed to permit three set-downs (0, 120, 240 degree rotations) to increase the sampling of the mirror surface.
    - Probe arrangement shall give equal weight to each probe (same swept tributary area)
    - Probe arrangement shall be such that 0, 120, 240 deg set-downs do not measure the same points on the mirror
    - 2D profilometer system shall include mechanical and software capability for performing calibration against a Ø1.520m x 0.300m zero-expansion polished and tested reference sphere (ITCC provided).
    - 2D profilometer system shall include software and electronics that collects probe readings, and then processes the measure data, reporting Zernike coefficients, PV, RMS, and a graphical surface map.

- The High Resolution Sub-aperture System
    - The High Resolution sub-aperture system shall be based on a COTS Fizeau interferometer
    - The High Resolution sub-aperture system shall have an aperture of 80mm minimum, and a resolution of at least 0.25mm
    - The High Resolution sub-aperture system shall be designed to receive a polished mirror for testing.
    - The High Resolution sub-aperture system shall be able to take sub-aperture data anywhere on the mirror surface.
    - The High Resolution sub-aperture system shall be able to measure right to the edge of the mirror
- Optical surface roughness measurement instrument
    - The surface roughness measurement instrument shall be a COTS instrument with adequate objectives to measure the required spatial frequencies.
    - The instrument shall be able to measure the micro-roughness anywhere across the mirror, including at the edge of the mirror.
    - The instrument shall have a resolution < 2nm

References:

[1] TMT.OPT.TEC.10.052.REL03

[2] TMT.OPT.PRE.09.099.DRF03

[3] Segmentation_database_rel07_0.zip

[4] TMT.OPT.SPE.11.001

[5] M1S-001-01000

[6] TMT.OPT.SPE.07.001

The above Documents may be found under Primary Mirror Segments (M1) at http://www.tmt.org/documents

II. Section B

Methodology of Submission and Qualification

6. Part I - Expression of Interest (EOI)

6.1 Sealed EOI shall be submitted in the format specified in the Appendix, enclosing documents listed below and any other documents that would help in the evaluation of the EOI.

6.6.1 The profile of the Company.

6.6.2 Details of past experience of the company in executing grinding and polishing work on thin, aspheric low expansion glass / glass-ceramic optics (aspect ratio ~1/30) of size 1.5m (dia), or larger, using the SMP technique.

6.6.3 Details of past experience of the company in executing projects involving optics related to astronomical or other sciences if any.

6.6.4 Appreciation/Reward Letters and other supporting documents with reference to 6.6.2 and 6.6.3 above.

6.6.5 The management structure and brief bio-data of top technical personnel.

6.6.6 Technical staff strength related to the Bid.

6.6.7 Manufacturing plants and equipment of the company.

6.6.8. Financial position of the Company supported by Audited balance sheets for the last three years.

6.6.9 Solvency certificates (not older than 12 months) issued by scheduled/nationalized/multi-national bank with which the bidder holds the current account, or a Government Agency.

6.6.10 Copy of Registration Documents of the Company.

6.2 The EOI should be printed on company stationery and the authorized person who signs the offer is required to indicate his/her e-mail ID, mobile no. and also general e-mail ID for easy and fast communication.

6.3 The envelopes for EOI shall bear the following: “Tender Notification No.PUR/IMP/TMT/MG&PM/CAP/014/2013-14 dated14.02.2014”, ” Transfer of Technology and Supply and Installation of Equipment for Polishing M1 Segments of the Thirty Meter Telescope – Stressed Mirror Polishing Technique: Expression of Interest”, name and address of the Bidder and it shall be addressed to:

The Director,
Indian Institute Of Astrophysics (IIA),
II Block, Koramangala,
Bangalore – 560 034
India

6.4 The EOIs will be evaluated based on, but not limited to, the following criteria:

6.4.1 Past experience of the Company in grinding and polishing thin, aspheric mirrors of size 1.5m dia or larger, using the SMP technique.

6.4.2 Past experience of the Company in executing projects involving optics.

6.4.3 Profile and Financial Position of the Company.

6.4.3 Technical staff strength relevant to the Bid.

6.4.4 Manufacturing plants and equipment of the Company relevant to the Bid.

7. Part 2 - Submission of Technical and Price Bids: General Terms

7.1 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.

7.2 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.

7.3 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.

7.4 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.

7.5 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.

7.6 The 'Technical Bid' shall contain, in addition to the Bid, supporting documents that would help in the technical evaluation of the Bid.

7.7 The Technical and Price Bids (both original and copy) shall be sealed in separate envelopes. The envelopes shall bear the following: "Global Tender Notification No.PUR/IMP? TMT/MG&PM/CAP/014 dated 14.02.2014 ,Transfer of Technology and Supply and Installation of Equipment for Polishing the M1 Segments of the Thirty Meter Telescope – Stressed Mirror Polishing Technique", and "Technical Bid" or "Price Bid" as appropriate.

7.8 Both the envelopes shall bear the name and address of the Bidder.

7.9 The two sealed envelopes shall be enclosed in a third sealed envelope. This envelope shall bear the following: "Global Tender Notification No.PUR/IMP?TMT/MG&PM/CAP/014 dated 14.02.2014, Transfer of Technology and Supply and Installation of Equipment for Polishing M1 Segments of the Thirty Meter Telescope – Stressed Mirror Polishing Technique: Technical and Price Bids", bear the name and address of the Bidder, and shall be addressed to:

The Director,
Indian Institute Of Astrophysics (IIA),
II Block, Koramangala,
Bangalore – 560 034
India

If the envelopes are not sealed and marked as required, IIA 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 by the date and time indicated. IIA will not be responsible for late, delayed bids and loss of bids in transit, whatsoever the reason may be.

7.11 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, if it finds necessary.

7.13 At any time prior to the deadline for submission of Bids, IIA 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.

7.14 IIA 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 and Bidder previously subject to the deadline will thereafter be subject to the deadline as extended.

7.15 In order to allow reasonable time for the prospective bidders for taking the amendment into account in preparation of their bids, IIA 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 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 Bidder 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, unless a specific written acceptance thereof is obtained.

7.18 Any effort by a Bidder to influence IIA in the bid Evaluation, bid Comparison or contract award decisions may result in the rejection of their bid.

7.19 IIA reserves the right to accept/reject part/any one or more of the tendered/quoted items without assigning any reasons.

7.20 Any clearance from Government bodies of the country of origin, if required, for exporting the equipment under discussion to India, has to be obtained by the Bidder at their expense.

7.21 Any clarifications pertaining to this document may be obtained from IIA by the Bidders by writing at the following address at least seven days prior to the due date for submission of bids.

The Director,
Indian Institute of Astrophysics,
II Block, Koramangala
Bangalore 560 034
India

Contact for Technical Queries: Dr. G.C. Anupama (gca@iiap.res.in); Dr. J.P. Lancelot (jpl@iiap.res.in); Mr. S. Sriram (ssr@iiap.res.in)

Contact for Commercial Queries: Shri Y.K. Raja Iyengar (ykri@iiap.res.in)

8. Part 2a - Technical Bid: Details

8.1 The Technical bid shall include but not limited to the following items:

1. Description of the technological approach proposed to be followed to execute the project
2. Strategy to be followed for the execution of the project including tools and technologies to be used.
3. Fabrication drawings of custom tools.

4. Project execution and management details, including details of the project team, escalation paths etc.
5. Details of the resources, infrastructure or data expected to be provided by IIA to the successful bidder for undertaking the project.
6. Risk identification and mitigation plans.
7. Quality audit, control and assurance plans.
8. Change control process.
9. Detailed time schedule for the project.
10. Commercial terms and conditions.
11. Acceptance criteria and test plans in the factory and on-site.
12. A copy of the Price Bid without indicating the quoted Price.

8.2 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. Part 2b - Price Bid: Details

9.1 The Price Bid shall include the following:

a. Man power training and technology transfer component.
b. An item wise break-up clearly indicating any free-issue material, imports etc..
c. Applicable taxes, duties or other statutory payments.
d. Installation and Commissioning, Warranty, support through electronic mode of communication.
e. Any other cost such as for tooling, packaging, travel etc..
f. Insurance and freight.
g. Total cost along with proposed payment stages, schedule and percentage to be paid at each stage.
h. Mode of payment by IIA (like Letter of Credit, Site Draft etc.)

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 120 days from the date of opening of bids. IIA may

ask for the Bidder's consent to extend the period of validity. Such request and the response will be made in writing only. A Bidder agreeing to the request of IIA for extension of the bid will not be permitted to modify the bid (if already submitted).

9.4 Price bid shall be only in fully convertible currency or INR.

10. Eligibility Criteria and Qualification Process

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. If some manufacturing, testing and inspection facilities are not available with the company, it should mention about their access to such required facilities at other places.

c. Project planning and Execution methodology followed by the Company, with specific emphasis on schedule and cost control.

d. Company's views if any, on the need to form a consortium to meet quality, cost and time schedule.

e. The Company should have executed at least two projects involving similar precision fabrication and costing about Rs. 40 Crores (approximately 6M USD) during the past five years.

f. To assist in the evaluation of bids, IIA may at its discretion ask the bidder for a clarification of its bid. IIA may call for meetings with bidders to seek clarification at appropriate times in its premises in Bangalore. The bidders shall attend the meeting at their own cost. The request for clarification and the response shall be in writing.

g. Following the evaluation of technical bids, the price bids of qualified bidders shall be opened to choose the bidder to execute the project.

h. The evaluation committee may hold commercial discussion with the selected Bidder to execute the project.

i. Prior experience with similar projects, commitment and risk evaluation will play an important role in the selection process.

j. Bidder shall have process-ready SMP technology with a demonstrated capability for polishing 1.5m dia (or larger), aspect ratio ~1/30 Glass Ceramic mirrors having at least 225 micron aspheric departure to an accuracy of 2 microns PV or better with smoothness better than 3nm RMS as measured using 80mm-120mm sub-aperture interferometric test. The process shall also have demonstrated a micro-roughness better than 2nm RMS.

III. Section C

11. Terms and Conditions

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

11.1 Subcontracts

The following terms and conditions refer to jobs subcontracted by the Bidder:

a) The Subcontractor is an independent contractor.

b) The Bidder shall provide as an independent contractor and not as an agent of IIA, all necessary personnel, materials, equipment and facilities to perform the Work.

c) The Bidder shall not assign its rights or obligations to a third party without the prior written approval of IIA.

d) Notwithstanding any subcontract under this Agreement, whether approved by IIA or not, the Bidder shall remain fully liable and responsible to IIA for the satisfactory and timely completion of the Work.

11.2 Payment

a) IIA shall pay the Bidder the price in accordance with a milestone schedule.

b) Upon completion of each milestone, the Bidder shall submit to IIA an Invoice for the amount corresponding to that milestone in Schedule.

c) The Bidder shall submit documentary evidence, including but not limited to photographs and illustrations, as verification of completion of each Milestone. IIA may at its own discretion verify and substantiate that the milestone has indeed been performed or completed as invoiced by the Bidder. Such verification may require Bidder to submit to IIA additional documentation with regard to quality control normally expected during process of manufacture, and/or inspection by IIA and/or its authorized representatives. Any request for substantiation under this clause shall be made by IIA 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 for the equal amount

11.3 Vesting of Title and Assumption of risk

a) On each item to be delivered by the Bidder, including an item of work in progress, in respect of which payments have been made in accordance with Clause 11.2 above, IIA 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 delivered to and accepted by IIA.

b) Risk for loss or damage to deliverable Items provided by the Bidder shall rest with the Bidder, until final acceptance by IIA.

c) Title to all deliverable Items provided by the Bidder shall pass from the Bidder to IIA upon final acceptance or the final payment under Clause 11.2 above, whichever last occurs.

d) IIA shall not accept any liability for the Bidder and its subcontractors, their subsidiaries and/or their officers, employees or agents, servants, and assignees, or any of them or for their property. The Bidder shall indemnify and keep harmless IIA, 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 Bidder, 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 Bidder, its subsidiaries and/or their officers, employees or agents, servants and assignees, or all or any of them.

11.4 Intellectual Property rights

a) All Intellectual Property Rights existing in a party prior to the Contract ("**Background 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 ("**Generated Intellectual Property Rights**") shall, upon completion of the Work, vest in IIA/ITCC and TMT project.

11.5 Confidential Information

a) The Receiving party, i.e. IIA/ITCC, shall protect the confidential information provided by the Disclosing party, i.e. Bidder, and keep it secure, and shall not at any time:

    a. directly or indirectly disclose or distribute the confidential information to any person other than its representative, employee, agent or advisor, except where such disclosure is necessary for the purpose of the Work;

    b. use or copy the confidential information except for the purpose of the Work;

    c. in future use or copy the confidential information except for the purpose of projects funded by the Government of India, or its agencies.

b) Where the receiving party discloses confidential information to a representative, employee, agent or advisor under Clause 11.5a 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 provisions of this Clause 11.5 are subject to the provisions of Clause 11.4.

11.6 Settlement of disputes

a) All disputes arising in connection with the interpretation or implementation of the contract shall be amicably settled by IIA and the Bidder, by direct discussion.

b) If IIA and the Bidder are unable to resolve a dispute within 30 working days of the dispute being referred to them in accordance with Clause 11.6a, the parties may agree to refer the dispute to mediation.

c) IIA and the Bidder appoint a mediation committee comprising of two nominees by IIA and two nominees by the Bidder. IIA and the Bidder 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 Bangalore. 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.

11.7 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 11.7.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 Bidder and IIA 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.

11.8 Termination

a) IIA may terminate the Work with sixty (60) days prior written notice any time without assigning any reason or cause by notifying the Bidder in writing. In the event that the Work is so terminated by IIA then IIA shall pay the Bidder total amount of the costs and liabilities incurred by the Bidder up to the date of termination. The Bidder shall deliver to IIA all products connected with this work (manufactured and COTS) in an as is where is condition.

b) IIA may at any time terminate the contract by giving written notice with immediate effect in any of the following cases

   i. If the Bidder 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.

   ii. If it is determined through appropriate proceedings that the Bidder has resorted to fraudulent or corrupt practices in connection with its securing or implementation of this Agreement.

11.9 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 IIA including transportation charges and transit insurance.

c) IIA, at its cost, shall arrange necessary transportation and Transit Insurance for shipment to any other site for acceptance tests.

d) All the materials, subsystems, major test equipments procured or developed under the present project shall be insured against all risks including loss due to fire, damage, theft, etc., and hypothecate to IIA

11.10 Acceptance Criteria

a) Qualification of the custom built equipment (both numbers) by grinding and polishing roundels and demonstration of specifications as per acceptance criteria listed in Section 5.1.4.

b) On-site demonstration of the performance after delivery and installation, as specified in Section 5.1.6.

c) All deliverables shall meet the requirements specified in Section 5.3

d) Stage inspection and final inspection of all deliverables will be carried out by the IIA/ITCC and/or their authorized representatives.

11.11 Patents, Copyrights and other Proprietary rights

The Bidder warrants that any deliverable Item provided to IIA 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.

11.12 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 and/or its authorized representatives, at reasonable times and with reasonable notice to the Bidder.

b) The Bidder shall provide IIA/ITCC and/or its authorized representatives, 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 Bidder to participate in the Work in respect of the disciplines in which they are specialized.

11.13 Warranty

The Bidder warrants that all Deliverable Items shall be free and clear of all liens and encumbrances pertaining to title at the time of delivery to IIA, India. The Bidder’s liability and IIA’s sole remedy under this warranty shall be limited to the Bidder 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 Bidder will provide a one year warranty from date of acceptance and installation of the deliverables at IIA.

And the Bidder warrants that:

all deliverable Items that are procured or furnished by the Bidder 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;

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

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.

11.14 Deliverable documentation and Standards

The deliverable documentation shall include, but not limited to, installation, operation and maintenance manuals and drawings (both hard and soft copies). All documentation shall be in the English Language.

11.15 Progress reports

The Bidder shall provide IIA 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.

11.16 Performance guarantee

IIA 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.

11.17 Governing law

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

12. APPENDIX

FORMAT FOR SUBMISSION OF "EXPRESSION OF INTEREST"

IIA RFP No (to be Inserted)

Bidder's Offer No. ----------
Dated ----------

FROM
M/s ----------

To
The Director,
Indian Institute of Astrophysics (IIA),
II Block, Koramangala,
Bangalore – 560 034
India

Dear Sir,

We have gone through the conditions pertaining to the Announcement of Opportunity and by accepting the same, we are submitting herewith our Expression of Interest.

We hereby agree to Transfer of Technology, Supply, Installation and Commission the Stores conforming to the specifications incorporated in Section – A.

Yours faithfully,

Stamp and Signature of the Bidder