



INDIAN INSTITUTE OF ASTROPHYSICS

IIND BLOCK, SARJAPUR ROAD, KORAMANGALA,
BANGALORE-560 034

PUBLIC TENDER NOTICE NO:PR/PT/JPLCT/HCT/PLANT/IAO/ CAP/547 DATED 22ND DECEMBER 2015

The Director, Indian Institute of Astrophysics invites Quotations/Bids (**Double Bid System**) both Technical bid and Commercial bid from reputed firms for following:-

Sl.No.	Description	Quantity	E.M.D	Tender Fee
			(Refundable) Rs.	(Non-refundable) Rs.
01.	Design, Manufacturing, Installation, testing, Commissioning of Aluminum Coating Plant for 2M Optical Telescope Mirror at IAO, Hanle (300 KM from Leh, Jammu and Kashmir) (As per detailed specification in the Annexure – I)	01 Set	8,75,000/-	500/-

Note: The Tender documents with specification details are available on IIA website www.iiap.res.in/tenders.htm. Hence the interested tenderers may at their option down load the same from our website (as no hard copies of Tender documents is/are provided from this office) and submit their offer along with EMD (refundable) & Tender fee (non-refundable) prescribed therein, only in the form of Demand Draft drawn in favour of Director, IIA. However, your offer with bid should be superscribed in a envelope mentioning the Tender Notice No., Date of opening, and submit both Technical bid and Commercial bid in a separate sealed envelopes addressed in favour of Director, Indian Institute of Astrophysics, 2nd Black, Koramangala, Bangalore – 560 034.

02. The firms who fulfill the following requirements shall be eligible to submit their bid. Joint ventures are not acceptable.

- (a) Tendering Company shall be professionally managed and equipped with facility for the supply and maintenance of tendered items.
- (b) The tenderers should have completed at least one similar single work for a minimum value of Rs.3.5 Crores during the last 3 financial years (i.e., current year and two previous financial years).

(c) The total contract amount received during the last 3 financial years, and the current financial year should be minimum of 150% of the above mentioned value. The tenderer should submit Audited Balance Sheet duly certified by the chartered accountant to this effect. They should also submit Bankers Solvency Certificate to a minimum of Rs.3.5 Crores.

(d) The Private Body Contractor shall be required to produce the TDS Certificate indicating the Income Tax deducted by the client for the execution of similar \ items, completed individually of value not less than Rs.3.5 Crores.

03. Both Technical bid and Commercial bid supported by the above information should be submitted in a separate sealed envelopes duly superscribed with the name of work/item. The Technical bid and Commercial bid will be received by this office **upto 15.00 Hrs. latest by 28th January 2016.**

04. If any information furnished by the tenderers is found incorrect at a later stage, the firm shall be liable to be debarred from tendering and taking up of work in IIA. The Institute reserves the right to verify the particulars furnished by the tenderers.

05. The interested tenderers may contact Mr.J.P.L.C.Thangadurai (Ph.No.22541232) to discuss Technical Clarification and Shri.Y.K.Raja Iyengar (Ph.No.22541244) for Commercial Clarification, if any, on or before 18th January 2016 during office hours, before submitting bids.

06.The firms should submit both Technical bid and Commercial / Price bid separately superscribed along with EMD and Tender fee of prescribed amount **upto 15.00 Hrs. Latest by 28th January 2016.** The Technical bids will be opened in presence of the bidders or their authorized representatives **at 15.30 Hrs. on 28th January 2016.**

07. EMD & Tender fee of prescribed value shall be sent along with the Technical bid, tenderers in the form of demand draft only in favour of “The Director, Indian Institute of Astrophysics, Bangalore, drawn from any Indian Nationalised / Reputed Banks in India.

08. Incomplete bids are liable for rejection.

09. Late / delayed offer will not be considered.

10. IIA is not responsible for any delay / loss of documents in transit.

11. No bids will be considered if prescribed Tender Fee and EMD is not found with the technical bid.

12. The offer should be valid for a minimum period of 120 days from the date of opening of bid.

13. The Commercial / Price bids will be opened of those firms technically qualified, in the presence of such bidders or their nominated representatives. The date of opening will be intimated to those bidders who are successful in Technical bid.

14. IIA reserves the right to reject any or all tenders without assigning any reasons.

**Administrative Officer
IIA, Bangalore-34**

ANNEXURE - I

**INDIAN INSTITUTE OF ASTROPHYSICS
BANGALORE – 560034
INDIA**

REQUEST FOR PROPOSAL

FOR

DESIGN, MANUFACTURING, INSTALLATION, TESTING AND
COMMISSIONING OF ALUMINIUM COATING PLANT FOR 2m
OPTICAL TELESCOPE MIRROR AT IAO, HANLE

Indian Institute of Astrophysics
Bangalore

November 2015

I. INTRODUCTION

The Indian Astronomical Observatory, Hanle, the high-altitude station of IIA is situated at an altitude of 4500 meters above mean sea level to the north of Western Himalayas, 260 Km southeast of Leh, Jammu & Kashmir State. A 2-m optical infrared telescope (Himalayan Chandra Telescope, hereinafter HCT) is installed at the observatory. This telescope is remotely operated from CREST, Hosakote, using a dedicated satellite link.

The Vacuum Coating Plant at IIA Hanle is for coating of the primary and secondary mirrors of HCT. The frequent coating of these mirrors becomes necessary because they are exposed to the atmosphere and reflectivity decreases with time. This is a Request for Proposal to design, fabricate, install and commission a coating plant for HCT at Hanle.

II. SCOPE OF WORK

The Vacuum Coating Plant at IAO, Hanle is required for undertaking the coating of the Primary and secondary mirrors of HCT. The frequent coating of these mirrors becomes necessary because they are exposed to the atmosphere and reflectivity decreases with time. The best coatings for optical telescopes are aluminium, silver, and gold, which have good reflectance in the visible and infrared region.

Aluminium is the reflective coating of choice for general purpose, ground based telescope mirrors because of its very good reflectance from the ultraviolet to the infrared and it can easily be deposited and removed. The common Coating plant is required primarily for coating the primary and secondary mirrors of HCT.

The following details regarding the scope of work are provided to the bidder (company) for the Coating Plant:

2.1 Requirement:

A vacuum plant is to be set up at IAO, Hanle for coating 2m primary mirror of HCT and the secondary mirror. The technical details of the mirror, their diagrams are given in Annexure 1. The plant should also have arrangements for coating single or multiple mirrors of smaller dimensions including the secondary mirror of HCT.

2.2 Location and Environment:

The coating plant is to be installed and commissioned at the Indian Astronomical Observatory located at Hanle, Jammu & Kashmir state at an altitude of about 4500m above MSL. The environmental conditions at the site are:

Altitude	4500M
Atmospheric Pressure	570 – 600 mbar
Operating Temperature	+10 to + 30 deg C
Storage Temperature	-30 to + 30 deg C
Operating Relative Humidity	5% to 90 %
Storage Relative Humidity	5% to 100% non-condensing

Thus, the plant must withstand these extreme conditions of temperature and humidity without any damage to any of the components while in operation or in storage condition.

The space available at the site for Coating Plant is 9m (Length) x 5m (Width) x 4.5m (Height). The exact layout of the plant should be finalized in consultation with IIA during the Preliminary Design Review and a possible site visit by the vendor.

2.3. Coating Process:

There are three major physical vapor deposition (PVD) processes that could be used for coating of astronomical mirrors namely, thermal evaporation, electron beam deposition and sputtering. However sputtering is preferred over other techniques because of the following reasons:

- Sputter targets can have much larger surfaces than evaporative sources. This simplifies problems of coating uniformity.
- Since the target is large, a relatively small distance to the substrate is sufficient which results in a smaller, cheaper coating plant.
- The solidity of sputtering targets permits, theoretically, operation at any angle.
- Since the distance between the targets and the substrate is reduced, a high degree of control can be maintained over grain diameter, and consequently reflectance.
- Multicoat deposits are possible
- The adhesion of the coating to the substrate is better
- Reactive processes can easily be done by sputtering a metallic target while reactive gases are introduced into the chamber, to enable oxides, nitrides, etc., to be deposited.
- Sputtering has been universally applied in the semiconductor production area, and in producing low emissivity coated architectural glass.
- Due to advantages of coating uniformity, smaller plant size, more flexibility of operation at any angle etc, it is preferred to have magnetron based coating facilities capable of depositing high quality aluminum (Al).

2.4. Vacuum Chamber and Evacuation System:

- A concept design of the chamber and the evacuation system is to be made available for

approval by IIA.

- The chamber size should be appropriate to accommodate the mirror handling tool also.
- The vacuum chamber is to be fabricated from Stainless Steel SS 304L and all material used inside the chamber should be vacuum compatible. Adequate ports and fittings should be provided for meeting the requirements of inert gas atmosphere, evacuation, purging, cooling etc.
- Enough number of view ports should be provided for inspection of the chamber interior during the evacuation and coating process. The following are required to be incorporated in the Vacuum Chamber and the Evacuation System design

2.4.1 Vacuum Chamber

1. Concept Design, Approval by IIA
2. Structural Design including stress analysis
3. Mirror Support Structures (for Primary and Secondary Mirrors)
4. Substrate Holder
5. Mirror Rotating System
6. Magnetron Source, Ion Cleaning and Coating System

2.4.2 Evacuation System

1. Roughing and High Vacuum Pumps (For High Vacuum only. Turbo-molecular pumps preferred.
2. Valves and Gauges from standard companies such as Varian, Pfeiffer, Alcatel etc.
3. A coarser Bourdon type gauge to be installed at the chamber top cover itself
4. All the plumbing, Cold Traps etc.
5. Chiller for water cooling.

- The pumps should be able to reach the required vacuum in six hours; lesser the better.
- The leak rate should be less than 10^{-2} mbar l/sec. An estimate of the vacuum degradation rate (leaks, degassing etc.) should be provided.
- The makes and models of the pumping system components along with their specification details should be provided.
- The system should allow preparing the surface to be coated with gas discharge techniques.
- Company must design the coating plant components in such a fashion that it can be safely transported considering the remoteness of the site.

2.5. Coating Process Requirements

- Magnetron sputtering technique is to be used for coating. The make and model of the magnetron system and its power supply should be provided.
- The coating characteristics should be as follows:

- Coating Thickness: 1000 to 2000 Angstroms \pm 50 Angstroms.
- Reflectivity >90% from 200nm to 700nm and >95% from 1000nm to 5000nm
Incidence angle should be limited to within 45° over any area of the mirror being coated.
- The substrate should be opaque after coating such that no pinholes are seen.
- Bidder must give concept sketches of masks to be used for each mirror.
- Since some smaller mirrors (secondary etc) need to be placed at the center of the coating chamber the magnetron length may have to extend beyond the chamber center. The length of the magnetron MUST be long enough to cover the outermost edge of the primary mirror to the center.

2.6. Gauges and Meters

Adequate number of gauges and meters should be provided to check the pressure and temperature at all the necessary parts of the evacuation, coating and pumping systems. The makes and models as well as specification sheets of the gauges and meters to be used in the system should be provided.

Adequate provision should be made for mounting the crystals for measuring the thickness and rate of coating of the substrate at 4 locations, with a single monitor with the provision to select any particular location for monitoring the process. The thickness monitor shall have the accuracy of measurement better than 5%.

2.7. Power Requirements

A realistic estimate of the power required (both starting and running) by the different subsystems (evacuation, coating, cooling, monitoring, control) should be provided. If required, provision should be made for soft starts and sequential start up procedures.

If power failure occurs during the operation of the plant, the electro pneumatically operated valves should close automatically and they may be restored within five to ten minutes. Any critical subsystems of the plant should have arrangements to take power independently from a UPS system, which will be available at the observatory.

2.8. Control Console:

The control console unit should contain the following:

- i. Auto Vacuum Controller with mimic diagram
- ii. Selector switch for auto/manual/standby mode
- iii. Push button switches for manual over ride

- iv. Utility failure indication with alarms
- v. Microprocessor based Pirani and penning gauge control unit
- vi. Ion Bombardment control
- vii. Magnetron source control.

2.9. Thin Film Deposition Equipment

The main components of thin film deposition equipment unit should consist of the following components:

- Sputter source for aluminum including power supply
- Shields to trim the aluminum coating deposited.
- Shutter panels
- Glow Discharge Cleaning Device (GDCCD) including power supplies.
- The DC Planar Magnetron Source consisting of the target 99.999% pure aluminum cathode bonded to a water-cooled backing plate to reduce the heat radiated to the mirror. The discharge is to be produced by the use of an inert gas (Argon) to support the flow of current between cathode and anode.
- The planar magnetron source for generating magnetic fields to focus electrons in the region of the sputtering target. The magnetron MUST be mounted horizontal such that the deposition is uniform by using an appropriate mask on the rotating glass substrate immediately below the magnetron.
- Stainless steel trim shields, which are placed below the cathode to trim the deposition of the sputtered aluminum, ensure that the mirror is evenly coated with a uniform thickness of aluminum.
- The GDCCD should consist of two aluminum electrodes, shaped to give the required profile. The glow discharge electrodes are to be water-cooled and are suspended from a dark space shield, which should also made of aluminum. The purpose of the GDCCD is to reduce adsorbed water molecules from the mirror, the inner surfaces of the chamber and all components mounted inside the chamber.

2.10. Operation and Safety:

The entire plant should have adequate safety interlocks and alarms to prevent accidental damage to the equipment or injury to personnel. Manual overrides should be provided for any automatic operational controls.

2.11. Manuals, Maintenance & Spares:

Detailed manuals should be provided containing the following information:

- Subsystem descriptions including detailed electrical and mechanical drawings,

circuit diagrams, interconnection & layout details etc.

- Operational procedures for handling the substrate, cleaning, evacuation, coating, purging, testing etc.
- Safety precautions and interlock/alarm recovery procedures.
- Instruction and maintenance manuals, trouble shooting and Fault finding procedures and recovery methods.

2.12. Miscellaneous:

12.1 Clear specifications (quality, quantity, fitting or piping specification, rate of supply, pressure etc.) should be given of any other auxiliary requirements which are necessary for the operation of the plant such as coolant, inert gas, liquid nitrogen etc. A price shall be quoted for these as Optional items. The make of the pneumatic pipings used for supply of external gases like argon/nitrogen etc and use of air compressor for pneumatic lifting of the chamber top lid etc must be specified and the specifications of the air compressor must be provided preferably of Jun-Air make.

12.2 Any other requirements such as ventilation, drainage, structural support etc. should be clearly specified.

12.3 The company should also provide the training about the operation of the plant, coating of the mirror and precautions related to the plant.

12.4. Testing at factory for all details/specifications, including a test coating- Minimum size of test glass to be 1mx2m to cover the full radial values from 0 to 1.8m. Tests to be performed are Thickness uniformity, Adhesivity and reflectivity. Supplier should have thickness measuring instrument (Step-stylus toll based) and also a reflectometer (with a recently calibrated reflectance standard) for above testing at factory.

12.5. The leak rate should be less than 10^{-2} mbar liter / sec.

12.6. Rotation movement with correct max dummy load to be checked at factory.

12.7. Packing and transport of all components.

12.8. Installation and Commissioning.

2.13 Following details are to be provided in technical proposal.

- i) Tentative sketches of the masks and configuration of the mirror/coating- source (Magnetron) to be used for each mirror for getting a uniform coating.
- ii) Estimate of the throughput of the main pump when the 2m mirror is inside the chamber.
- iii) Estimate of effect the >15 minutes time for coating on the quality of coating due to any minor leaks etc.
- iv) Give the main features of the kinematic support, and transfer of load to these from

- the mirror - lifting tool. The mirror drawings are provided in the Annexure.
- v) Give steps of all the functional tests planned at the factory and after commissioning at the site relevant to achieve the specifications on coating.
 - vi) List of Proposed tests to be conducted in the factory and measurement procedures of the thickness, uniformity of thickness and reflectivity.
 - vii) 'O' ring material (Viton) to be specified, together with details of the joint. No grease to be used.
 - viii) Requirement of power and other utilities that are to be provided by IIA

III TECHNICAL DETAILS:

The vacuum coating plant should be capable of achieving a vacuum of 1×10^{-6} m bar in clean, empty degassed condition in about 6 hours or less time. The working vacuum shall be in the range of 10^{-3} to 10^{-4} m bar. Following are the technical details of the sub systems the vacuum coating plant.

3.1 Vacuum Chamber:

The chamber should be approximately 2600 mm dia x 1700 mm height, made of stainless steel constructed with 2 halves which is basically a 2 torrispherical dished ends and clamped together at the middle by using clamps. The inner surfaces of the chamber are suitably polished for low out-gassing rates. The top side of the chamber which is torrispherical dish is to be welded with a flange. Suitable hooks are to be provided on the top side of the dished end. The bottom side is also a torrispherical dished end welded with a flange. All the joints and assemblies are welded using TIG welding Technique for leak tight joints. The two halves may be clamped together at the center by suitable clamping arrangement. Provisions are to be provided for opening the chamber by lifting the top dish by means of hydraulic / pneumatic cylinders. Wheels are to be provided for the movement of the lower dish horizontally by means AC geared motor with drive mechanism. The inner side of the lower dish should contain the whiffle tree for mirror support and a rotary drive mechanism. The rotary drive must be of non-rust and non-corrosive material which doesn't produce fine metal powder over long use to contaminate the chamber etc. The chamber should also have the following ports:

- a. Evacuation Port
- b. Rotary Mechanism Port
- c. Sensor Port
- d. Electrical Feed through Port
- e. Instrumentation Feed through Port
- f. Shutter Port
- g. Port for Crystal Holders
- h. View Port

3.1.1 Leak Testing:

The chamber and its sub assemblies are to be leak tested using Helium Mass Spectrometer leak detector to an individual leak rate of 3×10^{-8} m.bar lit/sec with global leak rate with valves in off system the pressure rises $< 10^{-2}$ m bar / day.

3.1.2 Support Structure

The chamber has to be supported on a tubular support structure in order to take care of the total weight of the chamber. The chamber needs to be welded with pads at the bottom onto which the tubular structure is welded. The support structures are to be suitable powder coated. A separate support structure made of MS tubes are to be provided for housing the bearing of the rotary drive mechanism and transfer the total load to the ground.

3.1.3 Vacuum Seals

The chamber has to be provided with Viton “O” ring seal to achieve vacuum sealing. The sealing should be made from Viton cord with edges cut at 45 degrees and fused together using appropriate glue and cold curing.

3.2 Rotary Work Holder for 2.1m diameter mirror

The rotary work holder has to be designed and fabricated in stainless steel to hold the back surface of the mirror with whiffle tree supports contact at 9 points with soft pads with appropriate load bearing Teflon make parts with spring action. Appropriate calibrated load cells are to be provided at the whiffle tree support to monitor the load distribution at all the points. The drawings of the back surface of the 2.1m primary mirror indicating the location of the are given in the annexure. The whiffle tree should be designed such that it supports the primary mirror load evenly, with the 9-point support distributed as per the existing mirror support. The entire assembly has to be supported with thrust and roller bearings to take care of the total load of the mirror. It has to be designed to take up the load up to 4 tons. The center of the mirror has to be suitably supported by a shaft to have vacuum tight with the surface during the rotation of the mirror. The drive mechanism for the entire assembly has to be achieved by means of reduction gear box with AC motor and drive. The RPM of the rotary motion is to be maintained between 3 – 5 rpm.

3.2.1 Substrate holder for smaller mirrors

A separate substrate holder may be provided to accommodate smaller size mirrors for coating. These have to be located on the arms of the main rotary work holder.

3.3 Magnetron Source

A water cooled rectangular magnetron source to hold the aluminium target, of purity 99.999%, of size 1800 mm width x 1000mm length is to be provided. The magnetron is supported on the inner side of the top lid with suitable supports and adjusting mechanisms to adjust the linear distance and the angle for aluminium sputtering on 2.1m mirror.

3.4. Ion Bombardment System

An ion beam bombardment system has to be provided for ion cleaning operation before the sputtering process. This has to be located inside the chamber. Appropriate power supply has to be provided.

3.5 Mask

In order to achieve uniform thickness of aluminium deposition on the substrate during the sputtering process, a stainless steel mask of appropriate size has to be provided and placed below the magnetron source.

3.6 Coating Characteristics

The supplied system should be capable of producing the following characteristics of the aluminium coating.

- Coating Thickness : > 1000 upto 2000 Angstroms
- Coating thickness uniformity : < +/- 5% of the given coating thickness
- Reflectivity: >90% from 200nm to 700nm and >95% from 1000nm to 5000nm
- Incidence angle should be limited to within 45° over any area of the mirror being coated.

3.7 Vacuum Pumping Systems

The coating unit should have adequate vacuum pumps comprising of Rotary pump, Roots pump, Cryo pump etc. The rotary pump and the mechanical booster pump should be used for roughing operation to evacuate the chamber to a rough vacuum level of 10^{-2} m bar. The system should also be provided with necessary valves, vacuum gauges for the measurement of vacuum at different stages of the process to monitor. Adequate protection of liquid Nitrogen trap made of stainless steel is to be provided in the roughening line connecting roughing vacuum system for any oil back streaming. Precautions should be taken to operate the pumps in the temperature range +5 to 40 deg C. The integrated system should achieve a vacuum level of 1 x

10^{-6} m bar at the chamber. The Vacuum piping lines are to be made of stainless steel SS 304 with necessary bellow adapters for connecting the rotary pump, the mechanical booster pump with the chamber. These pipelines are to be designed to have maximum conductance and shortest paths.

3.8 Valves

Two high vacuum gate valves are to be provided between the cryo pump and the chamber, of which one of the valve is to be programmed to open in partial mode to maintain the required partial pressure with Argon inside the chamber during sputtering operation i.e. it will act like a throttle valve. The valves are provided with limit switches for safe operation. Two numbers of isolation gate valves of reputed make like M/s Leybold / Pfeiffer / VAT pneumatically operated gate valves are to be provided between the cryo pump and the rotary pump. The chamber is provided with a vent valve to expose the chamber to the atmosphere. Also, there should be provision to connect dry nitrogen source instead of exposing to atmosphere. The valve ports are to be interconnected with the high vacuum valve such that when the vent valve is opened, the other valves cannot be energized.

3.9 Vacuum Gauges

Three numbers of Pirani gauge sensor of M/s. Edwards make with one cold cathode sensor should be provided with necessary cables to measure the vacuum in the range of 1000mbar to 10^{-6} m bar. One set of M/s. INFICON make capacitance gauge with controller having the measuring range of 0.1 m bar to 10^{-5} m bar is to be provided.

3.10. Leak Rate

The permissible leak rate for all weld joints tested using Helium Mass Spectrometer Leak Detector is $< 3 \times 10^{-8}$ m bar ltrs / sec.

The permissible global leak rate by pressure rise method in valve shut off condition is $< 1 \times 10^{-2}$ m bar lit. /sec in clean, cold, empty degassed condition.

3.11. Gas Inlet System

The gas inlet system should consist of a gas manifold with mass flow controllers having flow range of 500 cc/s. A valve is provided to admit Argon gas for sputtering operation.

3.12. Control Console and Instrumentation

A stand alone ~ 19 inch industrial standard control system is to be provided which should be

integrated to the main system. All the controllers and the display units are to be mounted on the control console. The control console shall be provided with a door and the IPC shall be mounted on the front door panel. The control console should be aesthetically designed and only the IPC and emergency ON /OFF switch will be visible outside.

The control console shall house the following manual control units

- Auto vacuum controller with mimic diagram, switches for manual over ride, selector switch for auto/manual standby mode, utility failure indication with alarms.
- Cryo pump controller
- Vacuum measuring gauge control units
- Ion bombardment control
- Magnetron source control
- Digital thickness monitor
- Rotary drive Control

All the electrical switchgear like control transformers, relays, timers fuses shall be mounted on a plate and fitted vertically inside the control console at the bottom position for convenience of maintenance. The control console shall be wired to operate on 415V AC, 50Hz, 3 phase power supply.

3.13 Automation of the Coating Process

The coating system shall be designed to operate both in automatic and manual modes. Microprocessor based Programmable Logic Controller (PLC) shall be incorporated into the system along with Supervisory and control Data Acquisition (SCADA) software for process control and recipe programming. The software shall interface various operations to front end devices to offer real time graphic operator interface. It should also provide facilities to collect data, reports and supervisory control. The entire process recipe shall be developed along with the necessary control features. Provision should be made available for remote diagnostics and software up-gradation.

IV DELIVERABLES

The vendor shall design, manufacture, install, commission and test a vacuum coating plant for coating 2.1m primary mirror at IAO, Hanle, J &K conforming to the specification given above. The coating plant should be delivered with following deliverables.

4.1. Vacuum Chamber

The vacuum chamber shall be manufactured as per the specifications given in section III.1 The chamber shall be leak tested as per the standards and the test report should be provided. The

chamber shall be provided with the necessary vacuum seals and Viton O rings. Adequate ports and fittings should be provided for meeting the requirements of inert gas atmosphere, evacuation, purging, cooling etc.

4.2. Mirror Holders

The vendor shall design and supply the rotary mirror holder for holding the 2.1m primary mirror and a separate holder for accommodating smaller size mirror inside the chamber as per the specifications.

4.3. Vacuum Coating Process

The vendor shall develop sputtering process for the purpose of coating aluminium on the mirror substrate. The vendor shall design and supply the appropriate magnetron source to hold the aluminium target of purity 99.999% as per the dimensions mentioned in section II.2.3 The process should ensure uniform coating over the substrate as per the characteristics given in section III.6. The vendor shall also provide the design and manufacture masks for coating the large and small mirrors.

4.4. Automation of Vacuum Cycle

The automation of the vacuum cycle shall be provided with micro processor based programmable logic controller (PLC) of GE make for the coating process. Supervisory Control and Data Acquisition (SCADA) software is to be provided for the process control by sequential operation to build up a standard recipe for vacuum pump down control and shutters. The software shall have the recipe programming, storage and recall facility.

4.5. Coating Sub-Systems

The vendor shall provide the following subsystems for effective coating process.

- a. Ion Bombardment system for ion cleaning process
- b. Glow Discharge Cleaning Device (GDGD) including power supplies.
- c. Vacuum Pumping systems to achieve an ultimate vacuum level of 1×10^{-6} m bar.
- d. High vacuum valves as specified in section III- 3.8
- e. Vacuum measuring gauges for the measurement of vacuum at intermediate and at the chamber
- f. Argon gas inlet system
- g. Control console and instrumentation as per the specifications given in section III 3.12
- h. Thin film deposition monitoring unit for the measurement of the thickness of the aluminium being coated on the substrate

4.6. Power Requirements

The total estimate of the power required (both starting and running) by the different subsystems (evacuation, coating, cooling, monitoring, control) should be provided. If required, provision should be made for soft starts and sequential start up procedures.

If power failure occurs during the operation of the plant, it may be restored within five to ten minutes. Any critical subsystems of the plant should have arrangements to take power independently from a UPS system, which will be available at the observatory.

4.7 Operation and Safety:

The entire plant should have adequate safety interlocks and alarms to prevent accidental damage to the equipment or injury to personnel. Manual overrides should be provided for any automatic operational controls. Adequate safety devices are provided to protect the sputtering unit from any malfunction or operator's errors.

4.8 Manuals, Maintenance & Spares:

Detailed manuals should be provided with the following information:

- Subsystem descriptions including detailed electrical and mechanical drawings, circuit diagrams, interconnection & layout details etc.
- Operational procedures for handling the substrate, cleaning, evacuation, coating, purging, testing etc.
- Safety precautions and interlock/alarm recovery procedures.
- Instruction and maintenance manuals, trouble shooting and Fault finding procedures and recovery methods.
- After sales warranty- 3 years following successful installation and commissioning at site.
- Supply of spares for 3 years following the expiry of warranty period.

V. SCHEDULE

1. Preliminary Design Review	1 month after receipt of PO
2. Critical Design Review	1 month after PDR
3. Pre-Shipment Acceptance Test	5 months after CDR
4. Commissioning and Installation at Site	1 month after Pre-shipment Test

VI. ACCEPTANCE CRITERIA

6.1. Pre-Shipment Acceptance Tests:

Pre-shipment acceptance tests shall be carried out by the competent experts at the vendor's location in the presence of IIA personnel.

The whole unit shall be tested with Mass Spectrometer Leak Detector sensor to achieve 3×10^{-8} m bar liters / sec and report generated.

The permissible global leak rate by pressure rise method in valve shut off condition is $< 1 \times 10^{-2}$ m. bar lit. /sec in clean, cold, empty degassed condition shall be demonstrated.

The performance of the coating plant shall comply all the above given specifications.

- Coating Thickness : > 1000 up to 2000 Angstroms
- Coating thickness uniformity : $< +/- 5\%$ of the given coating thickness
- Reflectivity: $>90\%$ from 200nm to 700nm and $>95\%$ from 1000nm to 5000nm
- The performance of the complete vacuum coating process shall be demonstrated both in auto and manual mode.

Trial coating on glass coupons to cover the full radius of 0 to 1.05m has to be performed.

Test reports on the coating thickness uniformity, adhesivity and reflectivity shall be provided.

The rotary motion of the mirror holders shall be tested with dummy load and demonstrated.

6.2 Final Acceptance Tests:

All the tests mentioned above have to be performed at the site after commissioning. Final performance matrix shall be generated for final acceptance. The sample test plates provided by IIA shall be coated with the high purity aluminium.

VII. WARRANTY AND SUPPORT

The vendor shall provide a warranty for the entire coating plant for a period of 1 year from the date of final acceptance of the plant against any manufacturing or faulty components. The vendor shall supply necessary spares for a minimum period of 10 years.

VIII. TRAINING

The vendor shall arrange training of IIA personnel at their works for the safe and proper operation of the coating plant. The training shall include the operational procedures for handling the substrate, cleaning, evacuation, coating, purging and testing. They shall also familiarize IIA personnel in trouble shooting and fault finding procedures.

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IIND BLOCK, SARJAPUR ROAD, KORAMANGALA,
BANGALORE-560 034

No.PR/PT/JPLC/HCT/PLANT/IAO/CAP/547

Dated: 22nd December 2015

M/s.

Dear Sirs,

The Director, Indian Institute of Astrophysics, Bangalore invites Sealed Tenders for the supply of Stores detailed in the Tender form hereto attached. The Tender terms and conditions enclosed are also may be noted carefully. If you are in a position to quote for the supply in accordance with the requirement, please submit your quotation in the attached Tender form also.

Your Technical bid and Commercial bids must reach this office on or before the date and time indicated in the Tender Schedule.

Thanking you,

Yours faithfully,

Encl: as above.

P.Kumaresan
Administrative Officer
for Director

Phone: 22541244 Fax: 25534043

Email: purchase@iiap.res.in Website: www.iiap.res.in

**INDIAN INSTITUTE OF ASTROPHYSICS
BANGALORE-560 034**

**PUBLIC TENDER NOTICE NO:PR/PT/JPLCT/HCT/PLANT/IAO/
CAP/547 DATED: 22ND DECEMBER 2015**

TENDER FORM

FROM:

TO

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

Sir,

I/We hereby offer to supply the stores indicated below at the price hereunder quoted and agree to hold this offer open till_____. I/We shall be bound to supply the store hereby offered upon the issue of the Purchase order communicating to the acceptance thereof on or before the expiry of the last mentioned date. You are at liberty to accept any one or more of the items of such stores. I/We notwithstanding that the offer in this tender has not been accepted in whole, shall be bound to supply such items and such portion or portions of one or more of the items as may be specified in the said Purchase order communicating the acceptance.

Sl.No.	Description of the item(s)	Quantity	Unit	Amount	Dely.	Period
01.	Design, Manufacturing, Installation, testing, Commissioning of Aluminium Coating Plant for 2M Optical Telescope Mirror at IAO, Hanle (300 KM from Leh, Jammu & Kashmir) (As per detailed Specification in the Annexure I)	01	Set			

Place at which the Delivery is required : The Coating Plant is to be Installed and Commissioned at Indian Astronomical Observatory, located at Hanle, Jammu and Kashmir.

Date by which the supplies are required : Delivery period see Annexure - I in the RFP

2. I/We have understood the items of the tender annexed to the invitation to this Public Tender and have thoroughly examined the specifications/drawing and /or pattern quoted or referred to herein and/are fully aware of the nature of the stores required and my/our offer is to supply the stores strictly in accordance with the requirements subject to the terms and conditions contained in the Purchase order, if communicated on the acceptance of this tender either in whole or in part.

Date:

Signature and seal of Tenderer

TERMS AND CONDITIONS OF CONTRACT

1. DEFINITIONS :

a.) The terms 'Purchaser' shall mean the Director, Indian Institute of Astrophysics, Bangalore -560 034.

b.) The term 'Contractor' shall mean, the person, firm or company with whom or with which the order of stores is placed and shall be deemed to include the Contractor's successors, representative, heirs, executors and administrators unless excluded by the contract.

c.) The 'Stores' shall mean that contractor agrees to supply under the contract as specified in the Purchase Order including erection Plants and machinery and subsequent testing, should such as condition be included in the Purchase Order.

d.) The terms 'Purchase Order' shall mean the communication signed on behalf of the Purchaser by an Officer duly authorized intimating the acceptance on behalf the Purchaser on the terms and conditions mentioned or referred to in the said communications accepting the tender or offer of the contractor for supply of stores or plant, machinery or equipment or part thereof.

2. PRICES :

Tenders, offering firm prices will be preferred, where a price variation clause is insisted upon by a tenderer, quotations with a reasonable ceiling should be submitted. Such offers should variably be supported by the base price taken into account at the time of tendering and also the formula for any such variations.

3. DUTY EXEMPTION :

(a.) Excise duty exemption certificate will be provided if considered against the categories of items tendered, under the Govt. of India Notification No. 10/97 valid till 2016.

4. SECURITY DEPOSIT:

On acceptance of Tender, the Contractor shall, at the option of the Purchaser and within the period specified by him deposit with him in cash or any other form as the Purchaser may determine, Security deposit not exceeding ten percent of the value of the contract as the Purchaser shall specify. If the contractor is called upon by the purchaser to deposit 'Security' and the contractor fails to provide the security within the period specified, such failure shall constitute a breach of the contract and purchase shall be entitled to make other arrangements for the re-purchase of the stored contracted for at the risk of contractor in terms of sub-clause (ii) and (iii) of clause 10 (b) hereof and/or to recover from the contractor damages arising from such cancellation.

5. GUARANTEE AND REPLACEMENT :

a.) The contractor shall guarantee that the stores supplied shall comply fully with the specifications laid down, for material workmanship and performance.

b.) For a period of (12) twelve months after the acceptance of the stores, if any defects are discovered therein or any defects therein found to have developed under proper use arising from faulty stores, design or workmanship, contractor shall remedy such defects at his own cost provided he is called upon to do so within a period of 14 months from the date of acceptance thereof by the purchaser who shall state in writing in what respect the store or any part thereof are faulty.

c.) If in the opinion of the purchaser, it becomes necessary to replace or renew any defective stores such replacement or renewal shall be made by the Contractor free of all costs to the purchaser provided the notice informing the contractor of the defect is given by the purchaser in this regard within the said 14 months from the date of acceptance thereof.

d.) Should the contractor fail to rectify the defects, the purchaser shall have the right to reject or repair or replace at the cost of the contractor the whole or any portion of the defective stores.

e.) The decision of the purchaser, notwithstanding any prior approval of acceptance or inspection thereof on behalf of the purchaser, as to whether or not the stores supplied by the contractor are defective or any defects has developed within the said period of 12 months or as to whether the nature of the defectives required renewal or replacement shall be final, conclusive and binding on the contractor.

f.) To fulfill guarantee conditions outlined in Clause 5(a) to (d) above, the contractor shall, at the option of the purchaser, furnish a Bank Guarantee (as prescribed by the purchaser) from a Bank approved by the purchaser for an amount equivalent to 10% of the value of the contract along with first shipment documents. On the performance and completion of the contract in all respects, the Bank Guarantee will be returned to the contractor without any interest.

g.) All the replacement stores shall also be guaranteed for a period of 12 months from the date of arrival of stores at Purchaser's site.

h.) Even while the 12 months guarantee applied to all stores in case where a greater period is called forth by our specifications then such a specification shall apply; in such cases the period of 14 months referred to in Para 5(b) and (c) shall be 'asked for' guarantee period plus two months.

6. PACKAGING, FORWARDING AND INSURANCE :

The Contractor will be held responsible for the stores being sufficiently and properly packed for transport by rail, road, sea or air, to withstand transit hazards and ensure safe arrival at the destination. The packing and marking of packing shall be done by and at the expenses of the contractor. The Purchaser will not pay separately for transit insurance, all risks in transit being exclusively of the contractor and the Purchaser shall pay only for such stores as are actually received in good condition, in accordance with contract.

7. TEST CERTIFICATE :

Wherever required Test Certificate should be sent along with the relevant dispatch documents.

8. ACCEPTANCE OF STORES :

a) The Stores shall be tendered by the contractor for inspection at such places as may be specified by the purchaser at the Contractor's own risk, expenses and cost.

b) It is expressly agreed that the acceptance of stores, contracted for is subject to final approval by the Purchaser, whose decision shall be final.

c) If, in the opinion of the Purchaser all or any of the stores that do not meet the performance or quality requirements specified in the Purchase Order, they may be either rejected or accepted at the price to be fixed by the purchaser and his decision as to rejection and the prices to be fixed shall be final and binding on the contractor.

d) If the whole or any part of the store supplied are rejected in accordance with Clause No.8(c) above, the Purchaser shall be at the liberty, with or without notice to the Contractor, to purchase in the open market at the expenses of the Contractor, stores meeting the necessary performance and quality contracted for in place of these rejected, provided that either the purchase, or the agreement to purchase, from another supplier is made within six months from the date of rejection of the stores as aforesaid.

9. REJECTION OF STORES :

Rejected stores will remain at the destination at the Contractor's risk and responsibility, if instructions for their disposal are not received from the Contractor within a period of 14 days from the date of receipt of the advice or rejection, the Purchaser or his representative has, at his discretion the right to scrap or seal or consign the rejected stores to the Contractor's address at the Contractor's entire risk and expense, freight being payable by the Contractor at actuals.

10. DELIVERY PERIOD :

a.) The delivery period of the stores stipulated in the purchase order shall be deemed to be the essence of the Contract, and delivery must be completed on or before the specified dates/period.

b.) Should the Contractor fails to deliver the stores or any consignment thereof within the period prescribed for such delivery, the Purchaser shall be entitled at his option either.

i) to recover from the Contractor as agreed liquidated damages and not by way of penalty, a sum of 2% of the price of any stores which the contractor has failed to deliver as aforesaid for each month or part of a month, during which the delivery of such stores may in arrears, or

ii) to purchase elsewhere, without notice to the Contractor on the account and at the risk of the contractor, the stores not delivered or others of similar description (where other exactly complying with the particulars are not, in the opinion of the purchaser readily procurable, such opinion being final) without canceling the Contract in respect of the consignment(s) not yet due for delivery or,

iii) to cancel the contract or a portion thereof, and, if so desired to purchase or authorize the purchase of stores not so delivered or others of similar description (where other exactly complying with the particulars are not, in the opinion of the purchaser readily procurable, such opinion final) at the risk and cost of the Contractor.

In the event of action being taken under sub-clause (ii) and (iii) of clause 10 above, the Contractor shall be liable for any loss which the Purchaser may sustain on that account, provided that the re-purchase, or if there is an agreement to re-provide shall made within (6) six months from the date of such failure. But the Contractor shall not be entitled to any gain on such re-purchase made against default. It shall not be necessary for the purchaser to serve a notice of such re-purchase on the defaulting Contractor. This right shall without prejudice to the right of the purchase to recover damages for breach of contract by the Contractor.

11. EXTENSION OF DELIVERY TIME :

As soon as it is apparent that Contractor delivery period/dates cannot be adhered to, an application shall be sent by the Contractor to the Purchaser. If failure, on the part of the Contractor to deliver the stores in proper time shall have arisen from any cause which the Purchaser may admit as reasonable ground for an extension of the time (and his decision shall be final he may allow such additional time as he considers it to be justified by the circumstances of the case without prejudice to the Purchaser's rights to recover liquidated damages under clause 10(i)(ii) and (iii).

12. PAYMENT :

Contractor's bill will be passed only after the stores have been received, inspected and accepted by the Purchaser for payment.

13. RECOVERY OF SUMS DUE :

Whenever there is breach of contract whether liquidated or not, money arising out of or under this contract against the contract, the Purchaser shall be entitled to recover such sum by appropriating, in part or whole, the security deposited by the Contractor, if a Security is taken against the contract. In the event of the Security being insufficient or if no security has been taken from the Contractor, then the balance or the total sum recoverable as the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the contractor under this or any other contract with the Purchaser. Should this sum be not sufficient to cover the full amount recoverable, the Contractor shall pay to the Purchaser on demand the remaining balance due. Similarly, if the purchaser has or makes any claims, whether liquidated or not, against the Contractor under any other contract with the purchaser, the payment of all moneys payable under the contract to the Contractor including the Security Deposit shall be withheld till such claims of the Purchaser are finally adjudicated upon and paid by the Contractor.

14. INDEMNITY :

The Contractor shall warrant and be deemed to have warranted that all stores supplied against this contract are free and clean of infringement of any patent, copy right or trade mark, and shall at all time indemnify the purchaser against all claims which may be made in respect of the stores for infringement of any right protected by patent, registration of design or trade mark and shall take all risk of accidents of damage which may cause a failure of the supply from whatever cause arising and the entire responsibility for sufficiency of all the means used by him for the fulfillment of contract.

15. ARBITRATION:

In the event of any question, dispute or difference arising under these conditions contained in the purchase order in connection with this contract, (except as to any matters the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of the Head of the Institution or of some other person appointed by him. It will be no objection that the arbitrator is a Government Servant, that he has to deal with matter to which the Contract relates or that in the course of his duties as Government Servant he has expressed views on all or any of the matters in dispute binding on the parties of this Contract.

(a) IT IS TERMS OF THIS CONTRACT:

If the Arbitrator be the Head of the Institution.,

i) in the event of his being transferred or vacating his office by resignation or otherwise, it shall be lawful for his successor-in-office either to proceed with the reference himself, or to appoint another person as arbitrator, or,

ii) in the event of his being unwilling or unable to act for any reason, it shall be lawful for the Head of the Institution, to appoint another person as arbitrator or,

(b) If the Arbitrator be a Person appointed by the Head of the Institution:-

In the event of his death, neglecting or refusing to act, or resigning or being unable to act for any reason, it shall be lawful for the Institution either to proceed with reference himself or to appoint another person as arbitrator in place of the outgoing arbitrator. Subject as aforesaid the Arbitration Act, 1940 and the rules there under and any statutory modifications thereof for the time being in force shall be deemed to apply to the arbitration proceedings under this clause. The Arbitrator shall have the power to extend with the consent of the Purchaser and the Contractor the time for making a publishing the award. The venue of Arbitration shall be the place as the Purchaser. In his absolute discretion may determine. Work under the contract shall if reasonably possible, continue during Arbitration proceedings.

16. COUNTER TERMS AND CONDITIONS OF SUPPLIERS :

Where Counter Terms and Conditions/printed or cyclostyled conditions have been offered by the Supplier, the same shall not be deemed to have been accepted by the Purchaser, unless specific written acceptance thereof is obtained.

17. SECURITY FOR PURCHASER'S MATERIAL(S) :

Successful Tenderer will have to furnish in the form of a Bank Guarantee or any other form as called for by the Purchaser towards adequate security for the materials/property by the Purchaser for the due execution of the Contract.