भारत सरकार | Government of India
अंतरिक्ष विभाग | Department of Space
द्रव नोदन प्रणाली केंद्र (द्रनोप्रकें-बें) | Liquid Propulsion Systems Centre (LPSC-B)
बेंगलूरु | Bangalore

एकीकृत टाइटेनियम मिश्रधातु नोदक टैंक उत्पादन सुविधा (आई टी पी एफ), तुमकुरु के प्रचालन एवं अनुरक्षण के लिए रुचि की अभिव्यक्ति (ई ओ आई)
Expression of Interest (EoI) for the operation and maintenance of Integrated Titanium alloy Propellant Tank Production Facility (ITPF), Tumakuru

ई ओ आई मोहरबंद लिफ़ाफे में प्रस्तुत की जाए/EoI to be submitted in sealed cover

A. ई ओ आई के विवरण / EoI Details		
विवरण/Description	:	**इसरो की विभिन्न परियोजनाओं के लिए नोदक टैंकों के उत्पादन के लिए एल पी एस सी द्वारा तुमकुरु परिसर (बैंगलूरु से 60 किमी दूर) संस्थापित की जा रही एकीकृत टाइटेनियम मिश्रधातु नोदक टैंक उत्पादन सुविधा के प्रचालन एवं अनुरक्षण के लिए वांतरिक्ष विनिर्माण से जुड़े भारतीय सार्वजनिक क्षेत्र के उपक्रमों/भारत सरकार के स्वायत्त निकायों से रुचि की अभिव्यक्ति आमंत्रित है। Expression-of-Interest is invited from aerospace manufacturing Indian PSU (Public Sector Undertakings)/ Autonomous Body of Government of India, for the operation and maintenance of Integrated Titanium alloy Propellant Tank Production Facility (ITPF) being established by LPSC at Tumakuru campus (60 kms from Bangalore), Karnataka for the production of propellant tanks for various projects of ISRO**
ई ओ आई की तिथि / EoI Date	:	**09/06/2023**
निर्धारित तिथि/Due Date	:	**07/07/2023**
क्रय एंटिटी/Purchase Entity	:	**द्रव नोदन प्रणाली केंद्र, बेंगलूरु** **Liquid Propulsion Systems Centre, Bengaluru**
केंद्र/Centre	:	**द्रव नोदन प्रणाली केंद्र, बेंगलूरु (द्रनोप्रकें-बें)** **LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B)**

ई ओ आई, मोहरबंद लिफ़ाफे में उसके ऊपर "आ टी पी एफ, तुमकुरु के प्रचालन एवं अनुरक्षण के लिए ई ओ आई" उल्लिखित कर क्रय व भंडार अधिकारी, द्रव नोदन प्रणाली केंद्र, 80 फीट रोड, एच ए एल 2 स्टेज, कोडिहल्ली, बेंगलूरु-560 008 को प्रस्तुत की जाए।

EoI shall be submitted in sealed cover superscribed with "EOIFOR OPERATION AND MAINTENANCE OF ITPF, TUMAKURU" and addressed to Purchase & Stores Officer, Liquid Propulsion Systems Centre, 80 Ft Road, HAL 2nd Stage, Kodihalli, Bengaluru – 560 008

ANNEXURE TO EXPRESSION OF INTEREST (EOI)

Liquid Propulsion Systems Centre
Indian Space Research Organisation
Bengaluru – 560 008, Karnataka

Advt. Ref. No.: LPSCB/PUR/EoI/01 Date: 09.06.2023

Invitation for Expression-of-Interest

"Expression-of-Interest" is invited from aerospace manufacturing Indian PSU (Public Sector Undertakings)/ Autonomous Body of Government of India, for the operation and maintenance of Integrated Titanium alloy Propellant Tank Production Facility (ITPF) being established by LPSC at Tumakuru campus (60 kms from Bangalore), Karnataka for the production of propellant tanks for various projects of ISRO.

1. **Introduction**

Liquid Propulsion Systems Centre (LPSC), Indian Space Research Organisation (ISRO), Government of India is responsible for design, development, realization and delivery of propulsion systems for various spacecraft & launch vehicle programmes of ISRO. Propellant tank is one of the critical element in propulsion system. The design requirements of propellant tanks include weight optimization, selection of Titanium alloy compatible with propellants as material of construction and incorporation of propellant management devices (PMDs) to ensure gas-free propellant supply to the engines under microgravity environment encountered in space.

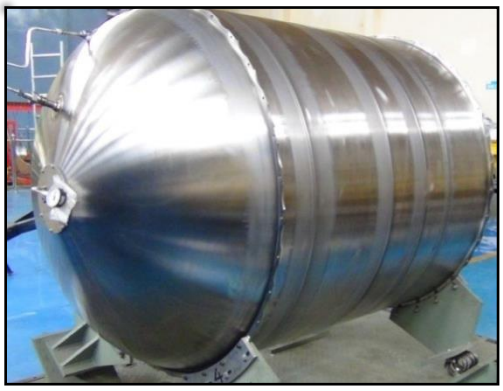
The space mission requirements are being enhanced considering the national needs. The additional hardware requirement due to this is being met by building additional capacity. Towards the requirement of higher number of propellant tanks, LPSC is establishing a dedicated state-of-the-art facility for the production of Titanium alloy propellant tanks (i.e., Integrated Titanium alloy Propellant Tank Production Facility-ITPF).

This production plant will have machining, chemical cleaning, welding including Electron Beam Welding, Inspection & Metrology & non-destructive inspection, precision assembly and test facilities including Quality Assurance/ Quality control (QA/QC) activities for realising flight worthy tanks.

LPSC proposes to effectively utilise the expertise, experience and capabilities of aerospace manufacturing Indian PSU (Public Sector Undertakings)/Autonomous Body of Government of India, and / or who possess prior experience in production of aerospace products. Accordingly, it is proposed to invite Expression-of-Interest (EOI) for the operation and maintenance of LPSC established ITPF.

The spacecraft propellant tanks are of volumes varying from 30 litres to 1,500 litres. The diameters vary from 400 mm to 1,400 mm. Thin walled, machined hemispheres along with propellant management devices (PMDs) are electron-beam-welded for realising the propellant tanks. Additional central cylinders are added to obtain higher volume propellant tanks as variants. In certain cases Cassini-shaped end-domes are used in place of hemispherical end domes.

The volumes of PS4 propellant tank (for 4th stage PSLV) varies from 1,600 litres to 3,000 litres approximately. The diameter is 1,380 mm. This is a bi-compartmental propellant tank with Propellant Acquisition System (PAS). In this case also the thin walled, machined semi elliptical end-dome and cylindrical-shells are electron beam welded to realise the propellant tanks.



2. Scope of work

The scope-of-work encompasses operation and maintenance of the ITPF by the aerospace manufacturing Indian PSU/ Autonomous Body of Government of India, for the production and delivery of spacecraft propellant tanks, PS4 propellant tanks along with propellant acquisition system (PAS) annually until contract tenure is completed.

2.1. Operation and maintenance

2.1.1. Operation and maintenance of facilities mentioned in section 4.0

2.1.2. Maintenance of Civil, Electrical, Water, Effluent treatment, Housekeeping, security of ITPF premises etc.

2.2. Deliverables

2.2.1. Tentative annual requirement is 18 nos. of spacecraft propellant tanks & 6 nos of PS4 propellant tanks along with 6 sets of Propellant Acquisition system (PAS). Annual requirements may vary based on mutual discussions.

2.2.2. Free Issue Material shall be supplied by LPSC in annual basis.

2.2.3. Draining devices & PMD parts, machined parts for PAS and anti-slosh baffles for PS4 propellant tank will be issued as free-issue-material (FIM) by LPSC.

3. **Tenure of the contract**

3.1. Tenure of the contract will be for the period of 5 years which is inclusive of initial training period.

3.2. Training will be provided during the qualification phase i.e. time required for qualifying the party through qualification of propellant tanks before regularizing the production line.

3.3. The period of contract may be extended for further duration on mutually agreed terms and conditions.

4. **Operation and involved facilities**

ITPF is a self contained plant and includes full complement of machining, welding (including Electron Beam Welding), inspection & QC, chemical cleaning, vacuum heat-treatment, non-destructive inspection, assembly clean-rooms and test facilities. The plant also includes captive power supply, UPS back up and utilities such as gas bank with network of distribution lines for various gases such as GN2, GHe, GAr, compressed air, etc. The entire facility will be equipped with computer network for digital workflow.

The bird's eye view of the various facilities & operation and maintenances involved are detailed below.

4.1. **Storage:** Receipt and storage of titanium alloy forgings, machined parts, standard parts and consumables at bonded stores. Safe storage of sub-assemblies and finished propellant tanks in respective bonded stores.

4.2. **High precision machining:** Machining of hemispherical / ellipsoidal /Cassini shaped domes, cylindrical rings with stringent geometrical & dimensional tolerances are carried out in machining facility. The high precision machine tools used are: Ø 1500 mm class horizontal heavy duty CNC lathe, Ø 600 mm class horizontal CNC lathe, 4 axes mill-turn centre, Ø 1500 mm vertical turn-mill centre, precision lathe, CNC milling machine, general purpose lathe and precision de-burring equipments & tools, etc.

4.3. **Inspection & Metrology:** Thorough inspection of machined parts such as thickness mapping of domes, visual and dimensional inspection is carried out in metrology and inspection facility. The high-end metrology inspection equipments used are co-ordinate measuring machine, height measuring instrument, surface finish measuring machine (portable), ultrasonic thickness gauge and other precision measuring instruments. Inspection is required to be carried out at various stages such as part level, sub-assembly level, final assembled propellant tanks, etc.

4.4. **Surface treatment:** Chemical cleaning of machined parts, preparation of weld joint surfaces, etc., is carried out in the chemical cleaning facility.

4.5. **Pre-assembly operations:** Precision de-burring of machined parts & sub-assemblies under microscope, visual inspection of standard parts, tube bending, matching, etc., are carried out in the pre-assembly area. A separate fitting room is identified for all manual fitting jobs.

4.6. **Sub-assembly conversion:** Assembly of machined parts is carried out in clean environment i.e., 1,00,000 Class clean-room. Orbital TIG welding is used to join the tubes of propellant / gas ports, etc. The final tank assembly and cleanliness verification is carried out in 10,000 Class clean room.

4.7. **Bubble point test facility:** Sub assembly level Bubble point tests will be carried out in this facility to verify the integrity of Screen/Wire meshes used at various stages of Propellant Acquisition Systems/ Propellant tanks built up.

4.8. **Welding & heat treatment:** Joining of machined parts & standard parts using electron beam welding / M. TIG welding processes are carried out in this facility. The machines used are: Electron beam welding machines and MTIG welding machine. The finished Titanium alloy spacecraft propellant tanks are heat treated in vacuum furnace (ageing).

4.9. **Non-Destructive Inspection (NDI):** The sub-assemblies and finished propellant tanks are subjected to elaborate non-destructive inspection in individual facilities. The weld joints are subjected to X-ray radiographic inspection, ultrasonic inspection and fluorescent penetrant inspection. Certain parts are inspected by eddy current method including robotic eddy current testing. In addition the spacecraft propellant tank will be subjected to shearograpy inspection through outsourcing.

4.10. **Sub-assembly / final machining:** Precision turning, milling and drilling/reaming operation and maintenances are carried out on sub-assembly/finished spacecraft propellant tanks in a special purpose 4 axes mill-turn centre. In addition, riveting is carried-out for fixing plate-nuts. Finally, the tank surfaces are manually polished.

4.11. **Testing and facilities:** The sub-assemblies and final assembled propellant tanks are subjected to various tests such as functional tests, pressure test, leak test, vibration test, cleanliness verification test etc.

4.12. The propellant tanks are subjected to hydraulic/pneumatic pressure tests. Separate hydraulic and pneumatic test facilities are employed for this. There is DM water plant production facility for the hydraulic test. The facilities are fully instrumented.

4.13. External leak measurements of the propellant tanks are carried out in dedicated leak test chamber.

4.14. The spacecraft propellant tanks will be subjected to vibration testing with the tanks filled with simulant fluid to simulate mass and under pressure. These tests will be carried out in vibration test facility which has suitable rating vibration shaker along with instrumentation and data acquisition system.

4.15. During the initial phase of operation, vibration facility for higher capacity spacecraft tanks (60 L to 1500 L) is to be outsourced by the party.

4.16. Verification of Interface Control Dimensions (ICD) of the final tank using CMM prior to delivery.

4.17. On-line quality surveillance at all stages of assembly & testing operations.

4.18. Documentation in digital mode, packing & delivery.

5. **Criticalities involved**

Machining of high-value Titanium alloy hemispherical domes / cylinders, etc., with varying surface profile from a stock thickness of 20.0 mm to varying thicknesses up to 0.8 mm final thickness. Adherence to geometrical tolerances as per drawings for jobs up-to dia. 1500 mm is a challenging work.

5.1. Assembly of high value added thin shells with draining device & PMD parts–in clean environment.

5.2. Electron beam welding of sub-assemblies and assemblies to realise the full propellant tank.

5.3. Advanced NDI of the propellant tanks which include X-ray radiography, ultrasonic inspection, eddy current inspection and shearographic inspection.

5.4. Testing of the propellant tanks which include functional testing (bubble point, flow characterisation, expulsion efficiency) pressure testing, leak testing, vibration testing, etc.

5.5. Safe handling of parts, sub-assemblies, and full propellant tanks during assembly and testing with stipulated safety measures during the realisation process. Ensuring proper storage of these items during work.

5.6. The free-issue-materials (FIM) comprising of Titanium alloy forgings, value added propellant management devices and anti-slosh baffles are long lead & high value items. Rejections at any stage of production in ITPF would impact delivery schedules and have major cost implications.

6. **Human resources required and HR policy:**

6.1. The PSU/ Autonomous Body of Government of India, shall deploy the necessary workforce to operate & maintain the ITPF facility.

6.2. Workforce should be qualified, experienced and possess requisite skill-sets for operation and maintenance of the dedicated facilities in ITPF and perform production work as specified.

6.3. The anticipated technical work-force of around 80 personnel (comprising of Graduate Engineers, Diploma Engineers & Technicians) may be required to be deployed for the production task.

6.4. In addition to above, adequate manpower to be deployed for the facility maintenance, housekeeping, security etc.

6.5. The PSU/ Autonomous Body of Government of India, shall have a HR policy of retaining the LPSC trained (as under para 6) workforce. This is very essential since attrition would lead to derailment of production activities, affect quality and delay in delivery schedule and lead to uncertainty in contract execution.

7. **Training of workforce of the PSU/ Autonomous Body of Government of India:**

The Personnel to be deployed shall possess basic skills in the broad areas identified under section 4 above.

LPSC shall impart essential job-specific training to the workforce in relevant critical areas. LPSC will provide training initially for identified personnel from the PSU/ Autonomous Body of Government of India. Subsequently the trained personnel shall impart the training to other personnel.

Other requirements to be met by PSU/ Autonomous Body of Government of India

8. **Security:** The workforce shall comply with necessary security regulations.

9. **Safety:** The Workforce shall follow all safety stipulations.

10. **Secrecy:** The work if entrusted shall be treated as confidential and shall not be divulged to any 3rd party. PSU/ Autonomous Body of Government of India, and their workforce shall abide by instructions of LPSC in vogue and shall provide undertaking to this effect.

11. **Who can participate in the EOI**

Aerospace manufacturing Indian PSU/ Autonomous Body of Government of India, that have experience to the ones described under points in paragraph (4) regarding operation and maintenance of ITPF, who have the skilled human resources for such critical activities, who have the requisite work experience & financial credentials can participate in the EOI. Preferably should be a profit making organization/company (not applicable for non profit organizations under GOI).

All necessary information shall be furnished by the participating PSU/ Autonomous Body of Government of India to facilitate evaluation of offers by LPSC. Whoever not participating in EOI shall not be eligible for participating in the tender for "Operation and maintenance of ITPF facility".

12. **Criteria for scrutiny and evaluation of EOI proposals**

12.1. **General**

12.1.1. The EOI shall contain complete information of the PSU/ Autonomous Body of Government of India, such as line of business, human-resources, infrastructure, assets, financial standing and credentials.

12.1.2. Self assessment on technical and organisational competence to respond to the EOI of this nature and magnitude by the participating PSU/ Autonomous Body of Government of India, to be furnished.

12.2. **Essential criteria for evaluation of EOI proposals**

12.2.1. Prior expertise in Machining of thin walled (thickness <2.0 mm) titanium propellant tank parts (diameter varying between 400 to 1150 mm) with thickness tolerance in the order of 50 microns, EB welding etc.

12.2.2. The PSU/ Autonomous Body of Government of India, desirous of submitting EOI proposals shall mandatorily be accredited with valid AS9100 or ISO9100 certification for the last 3 years of existing operation and maintenance.

12.2.3. Prior experience of more than 3 years in the last 10 years is essential in work areas such as manufacturing (machining, welding, heat-treatment, inspection) assembly, NDT, testing, evaluation and production of precision / complex / critical aerospace assemblies.

12.2.4. The PSU/ Autonomous Body of Government of India, shall possess human resource with adequate knowledge, skill and experience in the areas of manufacturing, metrology inspection, assembly, advanced non-destructive inspection, testing, quality control and maintenance of industrial equipment's & other essential requirements listed in section 4.0 .

12.2.5. Viable plan for Liquidity and Solvency during the currency of the project to an extent of Rs. 5.0 crores to be outlined.

Note:

(1) For clauses under Sl. No. 12, all information provided by the PSU/ Autonomous Body of Government of India, shall be backed by documentary evidences. Printed brochures to be enclosed.

(2) The final evaluation of the responses will be based on inputs furnished against our criteria, assessment based on facility visit, if necessary, feedback from customers and overall assessment.

(3) Party shall also furnish the requested details as per the checklist provided in Annexure-1.

(4) Opportunity shall be given to interested parties to visit ITPF facility upon request from the party.

(5) LPSC Expert Committee may scrutiny the Expertise/Experience/Heritage of the participating company in above specified fields i.e. section 4 to 12 (if deemed necessary).

(6) <u>Last date for Submission of EoI is 07/07/2023; 14:00 Hrs</u>

Annexure-1

Compliance matrix regarding document submissions by
PSU/ Autonomous Body of Government of India

(Explanation should be in detail, supported by documents with page Nos.)

Sl. No.	Item Description	Furnished/Compliance Yes/No	remarks, if any, Supporting documents with page Nos.
1	Name / Title and Address		
2	Contact details (Name, designation, phone no., e-mail, fax no., etc.)		
3	Line of business		
4	Details of human resources (relevant to the nature and magnitude of the scope of work)		
5	Experience in manufacturing, machining of thin walled titanium tank parts, NDT, testing & realisation of aerospace products (Work order/purchase order/ contract copies, satisfactory work completion certificates from Agencies where work was executed, with details regarding the nature and magnitude of work, etc.)		
6	Self assessment on technical and organisational competence to respond to the EOI of this nature and magnitude. (In the relevant areas of detailed in the scope of work)		
7	Details of infrastructure available with the PSU/ Autonomous Body of Government of India		
8	Documentary evidence for accreditation to valid AS9100 or ISO9100 certification for the past 3 years.		
9	Details regarding financial credentials such as:		
9.1	Viable plan for Liquidity and Solvency during the currency of		

Sl. No.	Item Description	Furnished/Compliance Yes/No	remarks, if any, Supporting documents with page Nos.
	the project to an extent of Rs. 5.0 crores.		
9.2	Certified copies for the annual financial turnover and balance sheet showing profit / loss.		
10	Manufacturing work-orders and contracts completed /ongoing for ISRO, if any		
11	Any other relevant information.		