

Expression of Interest (EOI) for design, development, realization and installation of EMI test facility for electric thrusters.

1. Introduction

Liquid Propulsion System Centre (LPSC) is a premier organization in India that develop and supply state of the art rocket engines for India's space program. Recently LPSC has embarked upon the development of high thrust electric propulsion systems which mainly consists of Stationary Plasma Thrusters (SPTs) using Xenon as propellant with a power level up to 20KW. As part of the development, it is planned to evaluate the Electro Magnetic Interference (EMI) generated by these thrusters [Radiated Emission (RE) and Conducted Emission (CE)] using a RF transparent dielectric chamber attached to the main vacuum chamber. The dielectric chamber will be housed inside a semi-anechoic enclosure. This document provides the gross specifications and requirements of the EMI measurement facility proposed at LPSC.

Attention of all reputed companies, organisations/ research laboratories either individually or as a consortium is drawn for submitting the EOI for the design, development, realization and installation of semi-anechoic enclosure, dielectric chamber and related equipment for EMI measurement from SPT in a timely manner. In case of consortium, there should be a prime contractor who will be responsible for the execution of the system.

2. Scope of work

- 2.1. Design of semi-anechoic enclosure and related equipment for measuring the EMI generated by SPTs of power level up to 20kW during testing. Design has to meet the measurement requirements as per MIL STD 461 E.
 - 2.2. Design of the RF transparent dielectric chamber which can be attached to the main vacuum chamber for housing the thrusters during firing as shown in Fig 1.
 - 2.3. Design of beam dump and other auxiliary systems.
 - 2.4. Review and approval of all the proposed designs by LPSC.
 - 2.5. Procurement of components, equipment and material as per the design specifications.
 - 2.6. Integration and testing of the complete system at LPSC as per mutually agreed plan.
 - 2.7. Provide the required training for the personnel involved.
 - 2.8. Service and maintenance of the facility after the warranty period.
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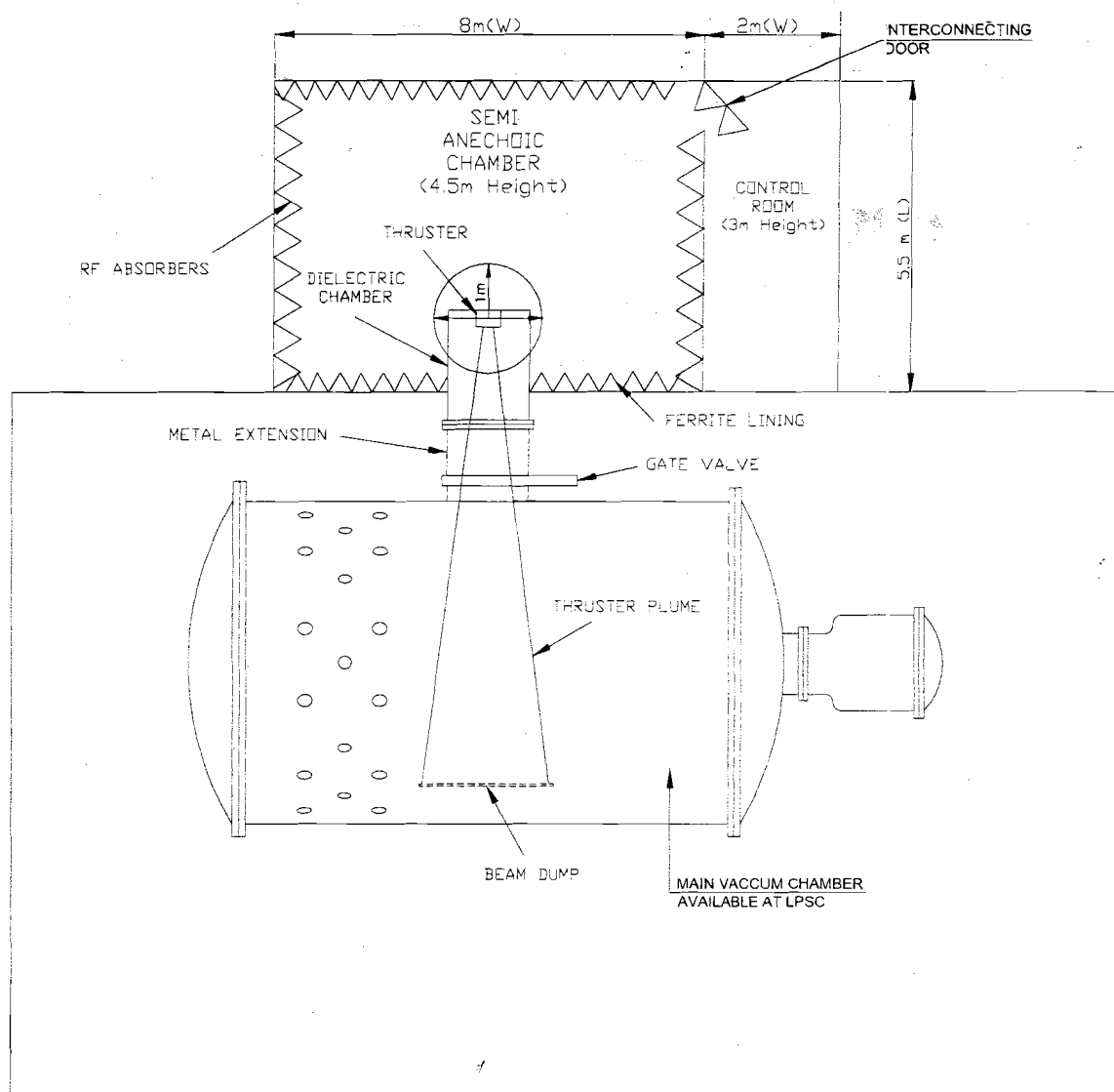


Fig 1. Typical schematic of EMI test facility for electric thrusters.

3. Scope of supply

Scope of supply includes doubly shielded semi-anechoic enclosure (along with RF absorbers fixed inside), control room for data acquisition and receiver equipment, RF transparent dielectric chamber and its vacuum pumping system, beam dump, test equipment (antennas and receivers) including processing software if any, thruster mounting structure, cooling mechanism, metal extension, Xenon feed system for SPTs and auxiliary equipment as detailed below and shown in Fig 1.

4. Technical details of proposal

Sl. No	Name of the Item	Requirement
1.	Semi-anechoic enclosure	Proposed approximate dimensions of semi-anechoic enclosure are 5.5m x 8m x 4.5m (LxWxH). The inside of the enclosure is to be completely covered with RF absorbers except the floor. Ferrite lining to be provided on the side of the chamber where the thruster will be firing.

		The enclosure should have provision to incorporate dielectric chamber. Measurements of radiated emission (14 kHz to 40 GHz) and conducted emission (30 Hz to 50 MHz range) generated from the thruster during operation need to be made as per MIL STD 461 E. A shielded control room of approximate dimensions 5.5m x 2m x 3m (LxWxH) should be installed adjacent to semi-anechoic enclosure to house the data acquisition system and control equipment.
2.	RF Transparent Dielectric chamber	RF transparent cylindrical chamber made of suitable material like S-Glass composite shall house the thruster while being fired. The proposed dielectric chamber of approximately 1m diameter, 1.5m long should cater to the EMI measurement of 5KW thruster. An option for future upgradability for testing 20 KW SPT may also be provided. Dielectric chamber may partially project out of semi-anechoic enclosure and will be mated to a metal extension. This metal extension shall be connected to the vacuum chamber through 1m diameter gate valve. The inside of the dielectric chamber is to be under high vacuum (1×10^{-5} mbar) during firing and the outside i.e semi-anechoic enclosure will be in ambient condition. Thickness of the dielectric chamber has to be chosen appropriately to withstand the pressure difference. Care should be taken while deciding the thickness since RF attenuation increases with wall thickness. Thruster should be mounted inside this chamber with the help of non-metallic and RF transparent structure.
3.	Beam dump	A suitable mechanism shall be provided inside the main vacuum chamber to avoid reflection of RF from vacuum chamber back into semi-anechoic enclosure through dielectric chamber as shown in Fig 1. It should also reduce the sputtering by avoiding direct hitting of thruster plume onto the vacuum chamber walls. The mounting requirements of this mechanism has to be provided beforehand.
4.	Auxiliary systems	The contractor shall supply all the auxiliary systems required such as thruster mounting fixture to support the thruster inside dielectric chamber, cooling mechanism to reduce the interface temperature between thruster mounting fixture and dielectric chamber,

		necessary feed throughs, metal extension, Xenon Feed system, and vacuum pumping system for the dielectric chamber etc
5.	Test equipment	Appropriate test instruments/equipment required for measurement of RE and CE shall be provided by the contractor. A typical list of probable systems are given in Annexure 1
6.	Third party inspection	Strict quality control and third party inspection shall be implemented during all stages of fabrication. Design reports, fabrication drawings, material certificates, inspection reports by third party and quality control documents shall be submitted to LPSC for review and approval.
7.	Safety	All required safety systems shall be installed to ensure the safety of the test article, anechoic enclosure and data acquisition system/diagnostic electronics if any.
8.	Transportation and installation	The transportation, installation and commissioning of the entire system at LPSC, Trivandrum premises is the sole responsibility of the contractor. Obtaining necessary approvals from respective departments for transportation is also Contractors responsibility.

5. Commercial details of the proposal

Vendor shall have previous experience in design and development of similar systems. Documentary evidence of the same shall be submitted along with the EOI. The company shall be financially strong to execute the work under this Expression of Interest.

The following commercial details of the company and proposal shall be submitted along with the EOI

1. Annual turnover of company in last 5 years.
2. Proof of experience in the field.
3. List of customers in aerospace or scientific area.
4. Details of similar systems realized elsewhere by the contractor.
5. Company website details.

6. Delivery period

Timely delivery is the essence of the contract.

Phase – I

- a. Design of anechoic enclosure, beam dump, RF transparent dielectric chamber and other auxiliary systems.
- b. Review and approval of the designs by LPSC.

Phase – II

Procurement of material/equipment, manufacturing and assembly.

Phase – III

Pre-dispatch inspection, transportation to LPSC site, erection and commissioning of the system.

Phase – IV

Acceptance testing of the system and training of personnel at LPSC.

The commissioning time for whole system shall be 6-8 months after the placement of purchase order.

1. Mode of tender

In the first stage, companies have to respond to this Expression of Interest (EOI) explaining their capabilities and expertise to execute the proposed work. **No price is to be quoted.**

The respondents will be called for preliminary discussions. Based on the discussions so held, detailed technical specification will be firmed up and detailed requirement specification in the form of RFP will be generated by LPSC.

In the second stage, techno – commercial offers and price bid based on finalized RFP shall be invited from the short listed vendors, on two part basis.

Final selection will be based on evaluation of techno-commercial offers and price bid.

2. Payment terms: payment terms will be finalized based on mutual discussion between the party and department.

3. Date of submission of EOI: Interested vendors may submit their Expression of Interest in a sealed envelope superscribing the "Reference number of this advertisement and EOI No.TE90 2017030488 Due on:04.01.2018 at 16hrs and opening on 05.01.2018 at 10.30 Hrs

The EOI has to reach the under signed before the due date and time.

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Annexure 1

Specifications of equipment/material

Active monopole antenna	30 Hz to 50 MHz
Bi conical antenna	20 MHz to 300 MHz
Log periodic antenna	200 MHz to 1.3 GHz
Horn antenna	0.8 GHz to 40 GHz
EMI test receiver (2 inputs) with preselection filters and emission measurement software	20 Hz - 40 GHz
RF cables (Ultra low loss)	30 Hz to 40 GHz
Current probes for CE measurement	30 Hz to 100 MHz