



INDIAN INSTITUTE OF TECHNOLOGY MADRAS
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V. Sathyanarayanan
Senior Manager (Project Purchase)

Ref: PHY/SSRK/032/2017
Date: 31.10. 2017

Open Tender No: PHY/SSRK/032/2017

Due Date: 21.11.2017, at 2.00 pm

Technical Bid opening meeting on 21.11.2017 at 3.30 p.m.

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, offers are invited for the supply of

“Micro-Machining System (MMS) for Femtosecond Laser Ultraprecision Fabrication”

conforming to the specifications given in Annexure.

A Vendor who can supply and integrate the above equipment alone need to respond to the tender please.

Instructions to the Bidder

- (i) **Preparation of Bids:** - The tenders should be submitted under two-bid system (i.e.) Technical bid and Financial bid.
- (ii) **Delivery of the tender:** - The tender shall be sent to the below-mentioned addresses either by post or by courier so as to reach our office before the due date and time specified in our Schedule. The offer/bid can also be dropped in the tender box on or before the due date and time specified in the schedule. The tender box is kept in the office of the

**Senior Manager,
Project Purchase
IC & SR Building 2nd floor,
I.I.T. Madras,
Chennai – 600 036.**

(iii) **Opening of the tender:** - The offer/Bids will be opened by a committee duly constituted for this purpose. The technical bids will be opened first and it will be examined by a technical committee which will decide the suitability of the bid as per our specifications and requirements. The bidders will be invited for opening of Technical bids. In respect of opening of financial bid, those bidders who are technically qualified only will be called for.

(iv) **Prices:** - The price should be quoted in nett per unit (after breakup) and must include all packing and delivery charges to various Departments/Centres/Institutions. The offer/bid should be exclusive of taxes and duties, which will be paid by the purchaser as applicable. However the percentage of tax & duties should be clearly indicated.

The price should be quoted without custom duty and excise duty, since I.I.T. Madras is exempt from payment of excise duty, and the custom duty will be paid at concessional rate against duty exemption certificate.

In case of import supply, the price should be quoted on EX-WORKS and CIP basis indicating the mode of shipment.

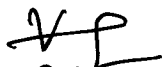
(v) **Agency Commission:** - Agency commission, if any, will be paid to the Indian agents in Rupees on receipt of the equipment and after satisfactory installation. Agency Commission will not be paid in foreign currency under any circumstances. The details should be explicitly shown in Tender even in the case of 'Nil' commission. The tenderer should indicate the percentage of agency commission to be paid to the Indian agent. The foreign Principal should indicate about the percentage of payment and it should be included in the originally quoted basic price, if any.

(vi) **Terms of Delivery:** - The item should be supplied to the Departments of Ocean Engineering as per Purchase Order. In case of import supply, the item should be delivered at the cost of the supplier to our Institution. The Installation/Commissioning should be completed as specified in our important conditions.

(vii) **Technical Bid Opening:** The technical bid will be opened on 21st November 2017 at 3.30 p.m at the Conference room, Department of Physics, IIT Madras and the financial bids of those tenders who are technically qualified will be opened at a later date under intimation to them.

(viii) IIT Madras reserves the full right to accept / reject any tender at stage without assigning any reason.

Yours sincerely,



V. Sathyanarayanan
Senior Manager (Project Purchase)
IC&SR Building, I.I.T. Madras,
Chennai – 600 036

SCHEDULE

Important Conditions of the tender

1. The due date for the submission of the tender is **21.11.2017, 2.00 pm.**

The offers / bids should be submitted in two bids systems (i.e.) Technical bid and Financial bid. The Technical bid should consist of all technical details / specifications only. The Financial bid should indicate item-wise price for each item and it should contain all Commercial Terms and Conditions including Taxes, transportation, packing & forwarding, installation, guarantee, payment terms, pricing terms etc. The Technical bid and Financial bid should be put in separate covers and sealed. Both the sealed covers should be put in a bigger cover. The Open Tender for supply of **"Micro-Machining System (MMS) for Femtosecond Laser Ultraprecision Fabrication"** should be written on the left side of the Outer bigger cover and sealed.

2. **EMD: - EMD should be at 2% (two percent) of the tender value quoted by the bidder.** The EMD should be included in the Financial bid which will not be opened for Technical evaluation. Enclosing the EMD in the Technical bid will automatically disqualify the tenderer. EMD should be in the form of DD in favour of "The Registrar, Indian Institute of Technology Madras" and payable at Chennai. The tender without EMD would be considered as UNRESPONSIVE and REJECTED. Photo/FAX copies of the Demand Draft/Banker's pay orders will not be accepted. No interest will be paid for the EMD and the EMD (Bid Security) will be refunded to the successful bidder on receipt of Performance Security.
3. **Performance Security:-** The successful bidder should submit Performance Security for an amount of 5% of the value of the contract/supply. The Performance Security may be furnished in the form of an Account Payee DD, FD Receipt from the commercial bank, Bank Guarantee from any nationalized bank of India will be an acceptable.

Only after submission of Performance Security, Purchase Order/Work Order will be released / L.C will be opened.

Performance Security in the form of Bank Guarantee:- In case the successful bidder wishes to submit Performance Security in the form of Bank Guarantee, the Bank Guarantee should be routed through the Beneficiary Bank to the end user bank. Otherwise, the Indian Agent of the foreign vendor has to submit a Bank Guarantee from a Nationalized Bank of India.

The Bank Guarantee should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the supplier including the warranty obligations.

4. If an Indian agent is involved, the following documents must be enclosed:
Foreign principal's proforma invoice indicating the commission payable to the Indian Agent and nature of after-sales service to be rendered by the Indian Agent.
 - ✓ Copy of the agency agreement with the foreign principal and the precise relationship between them and their mutual interest in the business.
 - ✓ The enlistment of the Indian agent with Director General of Supplies & Disposals under the Compulsory Registration Scheme of Ministry of Finance.
5. The offer/bids should be sent only for a machine that is available in the market and supplied to a number of customers. A list of customers in India and abroad with details must accompany the quotations. Quotations for a prototype machine will not be accepted.
6. Original catalogue (not any photocopy) of the quoted model duly signed by the principals must accompany the quotation in the Technical bid. No prices should ever be included in the Technical bid.
7. Documentary proof for the claimed position and repetition accuracies must be obtained from the principals and submitted along with the relevant pages of the standards.
8. Compliance or Confirmation report with reference to the specifications and other terms & conditions should also be obtained from the principal.
9. **Validity:** Validity of Quotation not less than 90 days from the due date of tender.
10. **Delivery Schedule:-** The tenderer should indicate clearly the time required for delivery of the item. In case there is any deviation in the delivery schedule, liquidated damages clause will be enforced or penalty for the delayed supply period will be levied.
11. **Risk Purchase Clause:-** In the event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from other sources on the total risk of the supplier under risk purchase clause.
12. **Payment:-** No Advance payment will be made for Indigenous purchase. However 90% Payment against Delivery and 10% after installation are agreed to wherever the installation is involved. In case of import supplies the payment will be made only through 100% Letter of Credit i.e. (90% payment will be released against shipping documents and 10% after successful installation wherever the installation is being done).
13. **Advance Payment:-** No advance payment is generally admissible. In case of specific percentage of advance payment is required, the Foreign Vendor has to submit a Bank Guarantee equal to the amount of advance payment and it should be routed through the

Beneficiary Bank to the end user Bank. Otherwise, the Indian Agent of the foreign vendor has to submit a Bank Guarantee through a Nationalized Bank of India.

14. **On-site Installation:** - The equipment or machinery has to be installed or commissioned by the successful bidder within 15 to 20 days from the date of receipt of the item at site of IIT Madras.
15. **Warranty/Guarantee:** - The offer should clearly specify the warranty or guarantee period for the machinery/equipment. Any extended warranty offered for the same has to be mentioned separately. (for more details please refer our Technical Specifications).
16. **Late offer:** - The offers received after the due date and time will not be considered. The Institute shall not be responsible for the late receipt of Tender on account of Postal, Courier or any other delay.
17. **Acceptance and Rejection:** - I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.
18. **Do not quote the optional items or additional items unless otherwise mentioned in the Tender documents / Specifications.**
19. **Disputes and Jurisdiction:** -
 - a. **Settlement of Disputes:** Any dispute, controversy or claim arising out of or in connection with this PO including any question regarding its existence, validity, breach or termination, shall in the first instance be attempted to be resolved amicably by both the Parties. If attempts for such amicable resolution fails or no decision is reached within 30 days whichever is earlier, then such disputes shall be settled by arbitration in accordance with the Arbitration and Conciliation Act, 1996. Unless the Parties agree on a sole arbitrator, within 30 days from the receipt of a written request by one Party from the other Party to so agree, the arbitral panel shall comprise of three arbitrators. In that event, the supplier will nominate one arbitrator and the Project Coordinator of IITM shall nominate one arbitrator. The Dean IC&SR will nominate the Presiding Arbitrator of the arbitral tribunal. The arbitration proceeding shall be carried out in English language. The cost of arbitration and fees of the arbitrator(s) shall be shared equally by the Parties. The seat of arbitration shall be at IC&SR IIT Madras, Chennai.
 - b. **The Applicable Law:** This Purchase Order shall be construed, Interpreted and governed by the Laws of India, Court at Chennai shall have exclusive jurisdiction subject to the arbitration clause.
20. All Amendments, time extension, clarifications etc., will be uploaded on the website only <http://tenders.iitm.ac.in> and will not be published in newspapers/ CPP portal. Bidders should

regularly visit the above website to keep themselves updated. No extension in the bid due date/ time shall be considered on account of delay in receipt of any document by mail.

Acknowledgement:- It is hereby acknowledged that the tenderer has gone through all the conditions mentioned above and agrees to abide by them.

**SIGNATURE OF TENDERER
ALONG WITH SEAL OF THE
COMPANY WITH DATE**

Specifications of Micro-machining System (MMS) for Femtosecond Laser Ultraprecision Fabrication

Requirements

- The MMS should consist of at least 3 precision motion stages two for the horizontal axis X and Y, and one for the vertical, Z.
- It should include an appropriate set of motion controllers which can be synchronized and manipulated with a single software program with capabilities listed below including adequate drivers and tools for laser-based manufacturing from CAD to fabricated part.
- Only MMS based on XYZ stacks will be considered.

Specifications

1. Compatibility with existing femtosecond laser system

Laser Micromachining Motion setup w/ Software to be used with COHR Astrella, 800nm, 1kHz, 35fs.

2. Minimum specifications for the XYZ Stack:

(Note: Horizontal axes are labelled X and Y here, the Vertical axis is labelled Z).

a) Min. specifications for X and Y Stages

- XY stages of the MMS should be mounted on a Granite base appropriate for precision machining with adequate smoothness and planarity;
- Travel Range: 200 mm or more
- Minimum speed in each > 200 mm/s
- Minimum Incremental Motion: $\leq 0.001 \mu\text{m}$
- Accuracy, typical : $\leq \pm 0.5 \mu\text{m}$
- Bi-directional Repeatability, typical: $\leq \pm 0.05 \mu\text{m}$
- Maximum Continuous Force >35 N
- Centered Load Capacity >280 N
- Pitch Typical : $\pm 20 \mu\text{rad}$
- Yaw Typical : $\pm 10 \mu\text{rad}$
- Flatness Typical : $\pm 0.75 (\pm 1.50) \mu\text{m}$

- xii. Straightness Typical : ± 0.75 (± 1.50) μm
- xiii. Origin Repeatability ± 0.025 μm
- xiv. Mean-time-between-failures (MTBF) : 20000 hours or more

b) Specifications for Z Stage:

- i. *Gantry mounting: should have Granite bridge and breadboard for mounting*
- ii. Travel Range: 100 mm
- iii. Centred Load Capacity: 400 N
- iv. Minimum Incremental Motion: 0.40 μm or smaller
- v. Min. speed: 20 mm/s or greater
- vi. Drive Screw Pitch: 3 mm
- vii. Limit Switches: should be included, preferably optical
- viii. Compliance in Pitch: 1 $\mu\text{rad/Nm}$ or better
- ix. Compliance in Yaw: 1 $\mu\text{rad/Nm}$ or better
- x. Resolution: 0.5 μm
- xi. Accuracy typical: ± 0.6 (± 2.0) μm
- xii. Uni-directional Repeatability Typical ± 0.10 (± 0.25) μm
- xiii. Bi-directional Repeatability Typical ± 0.15 (± 0.50) μm
- xiv. Pitch typical: ± 30 μrad or smaller
- xv. Yaw typical: ± 10 μrad or smaller
- xvi. Origin Repeatability ± 0.1 μm
- xvii. MTBF: > 20000 hours

3. Minimum specification for the combined XYZ stack

- i. Origin positioning: should be centered to the travel, should include mechanical zero signal (preferably optical), should satisfy origin repeatability parameters above.
- ii. Base Material should preferably be Aluminum (High Strength grade) and should avoid mild steel to avoid rusting.
- iii. Bearings used: should anti-creep crossed roller bearings or better.
- iv. Motor used in stages: Motor 3-phase synchronous ironless linear motor
- v. Limit Switches: system should incorporate limit switches, preferably optical.

- vi. Mean-time-between-failures (MTBF): 20000 h or more
- vii. Uni-directional Repeatability: 0.05 μm or better.

4. Minimum specification for Motion Controller:

- i. Number of Axis: Should control 3 axis (or more axis) and drivers should be included.
- ii. Expansion in number of axis: Should be expandable to 5 axis control.
- iii. Motion compensation capabilities: should have the ability to compensate linear error, and backlash with error mapping.
- iv. Motion synchronization between axes: motion should be synchronized point to point.
- v. Motion feedback: should include PID loops for position, velocity and acceleration.
- vi. Interface: Should have/support Plug and Play option with User-friendly interface including minimal stage configuration requirement ahead of each single use
- vii. Driver assemblies: should have a complete library of LabVIEW, Python and Matlab drivers which should be provided along with the controller at no additional cost.
- viii. Programmability: should have a Command Set supporting objected oriented language programming with functions preferably allowing TCL generated scripts and EPICS compatibility.
- ix. Connectivity: Ethernet and USB computer Interfaces

5. Minimum specifications for software drivers/platform included in the MMS system

- i. Software should have complete laser processing tool from CAD model to fabricated part.
- ii. Should convert the DXF, DWG and STL files automatically to motion optimized process
- iii. Laser should be hardware synchronized with through I/O of above quoted Controllers.
- iv. Laser shuttering through TTL
- v. 3D Printing and other process by user defined process parameters.

6. Upgradability, integrability and testing

- i. Should allow for upgrade to 5-axis system in the future without having to replace the motion controller or software;
- ii. Should allow the integration of a camera for inline monitoring;
- iii. Should be built and studied at the factory and tested prior to shipping. Manufacturer should share the test results with the shipment; and

iv. It should be upgradeable to Galvo scanner based applications.

7. Support and Service

- a. Technical support should be available preferably through Indian counterparts
- b. AMC prices if any should be quoted herein.

8. Warranty

- a. Min warranty period: 2 years
- b. Should also quote for extended warranty year-wise for up to 3 years.

9. Sample

- a. Specimen samples including glass (fused silica, BK7 etc), metal and polymer need to be supplied at the vendor's cost on request.
- b. Alternative to 9 a), the vendor may list research articles for each material where the quoted product line was used to do micromachining, in which case a letter or communication from one of the authors of the paper confirm this should be included.

10. Shipping and Handling

- a. FOB prices should quoted with
- b. Insurance
- c. Delivery time

11. Options and accessories

- a. Beam deliver system compatible with the MMS described herein with laser power control;
- b. Galvo scanner compatible with this system
Specifications mentioned in Annexure 1 below.
- c. Inline imaging/viewing system of suitable magnification for monitoring MMS described herein;
- d. Anti-vibration platform with supports:
Specifications mentioned in Annexure 2 below.
- e. Compatible safety housing for MMS described with light-shield
- f. Local Training: should be quoted as an option, if it is not free of cost

Annexure 1

Galvanometric scanner for MMS

Pre-condition

The quoted galvanometric scanner should be fully compatible and integrated with the MMS specified herein.

Specification

Aperture: 14 mm,

Step response time : 1% of full scale = 0.40 ms or lesser, 10% of full scale = 2.2 ms or lesser;

Marking speed 2.5 m/s or higher; Positioning speed: 6.0 m/s or higher;

Writing speed: Good writing quality = 800 cps or better; High writing quality = 550 cps or better

Long-term drift: offset < 100 μ rad and gain < 100 ppm (after 8h and after 24h)

Temperature drift: Offset = less than 15 μ rad/K or better ; Gain less than 25 ppm/K or better;

Beam displacement 15 mm or larger.

Annexure 2

Anti-vibration platform for Micromachining systems

Pre-conditions:

- The vendor may only specify anti-vibration platforms from product lines which have proven capability.
- Platforms from this product line should have been supported MMS systems in at least 3 laboratories/facilities in India and/or overseas. Letters of support and details of publications using these support systems should be provided.

Specifications

- A. Tabletop of Dimension: 1500 (5 ft) x 900 (3 ft) x 800 mm (L x B x H) or nearest – **2 nos**
- Thickness of Table top required: 400mm or nearest – 1 set
 - Dynamic Deflection coefficient : 1.10×10^{-3}
 - Relative Motion: 0.5nm
 - Compliance : 37nm/N
 - Natural frequency : 110Hz
- B. Suitable Air compressor (2nos) should be quoted along with the system
- C. Optionally Quote for joiner of dimension 1200 x 300mm (SS)

Working Surface specifications:

- Top Skin should have 4.0 mm thickness 430 series ferro magnetic SS plate, smooth sanded finish
- Side Walls should have 2.0mm thickness carbon steel plate with damped wood composite, vinyl covered finish
- Bottom Skin should be 4mm thickness carbon steel plate epoxy painted finish
- Core: Plated steel Honeycomb (0.25mm foil, 3.2cm² cell size)
- Surface Flatness: +/- 0.1mm over 600mm square
- Mounting Holes: Metric – M6-1.0 holes on 25mm grid, 37.5mm borders

- Hole/Core Sealing: Easy clean cylindrical cup (25mmdeep)
- Damping: Broadband Standard Damping

Pneumatic Support System (nearest) specification:

Load capacity: ~ 1600-1800 Kg

Height: 500 - 1000 mm (should be customized as per our needs)

Leveling: Auto Leveling by 3 Automatic Leveling valve

Leveling Repeatability: <1.2 mm

Performance Specifications

- 1st Resonant Frequency (provide plot/graph as evidence)
 - Vertical : ≤ 1.2 Hz
 - Horizontal : ≤ 1.5 Hz
- Roll off rate (or Isolation efficiency) at 5 Hz (provide plot/graph as evidence)
 - vertical : over 85 % Horizontal : over 75 % at 10 Hz
 - vertical : over 95 % ; Horizontal : over 85 %.

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