



भारत सरकार/GOVERNMENT OF INDIA  
अंतरिक्ष विभाग/DEPARTMENT OF SPACE  
विक्रम साराभाई अंतरिक्ष केंद्र/VIKRAM SARABHAI SPACE CENTRE  
तिरुवनंतपुरम/THIRUVANANTHAPURAM – 695 547

विज्ञापन संदर्भ सं./Advt Ref No: VSSC/MVIT PUR/EOI/03-2024

तिथि/Date:27/08/2024

विक्रम साराभाई अंतरिक्ष केंद्र [वीएसएससी], भारत सरकार, इसरो के प्रमोचन यान उपयोग हेतु "एसएस अवयवों के समुच्चयन एवं परीक्षण के लिए गोको" के लिए देश के अंदर के इच्छुक फर्मों से रुचि की अभिव्यक्ति आमंत्रित करता है।

**Vikram Sarabhai Space Centre [VSSC], Govt. of India, invites Expression of Interest from interested firms within the country for "Assembly and Testing of SAS Elements- GOCO" in GOCO mode of contract execution at VSSC for launch vehicle usage of ISRO.**

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**Interested parties can furnish their Expression of Interest quoting our reference No. 7033 2024 00 1008 on or before 30/09/2024; Time: 15.00 hrs to the following address**

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नियत तिथि और समय के बाद प्राप्त कोटेशनों को विलंबित निविदा मान जाएगा और आगे की प्रक्रिया के लिए विचार नहीं किया जाएगा। किसी भी स्थिति में, नियत तिथि बढ़ाने का अनुरोध स्वीकृत नहीं किया जाएगा।

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**Quotation is to be submitted through Speed Post only.**

हस्ताक्षरित/Sd/-

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1. ईओआइ की बिंदु सं. 7 के अनुसार उद्योग से प्राप्त होनेवाली अपेक्षाएं। Requirements from industry as per point no.7 of EOI.
2. ईओआइ की बिंदु सं. 8 के अनुसार बोलीकार दस्तावेज़ प्रदान करेंगे।The bidder shall provide the documents as per point no.8 of EOI.
3. ईओआइ की बिंदु सं. 9 के अनुसार लघुसूची बनाने का आधार। Basis of short listing as per point no.9 of EOI.
4. मेक इन इंडिया नीति के अनुसार केवल श्रेणी I और श्रेणी II के स्थानीय आपूर्तिकार ही इस बोली में भाग लेने हेतु पात्र हैं। Only Class I and Class II Local suppliers as per Make in India Policy are eligible to participate in the bid.
5. विदेशी विक्रेताओं को कोटेशन देने की अनुमति नहीं है।Foreign vendors are not permitted to quote.
6. श्रेणी I के स्थानीय आपूर्तिकारों को वरीयता दी जाएगी और उनके अभाव में, श्रेणी II के स्थानीय आपूर्तिकारों पर विचार किया जाएगा। Preference will be given to Class I Local Supplier and in their absence, Class II Local Suppliers will be considered.
7. नामिकायन की वैधता संविदा की प्रभावी तिथि (ईडीसी) से 2 वर्ष है जिसे आपसी करार के आधार पर एक और वर्ष के लिए बढ़ाया जा सकता है।Validity Period of Empanelment is 2 years from the effective date of contract (EDC) which can be extended for further one more year based on mutual agreement.
8. जिन विक्रेताओं की ईओआइ टीईसी द्वारा योग्यताप्राप्त हैं, हमारी अपेक्षा के आधार पर, उनके नाम एनआइटी (निविदा आमंत्रण करते हुए सूचना) जारी की जाएगी। NIT (Notice Inviting Tender) will be issued to vendors whose EOI are qualified by the TEC, based on our requirement.

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# **Assembly and Testing of PSLV & LVM3 Stage Separation Mechanisms at VSSC Facilities**

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**Call for Expression of Interest**



JUNE 2024  
 VIKRAM SARABHAI SPACE CENTRE  
 THIRUVANANTHAPURAM

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## ABBREVIATIONS

VSSC	: Vikram Sarabhai Space Centre
SDSC	: Satish Dhawan Space Centre
LPSC	: Liquid Propulsion System Centre
IPRC	: ISRO Propulsion Complex
URSC	: U R Rao Satellite Centre
PSLV	: Generic Polar Satellite Launch Vehicle
LVM3	: Launch Vehicle Mark3
PSLV - CA	: Polar Satellite Launch Vehicle - Core Alone
PSLV - XL	: Polar Satellite Launch Vehicle with XL Strap-on Motors
PSLV-DL	: Polar Satellite Launch Vehicle with two XL Strap-on Motors
PSLV-QL	: Polar Satellite Launch Vehicle with four XL Strap-on Motors
PSOM	: PSLV Strap-On Motor
PS1/PS2/PS3/PS4	: First/Second/Third/Fourth Stage of PSLV
IBL	: ISRO Ball Lock Mechanism
IWL	: ISRO Wedge Lock Mechanism
FAT	: Flight Acceptance Test
FRR	: Flight Readiness Review
FCD	: Functionally Critical Dimensions
BTR	: Bearing Test Rig
QAR	: Quality Assessment Report
TPS	: Thermal Protection System
DP	: Dye Penetrant
QC	: Quality Control
UTM	: Universal Tensile Testing Machine
LIR	: Launch Interface Ring
DLA	: Dual Launch Adaptor
INLS	: ISRO Nano Satellite Launch System
ID	: Identification number
RFP	: Request For Proposal
PCU	: Payload Cooling Umbilical
OPLF	: Ogive Payload Fairing
TRD	: Tension Release Device
SRC	: Standard Room Condition
LBS	: Linear Bellow system
PLF	: Payload Fairing

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## 1 Introduction

Vikram Sarabhai Space Centre (VSSC) is responsible for realization of Launch Vehicles of ISRO. Realization of flight component which involves assembly and testing (mechanical, instrumentation and electrical checks) for all launch vehicles of ISRO are presently being carried out at VSSC. The activities are carried out using in-house facilities located in Trivandrum, Kerala. Based on the demand for launch services of PSLV & LVM3, it is proposed to increase the launch frequency of PSLV to 4-6 launches in a year & LVM3 is expected to be 2-3 launches in a year.

**To meet this increased demand, it is proposed to outsource the assembly, instrumentation activities, inspection of critical dimensions & flight acceptance testing of all the PSLV & LVM3 Stage separation mechanisms to competent industries for carrying out the assembly & testing activities at VSSC facilities. The mode of operation will be GOCO-Government Owned Company Operated. All facilities for carrying out assembly works and acceptance testing will be provided by the department, while the activities have to be carried out by the industry at VSSC Trivandrum.**

## 2 Launch Vehicles

### PSLV

Polar Satellite Launch Vehicle (PSLV) is a launch vehicle developed and operated by the Indian Space Research Organization (ISRO). It was primarily developed to launch Indian Remote Sensing (IRS) satellites into Sun Synchronous Polar Orbits (SSPO). It has proven its worth in launching variety of satellites into SSPO. Further, it has demonstrated its capability for Geo-Transfer missions and used to launch small-medium sized payload satellites into elliptical Geostationary Transfer Orbit (GTO) and circular orbits with varying inclinations. PSLV has the capability to launch 1750 kg in SSPO at 500 km and 1425 kg in sub GTO mission (280 x 20650 km).

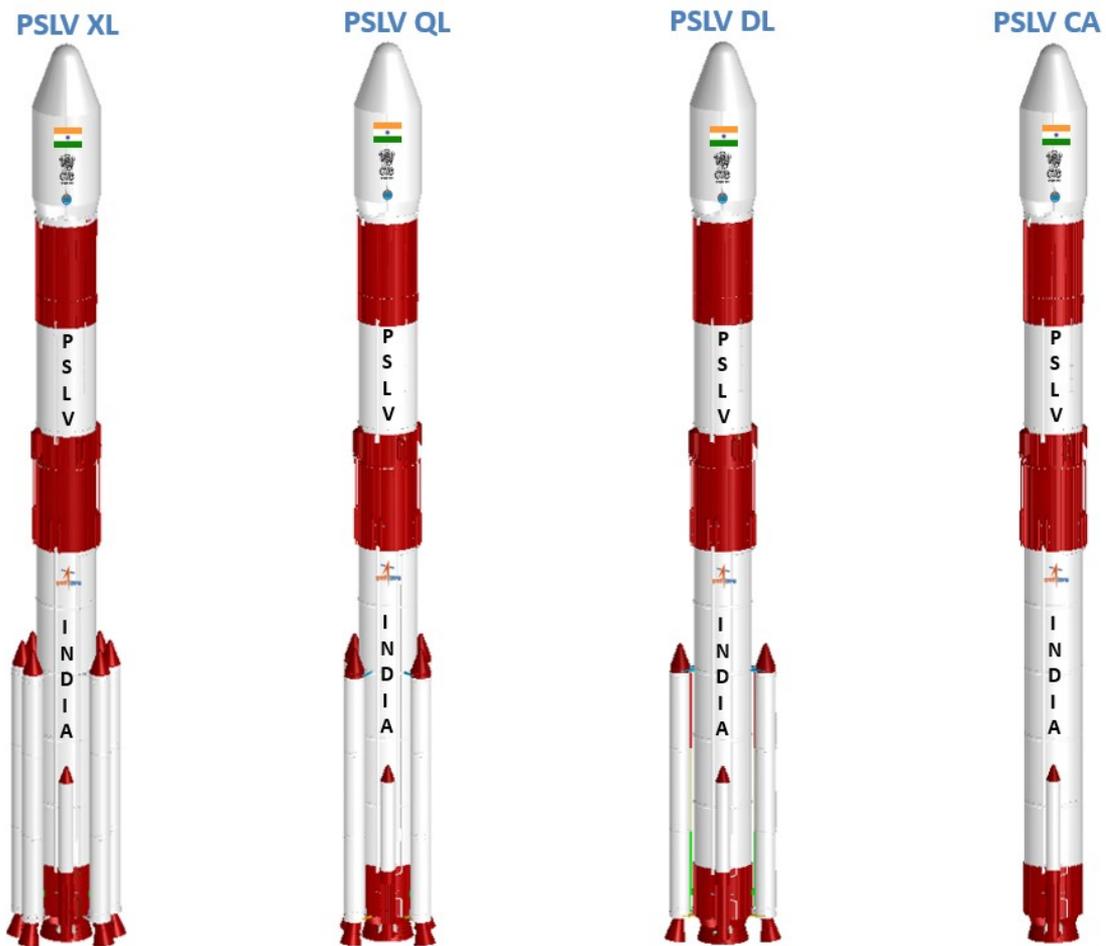
PSLV is a four stage vehicle with alternate solid and liquid propulsion modules. It stands 44 metres tall and weighs approximately 320 tones (XL variant). The first stage employs solid-fuel rocket booster (S 139) and none to six strap-on motors (depending on the variant). The second stage powered by Vikas engine uses Earth storable liquid propellants. The third stage uses solid propellant. The fourth stage has a twin engine configuration with liquid propellants. The Satellite or payload is mounted over a Payload Adaptor and is covered using Payload Fairing which protects the spacecraft and Vehicle Equipment Bay during the vehicle's ascent phase through the atmosphere.

With the repeated successful missions over the years PSLV has proven to be versatile and a reliable operational launch vehicle of ISRO. PSLV has a full-fledged end-to-end launch service management and has launched numerous foreign and Indian satellites including several dedicated commercial launches. PSLV today is one of the sought out vehicles to

launch a variety of satellites equipped to perform wide range of applications viz. communication, geographical survey, navigation, inter planetary missions etc. PSLV has successfully launched scientific missions involving Chandrayaan-1, Mangalyaan, Astrosat and the recent Aditya-L1, which demonstrated India's capability and placed the country among leading space faring nations of the world. PSLV has 4 basic configurations as indicated below, which is determined by the mission definition.

Versions of PSLV		
Designation	Variant	Description
PSLV - CA	<b>Core Alone</b>	Core vehicle without any strap-on boosters
PSLV-DL	<b>DL</b>	Core vehicle with two numbers of S12 strap-on boosters
PSLV-QL	<b>QL</b>	Core vehicle with four numbers of S12 strap-on boosters
PSLV - XL	<b>XL</b>	Core vehicle with six numbers of S12 strap-on boosters

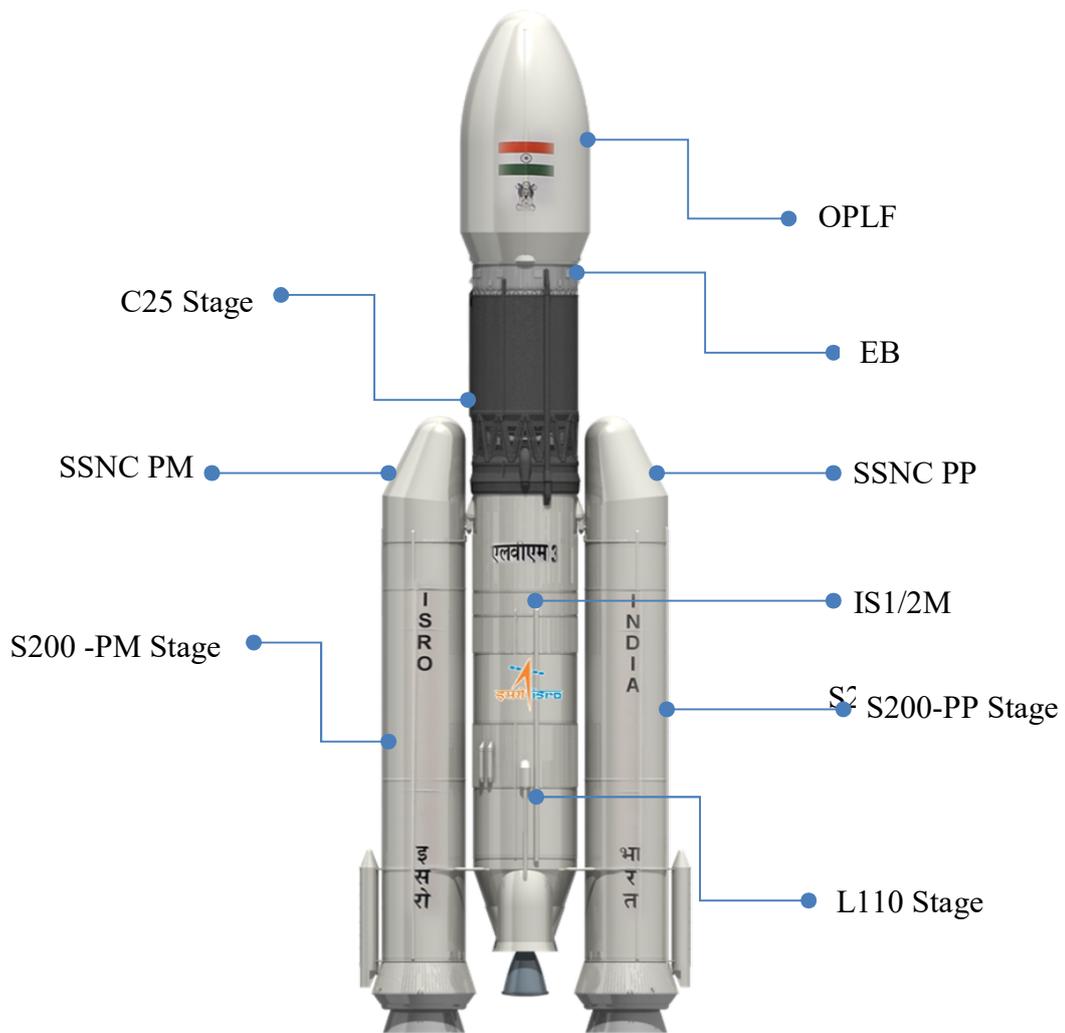
Currently PSLV has four operational variants as described below.



## **LVM3**

With the successful operationalization of PSLV and Geo-Synchronous Launch Vehicle (GSLV), ISRO got established as one of the most reliable, yet cost effective space systems providers to the nation, as well as to the international customers. Together with PSLV and GSLV, the requirements for communication spacecraft up to 2.2 tons in Geosynchronous Transfer Orbit (GTO) can be met with. The development of LVM3 was proposed as a logical next step in enhancing the payload capability to 4 tons and above, towards meeting our national requirements, for launching heavier satellites as well as to offer cost effective launch services to the international customers.

LVM3 is configured as a three stage vehicle with two solid strap-on motors (S200), one liquid core stage (L110) and a high thrust cryogenic upper stage (C25/C32). The S200 solid motor is among the largest solid boosters in the world with 204 tonnes of solid propellant. The liquid L110 stage uses a twin liquid engine configuration with 115 tonnes of liquid propellant, while the C25/C32 Cryogenic upper stage is configured with a fully indigenous high thrust cryogenic engine (CE20) with a propellant loading of 28 tons. The overall length of the vehicle is 43.5 m with a gross lift-off weight of 640 tonnes and a 5m-diameter payload fairing.



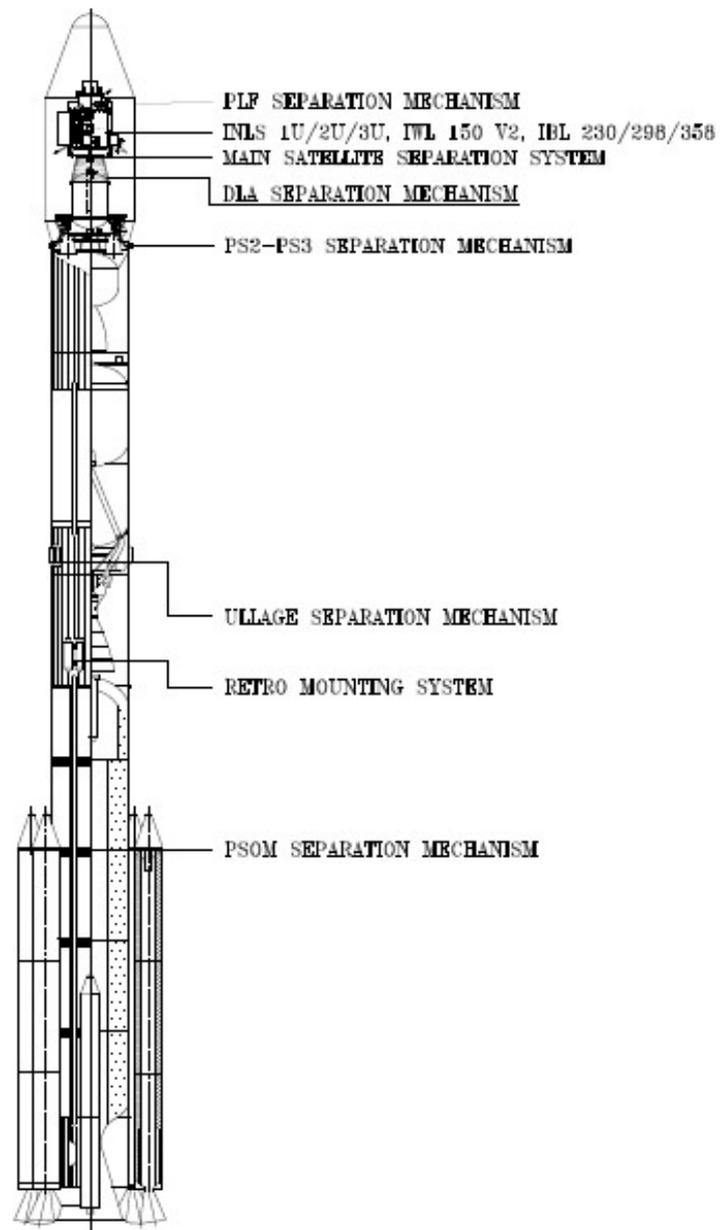
LVM3 Vehicle configuration

**Vehicle Specifications**

<i>Height</i>	: 43.5 m
<i>Vehicle Diameter</i>	: 4.0 m
<i>Payload Fairing Diameter</i>	: 5.0 m
<i>PLF Usable Volume</i>	: 110 m <sup>3</sup>
<i>Number of Stages</i>	: 3
<i>Lift Off Mass</i>	: 640 tonnes

### 2.1.1 Stage Separation Mechanisms of PSLV

The following are some of the major stage separation mechanisms of PSLV Launch Vehicle.



*Fig 1: PSLV XL configuration with stage separation mechanisms*

### 2.1.2 Stage Separation Mechanisms of LVM3

The following are some of the major stage separation mechanisms of LVM3 Launch Vehicle.

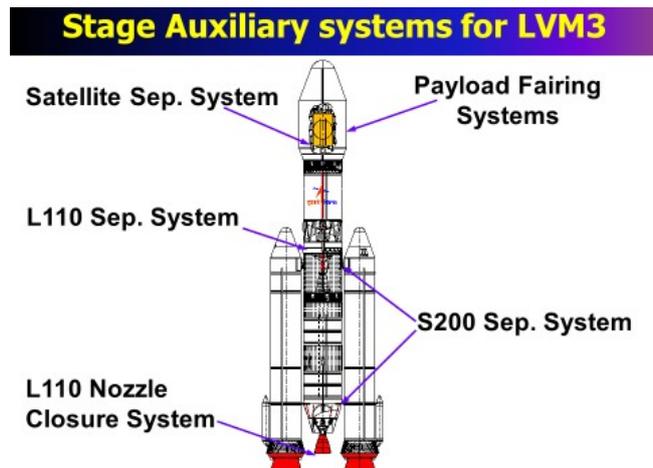


Fig 2: LVM3 configuration with stage separation mechanisms

### 2.2 Assembly & Flight Acceptance Testing of Stage Separation Mechanisms

The industry shall carry out all the activities involved in the preparation of separation mechanisms for flight at facilities inside VSSC, Trivandrum campus. The flight components, standard components, fasteners, consumables, fixtures, tools, UTM, DP testing facility & bearing test facility, work bench, metrological instruments, operation documents and assembly drawings will be provided by VSSC. VSSC will also provide the facilities for carrying out the flight acceptances testing (viz. load test, functional test, proof loading) of the component.

The industry is expected to deliver flight-ready mechanisms after performing all the required activities on the flight and standard components. All activities required for mechanism preparation, instrumentation of components and flight acceptance testing of PSLV & LVM3 stage separation mechanisms are to be carried out by the party using their assembly and testing team. All the facilities will be owned by the department and will be operated by the party. Required hierarchy of working force with required skill set (Manager-supervisor-operation in charge-technicians-helpers) must be maintained by the party.

### 3 Scope of Work

- Preparation & flight acceptance testing of PSLV Stage separation mechanisms to meet the requirement of 4-6 PSLV's per year, LVM3 stage separation mechanisms to meet the requirement of 2-3 launches per year and tenure of 3 years.
- Planning & execution of activities given by VSSC
- Mobilization and management of assembly/testing team
- Management and maintenance of facility provided by VSSC.

A typical flow of activities involved in realising a PSLV & LVM3 stage separation mechanism is described in the chart below. Operation documents, fabricated components, standard components such as, bearings, springs, wire rope, fasteners, etc will be supplied by VSSC.

Stage separation mechanisms to be delivered for PSLV flight are listed below.

S.No.	System to be delivered	Min. Qty / Year	Stand by Qty/Year	Max. Qty/Year
1	PSOM Separation mechanism	12	2	36
2	Ullage Rocket Mounting System	8	1	12
3	PS2 Separation Mechanism	4	1	6
4	PS3 Separation Mechanism	4	1	6
5	Main Satellite Separation Mechanism	3	1	4
6	Small Satellite Separation Mechanism (IWL/INLS 1U/2U/3U)	2 each	1 each	3 each
7	IBL 230/298/358 Separation System	2 each	1 each	3 each
8	Handling Band System preparation	10	1	12
9	DLA Separation System	0	1	1
10	PLF Separation Mechanism & sub system assembly	4	Nil	6

Stage separation mechanisms to be delivered for LVM3 flight are listed below.

S.No.	System to be delivered	Min. Qty / Year	Stand by Qty/Year	Max. Qty/Year
1	L110 Nozzle Closure System	4	1	6
2	S200 Separation System	4	1	6

3	L110 Separation System	2	0	4
4	Satellite Separation System with TRD assembly	2	1	4
5	Payload Cooling Umbilical System (common for both PSLV & LVM3)	6	1	9
6	OPLF Vent Valve assembly	44	2	66
7	OPLF Band Separation system with TRD	2	1	3
8	Poppet Valve for C25/C32 Stage	8	2	12

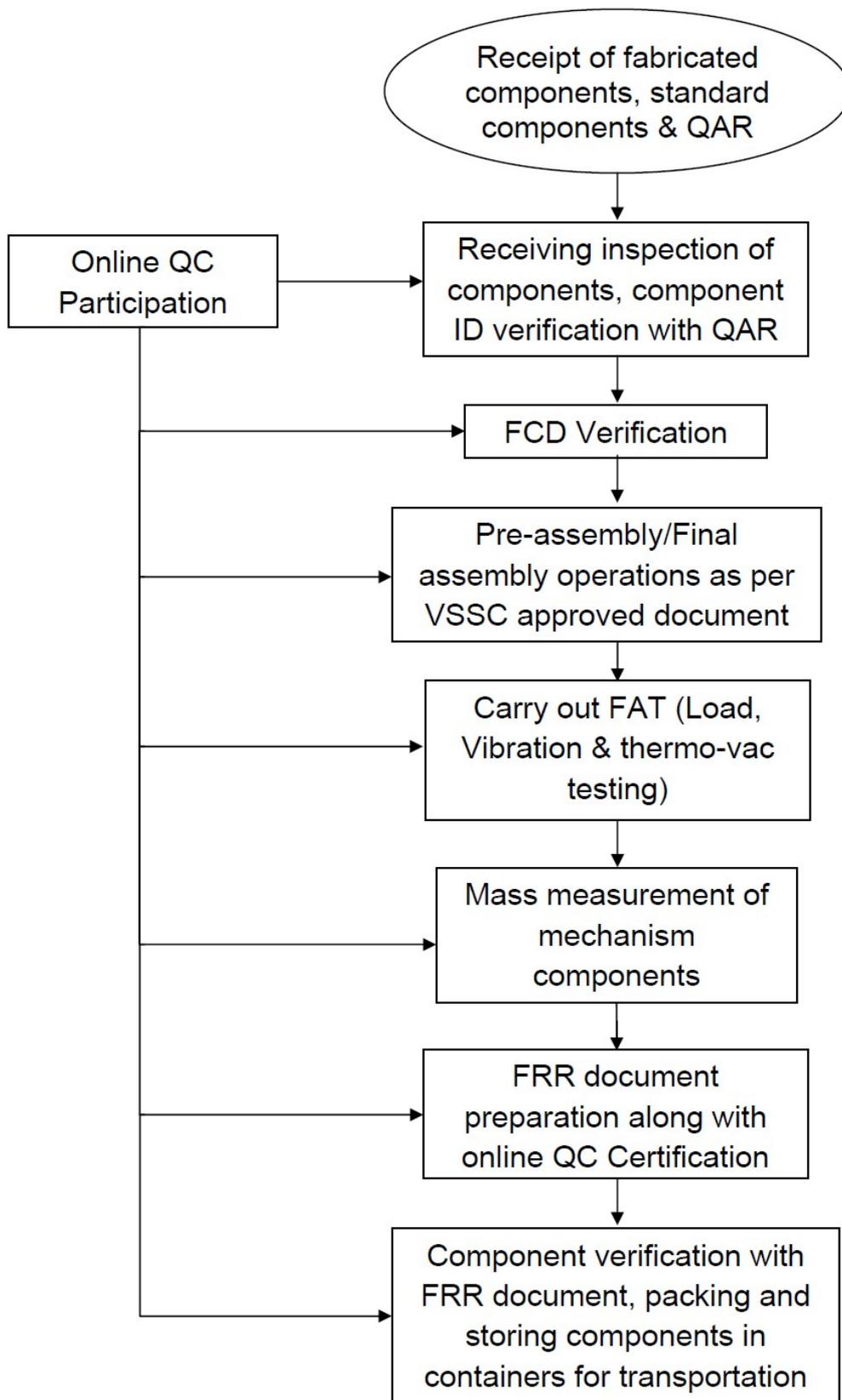


Fig 2: Flow of activities involved in realizing a PSLV & LVM3 stage separation

### 3.1 Mechanism Preparation Activities

Preparation activities for all stage separation mechanisms are given below.

#### 3.1.1 PSOM Separation Mechanism

S.No.	Activity
1.	Component identification, Receiving inspection and QAR verification for all components.
2.	Lapping and surface contact checking using Prussian blue of ball socket joint
3.	Lanyard assembly preparation, proof loading & failure load evaluation
4.	Band clamp assembly preparations and Stud proof loading
5.	Receiving and dimensional inspection of disc springs, Spring thrusters assembly preparations
6.	Monoball bearing radial proof loading, DP check, staking of monoball with rod end and axial proof loading
7.	Trial assembly with motor case hardware.
8.	System readiness document generation, clearance for flight integration and packing in container for despatch

Spring thruster assembly



**Fig 3.1: PSOM Separation Mechanism**



**Fig 3.2: Ball-socket Joint Lapping**



**Fig 3.3: Spring thruster assembly preparation**

#### 3.1.2 Retro & Ullage Rocket Mounting System

S.No.	Activity
1.	Hardware identification, Receiving inspection and QAR verification for all components.
2.	Trial suiting of all system components.
3.	Physical inspection of FCD during assembly
4.	Hole Drilling operation on lanyard brackets & insertion of heat shrinkable sleeve with end support in position.
5.	Ball Lock assembly, Spring thruster assembly & A-frame assembly operations
6.	Painting of RS-1 Nozzle caps, RS-2 Nozzle caps & Ullage PUF
7.	System readiness document generation, clearance for flight integration and

Retro motors



**Fig 3.4: Retro Mounting system**

Ullage motors



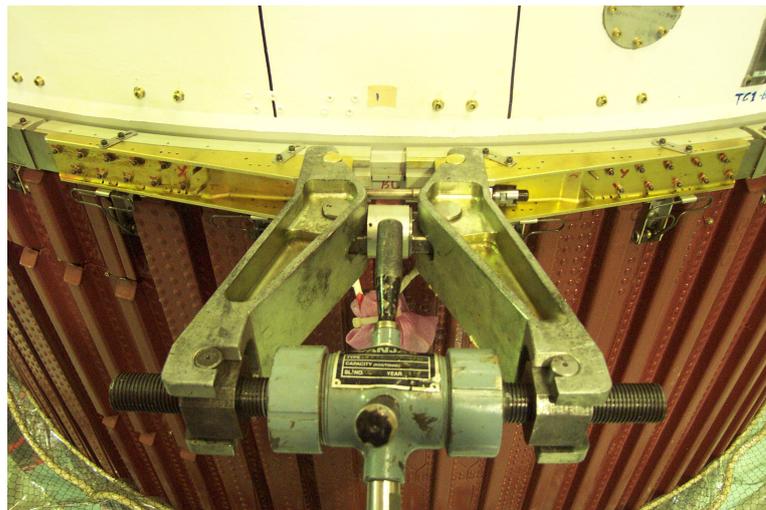
**Fig 3.5: Ullage separation mechanism**



**Fig 3.6: Ball lock assembly**

### 3.1.3 PS2 Separation Mechanism

S.No.	Activity
1.	Receipt of components, Component identification, Receiving inspection, QAR verification for all components.
2.	Surface preparation of band, thickness dimensional Inspection of band, Match Lapping Operations of spherical surfaces, Shear Screw fit verification with Band & Band end block, Sub-assembly preparation, hydraulic set up preparation and Band proof loading and DP
3.	Lanyard & cowling preparation
4.	Torsion spring sub assembly, Band sub assembly, Cowling sub assembly
5.	System readiness document generation, clearance for flight integration
6.	Identification of tools , fixtures and packing in container for despatch



**Fig 3.7: PS2 Separation Mechanism – Band Proof loading**

### 3.1.4 PS3 Separation Mechanism

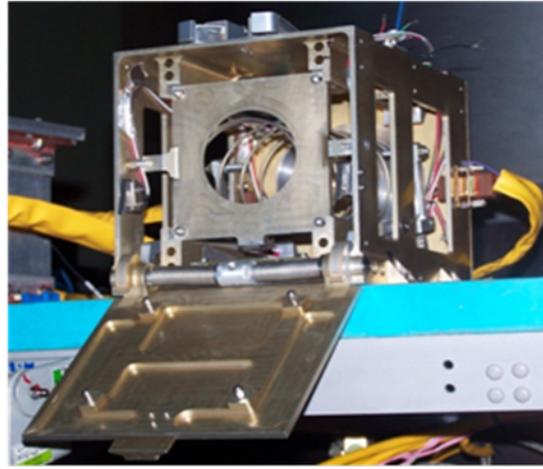
S.No.	Activity
1.	Receipt of component, Component identification, Receiving inspection, QAR verification for all components.
2.	PS3 separation ring & Retainer ring preparation , Ball lock joint acceptance testing with PB Ring
3.	Inner guide & outer guide suiting , hydraulic set up preparation
4.	Spring thruster sub assembly
5.	System readiness document generation, clearance for flight integration
6.	Identification of tools , fixtures and packing in container for despatch



**Fig 3.8: PS3 Separation Mechanism**

### 3.1.5 INLS 1U, 2U & 3U Separation Mechanism

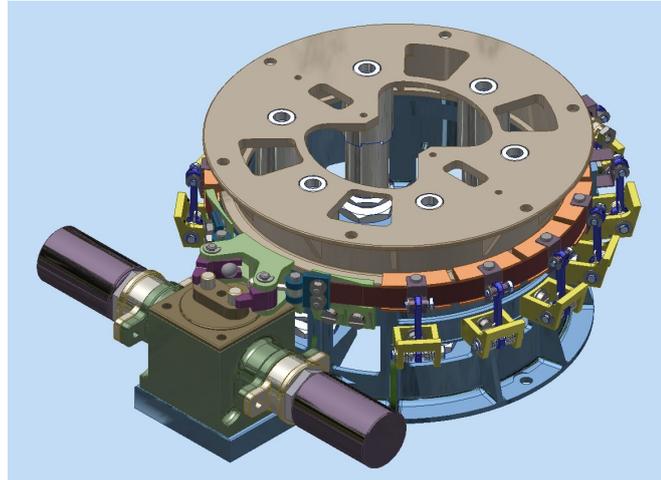
S.No.	Activity
1.	Receipt of component, Component identification, Receiving inspection, QAR verification for all components.
2.	Verification of assembly critical parameters
3.	Trial assembly of Satellite Box, release mechanism preparation , nylon rope preparation
4.	System assembly for acceptance testing , vibration & thermo-vac tests , release test
5.	Packing and Dispatch of components for match mate checks
6.	System readiness document generation, clearance for flight integration
7.	Identification of tools , fixtures and packing in container for despatch



**Fig 3.9: INLS 1U/2U/3U Separation Mechanism**

### 3.1.6 IWL 150 V2 Separation Mechanism

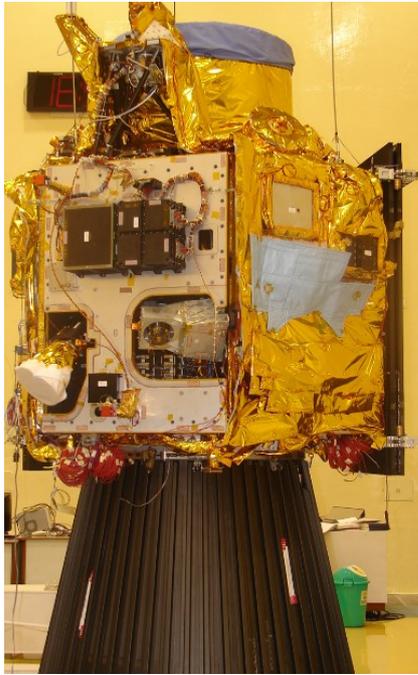
S.No.	Activity
1.	Receipt of component and fasteners from store, Component identification, Receiving inspection, QAR verification for all components.
2.	Acceptance tests of Solenoid pin puller (device level and release unit level) includes electrical characterization, force characterisation and pull-in voltage measurement
3.	Preparation of wire rope assembly, proof loading and failure evaluation tests.
4.	Proof loading of band and other connecting components, manual release check and DP testing.
5.	Trial suiting of components (Rings, Micro switches assy. Wedge link assy. Band assy., spring thrusters, Release system components)
6.	Assembly of system and test set up preparation for functional flight acceptance tests.
7.	System assembly for vibration and thermos vac acceptance tests.
8.	Final assembly of the system for flight.
9.	Assembly of system for match mate activities at VSSC.
10.	System readiness document generation, clearance for flight integration and packing in container for despatch.



**Fig 3.10: IWL 150 V2 separation mechanism**

### 3.1.7 Main Satellite Separation Mechanism

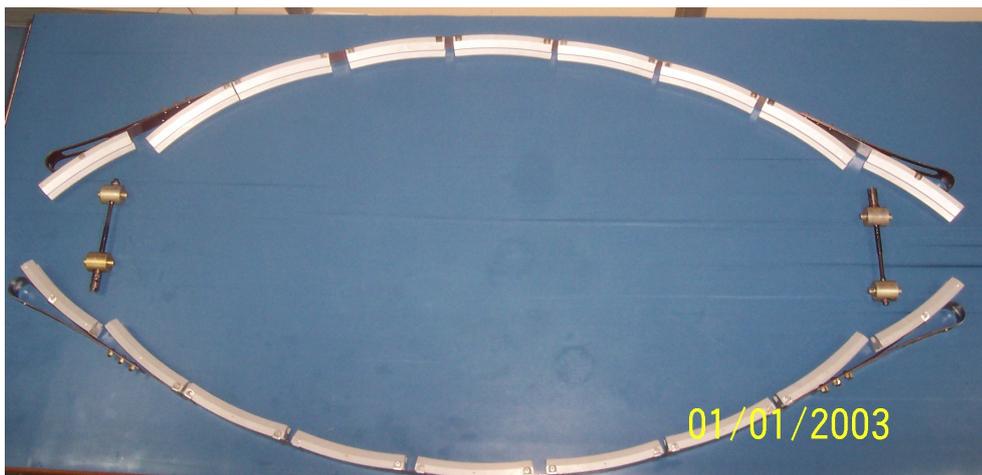
S.No.	Activity
1.	Receipt of component, Component identification, Receiving inspection, QAR verification for all components.
2.	Surface preparation of band, thickness dimensional Inspection of band, Match Lapping Operations of spherical surfaces, Shear Screw fit verification with Band, Sub-assembly preparation, proof loading and DP
3.	Spring thruster assembly and energy evaluation
4.	Packing and Dispatch of components for match mate checks at URSC Bangalore
5.	Receipt of items from URSC Bangalore after match checks and Receiving inspection of components
6.	System readiness document generation, clearance for flight integration and packing in container for despatch



**Fig 3.12: Main satellite Separation mechanism**

### 3.1.8 Handling Band System preparation

S.No.	Activity
1.	Receipt of component, Component identification, Receiving inspection, QAR verification for all components.
2.	Surface preparation of band, thickness dimensional Inspection of band, Match Lapping Operations of spherical surfaces, Shear Screw fit verification with Band, Sub-assembly preparation
3.	Proof loading of band system for vibration test, handling & thermo-vac test followed by DP check
4.	Packing and despatch of band clamp system



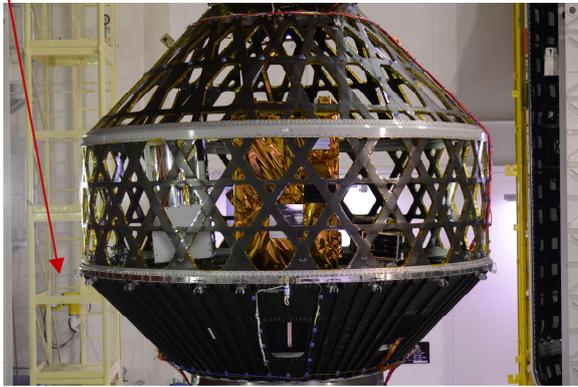
**Fig 3.13: Handling Band System**

### 3.1.9 Dual Launch Adaptor (DLA-U) Separation Mechanism

S.No.	Activity
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1.	Component identification, Receiving inspection and QAR verification for all components.
2.	Helical and Torsion Spring thruster Assembly preparation. Helicoil insert fitting.
3.	Band system preparation and acceptance testing- suiting with shear pin, proof loading of band and DP testing
4.	System readiness document generation, clearance for flight integration and packing in container for despatch

Band System



**Fig 3.14: DLA Separation Mechanism**



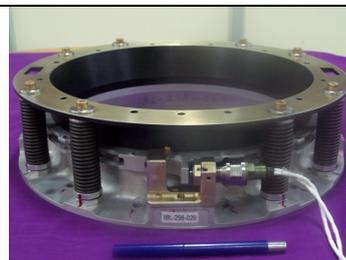
**Fig 3.15: Spring Thruster Canister**

### 3.1.10 IBL 230/298/358 Separation Mechanism

S.No.	Activity
1.	Component identification, Receiving inspection and QAR verification for all components.
2.	Spring thruster Assembly preparation- Spring thruster components preparation.
3.	Hydraulic Locking and release tests of mechanism till required specification is meet
4.	Disassembly of system, Re-assembly for acceptance test- Hydraulic Locking and release tests of mechanism
5.	Final locking of the mechanism, Packing & despatch of system with tools, fasteners for resonance survey
6.	System readiness document generation, clearance for flight integration and packing of system, tools & fasteners in container for despatch to SHAR



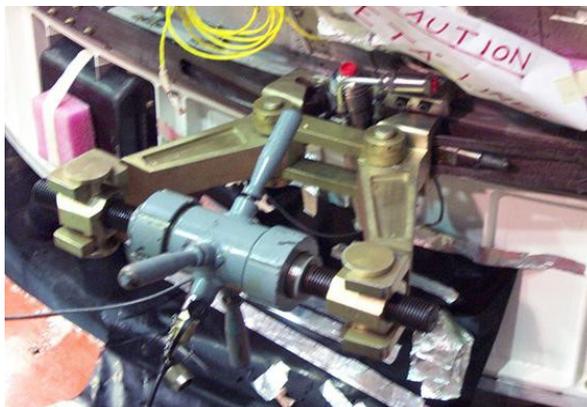
**Fig3.16: IBL 230 Separation mechanism**



**Fig 3.17: IBL 298 Separation mechanism**

### 3.1.11 PLF Separation Mechanism and sub system assembly

SL No.	Activity
1	Band System Acceptance Test - Includes match lapping, band proof loading and final NDT(DP) of the band components.
2	Proof Loading of Band Fixture and Jacks- Includes periodical proof loading of band fixture and jack and final NDT of the components
3	Band Preservation and periodic Maintenance - Includes all protocols taken for band storage and periodic maintenance required
4	Pre-Assembly Operations on Payload Fairing includes generation of necessary interfaces on PLF for APS, Debris free disassembly scheme, PCA transportation, Nose cone thermal insulation scheme, internal shielding sheet scheme.
5	Piston Cylinder Assembly Operations on PLF- includes transportation operations involved in movement of PCA of the PLF for charging
6	Vertical Trial Assembly Operations -includes vertical trial suiting of all PLF components and generation of suitable interfaces for final assembly at launch pad
7	Clean room Operations - includes assembly of APS blankets, debris free disassembly scheme, vent port bonding, Nose cone FE seal bonding and if required nose cone thermal insulation scheme/internal shielding sheet scheme.
8	Document preparation for system readiness review
9	Packing & dispatch to SHAR



**Fig.3.20 Band Assembly activity**



**Fig.3.21 Vertical Trial Suiting**

### 3.1.12 S200 Separation System

S. No.	Activity
1	Component identification, physical verification, cross-verification with QAR
2	Generation of flight & standby component list
3	Tensile testing of heat treated specimens (Bolt Housing & Link Body-I specimens)
4	Visual inspection of Bolt Housing and Link Body-I, II & III
5	Trial suiting of system components.
6	Blue match checks of match lapped spherical washers and spherical seatings for surface contact checks.
7	Mass measurement of components and assemblies
8	Minor Reworks on components like filing, hole drilling, tapping , turning etc.
9	Co-ordination with QA/QC agencies for final clearance after sub-system preparation & acceptance testing
10	Hydraulic Jack assembly and proof loading at UTM
	<b>Acceptance testing of Rod end bearings and Thrust bearings</b>
11	Axial Proof loading of monoball bearing
12	Acceptance testing of Thrust bearings at Bearing Test Rig
	<b>Forward Bolt and Aft link strain gauge calibration</b>
13	Bolt/Link setup assembly with fixtures
14	Load Testing at UTM
15	Bolt/Link setup disassembly
	<b>Batch acceptance of Pyro elements</b>
16	Pyrobolt/Link Assembly with functional test fixture
17	Test Preparations for unit level functional test
18	Functional test
	<b>Packing and despatch to SHAR/TERLS</b>
19	Re-verification of components, identification of tools, packing and despatch
20	Verification of Link assembly components, packing in fibre box and despatch
	<b>Documentation &amp; record keeping</b>
21	System readiness document preparation
22	System hardware inventory recordkeeping, receipt of hardware from Supplier, periodic inspection, storage & preservation.



**Fig.3.22 Photograph of thrust bearing pair**



**Fig. 3.23 Bearing test rig setup**

### 3.1.13 L110 Separation System

Sl. No.	Activity
1	System hardware inventory recordkeeping, receipt of hardware from Supplier, inspection, storage & preservation.
2	L110 separation system active unit preparation/acceptance test
3	L110 separation system passive unit preparation
4	System readiness document preparation after acceptance test for 12 active unit and 12 Nos. of passive unit.
5	Packing of active unit and passive unit in identified boxes and dispatch request to store for movement of hardware



**Fig. 3.24 Assembly of active & passive units of L110 Separation system**

### 3.1.14 L110 Nozzle Closure System(NCS)

Sl. No.	Activity
1	System hardware inventory recordkeeping, receipt of hardware from Supplier, inspection, storage & preservation.
2	Batch qualification of wire rope, oval sleeve/ ball shank terminal.
3	Dimension inspection and stiffness calibration of the torsion spring and preparation of non-conformance report if any for the same
4	Preparation of trial suiting hardware with L110 Nozzle
5	Wire rope proof load test as per VSSC approved procedure document
6	L110 nozzle closure system acceptance testing as per approved procedure document
7	Rain proofing cover stitching as per drawing
8	Packing of acceptance tested hardware
9	System readiness document preparation after acceptance test



**Fig.3.25 Nozzle closure system assembly with L110 Nozzle**

### 3.1.15 Payload Cooling Umbilical System for PSLV & LVM3

1.	Inspection of fabricated hardware & Brought Out Items
2.	Flight System Assembly at VSSC Valiyamala
	1. Ground half assembly
	2. Vehicle half assembly
	3. Compensator assembly
3.	Flight System Acceptance test (at VSSC Valiyamala)(5 ACCEPTANCE TESTS)
	1. Wire Rope Crimping
	2. Proof Loading of Release cable and Retention Cable Assembly
	3. Test set up preparation for Cooling Hose Pressure Test
	4. Cooling Hose Pressure Test
	5. Shutter Closure Trials.
4.	Cooling Hose Preparation and testing (at VSSC Valiyamala)
5.	Document preparation & Drawing generation/ updation
6.	Packing & dispatch to SHAR



**Figure 3.26: PCU COOLING HOSE PRESSURE TEST**



**Figure 3.27: PCU MECHANISM**

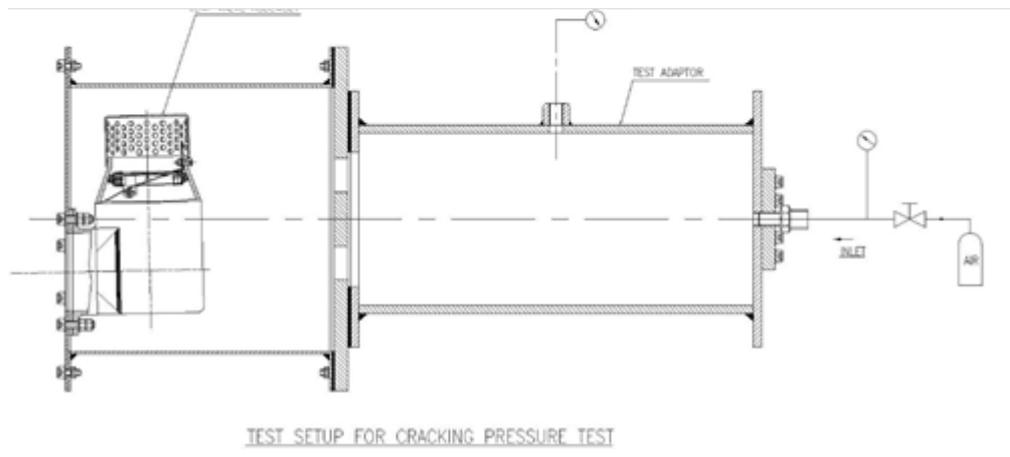
### **3.1.16 OPLF Vent Valve assembly**

#### **S.NO. ACTIVITY**

1. Receipt of components, Component identification, Receiving inspection, QAR verification for all components.
2. Bonding of valve disc & valve seal with VCA adhesive.
3. Vent Valve assembly as per procedure document.
4. Test Set Up Preparation.
5. Acceptance Testing of vent valve
6. Bonding of mesh & its wire locking.
7. Packing of vent valves before dispatch.
8. System readiness document generation, clearance for flight integration.



Figure 1 VENT VALVE ASSEMBLY

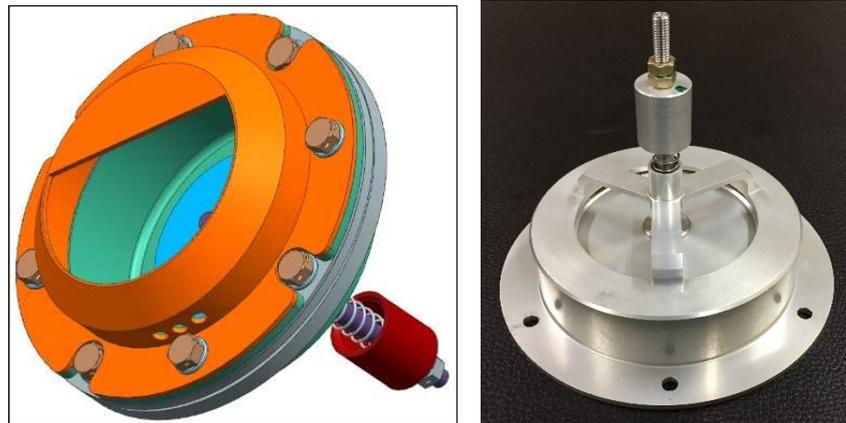


**Fig.3.29 OPLF Vent valve assembly**

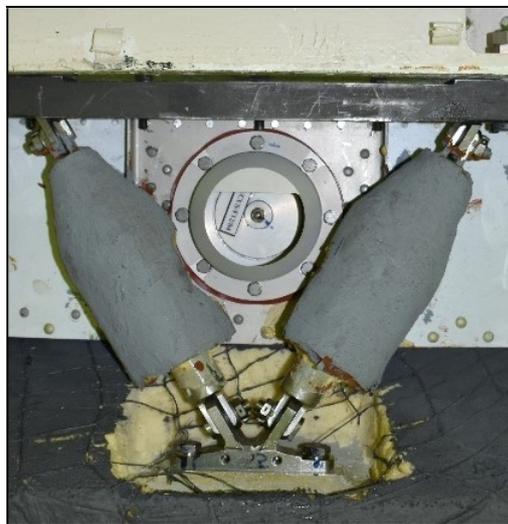
### 3.1.17 Poppet Valve for C25/C32 Stage

#### Activity

- 1.Raw Material Supply for fabrication
- 2.Receipt of fabricated hardware, component identification, physical verification, cross-verification with QAR, storage
- 3.Receipt of Bought Out Items, inspection & preservation
- 4.Flight System Assembly -Silicon Rubber Face Seal bonding to valve body, Poppet Valve assembly
5. Acceptance Testing - Test Set-Up Preparation & Cracking pressure test
6. System readiness Document generation, clearance for flight integration and packing for despatch



**Fig.3.30 CUS/C25/C32 STAGE POPPET VALVE ASSEMBLY**



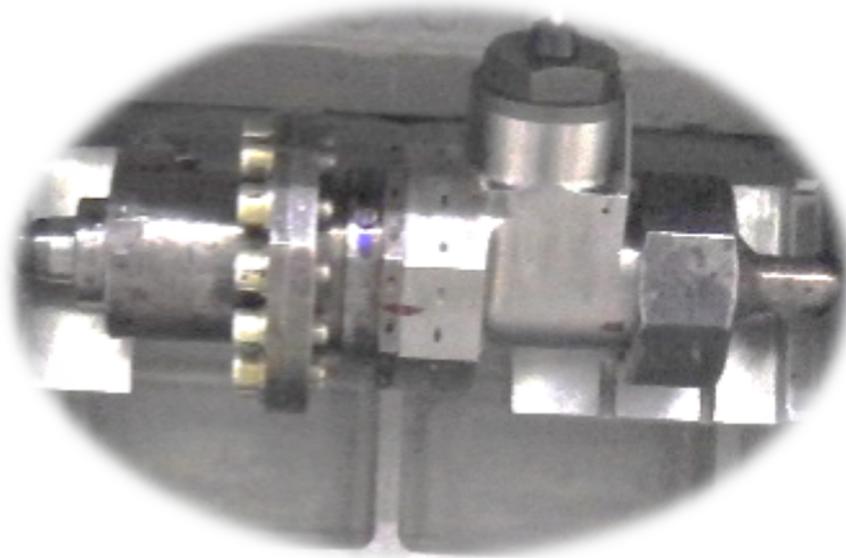
**Fig.3.31 POPPET VALVE ASSEMBLY TO STRUCTURE**

### **3.1.18 OPLF Band System with TRD assembly**

#### **S.NO. ACTIVITY**

1. Receipt of components, Component identification, Receiving inspection, QAR verification for all components.
2. DP of all the metallic components and preparation for RT of piston Rod
3. Split Collet suiting with piston rod
4. Gauging of components and their clearance
5. Trial suiting with pyro elements
6. Assembly of TRD by filling the damping fluid

7. Supply of assembled TRDs for acceptance testing
8. Disassembly of TRDs after acceptance testing
9. Gauging of all the TRD components after proof loading
10. DP of all the metallic components.
11. Assembly of TRD by filling the damping fluid
12. Assembly of flight identified TRD with Pyro elements
13. System readiness document generation, clearance for flight integration.



**Fig.3.32 TRD assembly**

### **Acceptance Testing of OPLF Band System**

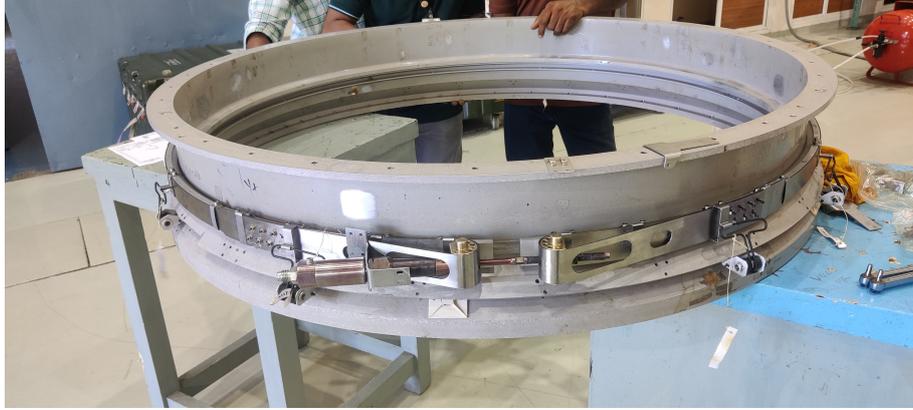
<b>S.NO.</b>	<b>ACTIVITY</b>
	<b>Preparation of hardware</b>
1	Component identification, physical verification, cross-verification with QAR
2	Generation of flight & standby component list
3	Movement of band system components to test bay
4	Surface preparation(buffing) of band, visual inspection and coordination with QC
5	Band Thickness mapping
6	Movement of band to test bay and DP test of band before proof loading
7	Cleaning and DP of Connecting Bolts, Rollers, Spherical Washers, Special Nuts and Special Lock Nuts and report generation
8	Match lapping of band system components and blue check
9	Round head pin assembly with band
	<b>Test Setup readiness</b>

1	Movement of fixtures, tools and hydraulic pumps to test bay
2	Test setup arrangement and band components assy with test rig
3	Acceptance testing of band
	<b>TRD Release test</b>
1	Readiness of Hydraulic System for TRD Release
2	Hydraulic Release test of TRD (Data acquisition and pressure sensor calibration shall be supported by the Dept.)
3	Disassembly of band system and disassembly of RH Pins
	<b>Post Test activities</b>
1	Movement of band to test bay and DP test of band before proof loading and report generation
2	Cleaning and DP of Connecting Bolts, Rollers, Spherical Washers, Special Nuts and Special Lock Nuts and report generation
3	Cleaning and DP of RH Pins and report generation
4	Packing and despatch and collection of Bands to and from Radiography
5	Band final assembly and packing for SHAR after taking necessary precaution for M250 components
6	<b>Documentation work</b>
	<b>Proof Loading of Band Fixture and Jacks (Once every year)-4 nos</b>
1	Components identification and physical verification
2	Packing and despatch for De-cadmium plating of components .
3	Preparation of proof loading setup and proof loading of components
4	Disassembly of components and transportation to NDT
5	Coordination with NDT for clearance
6	Packing and despatch for Cadmium plating of components
7	Assembly of the components and readiness of fixture

### 3.1.19 Satellite Separation System with TRD assembly

S.No.	Activity
1.	Receipt of component, Component identification, Receiving inspection, QAR verification for all components.
2.	Surface preparation of band, thickness dimensional Inspection of band, Match Lapping Operations of spherical surfaces, Shear Screw fit verification with Band, Sub-assembly preparation, proof loading and DP
3.	Packing and Dispatch of components for match mate checks at URSC Bangalore

4.	Receipt of items from URSC Bangalore after match checks and Receiving inspection of components
5.	Assy of band system with TRD and hydraulic release tests
6.	Evaluation of the hardware and re assembly of the system for flight
7.	System readiness document generation, clearance for flight integration and packing in container for despatch



**Fig.3.33 LVM3 Satellite separation system**

### 3.1.20 Instrumentation and Electrical checks

Load cell preparation for all above mentioned stage separation mechanisms and heat shield separation mechanisms are given in the table below

S.No.	Activity
1.	Surface preparation
2.	Strain gauge preparation and positioning
3	Strain gauge bonding with AE 15 bond
4.	Curing & postcuring
5.	Terminal preparation and bonding with M bond 200
6.	Tape removal
7.	Bridge inter connection
8.	Lead wire preparation and extension
9	Anchoring
10	Protective coating, M coat A & C and curing
11	Quality inspection
12	Health checks
13	Preparation for drift study
14	Drift study 48 hrs/Data logging
15	Calibration
16	Preparation of Calibration certificate
17	Support for all flight acceptance tests.
18	System readiness document preparation
19	Post flight data analysis and documentation

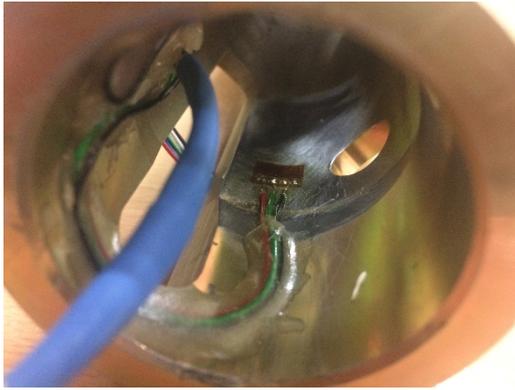


Fig 3.34: Strapon Inner guide load cell

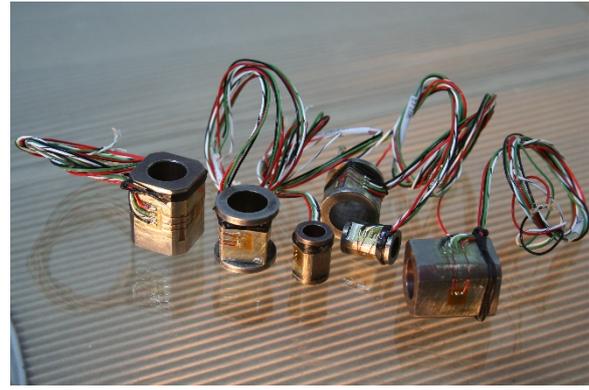


Fig 3.35: Load washers for various mechanisms

20	Realization of SS wire rope
21	Mounting and harnessing micro switches – prime and redundant
22	Realization of instrumentation set up for solenoid pin puller characterization
23	Solenoid pin puller acceptance tests
24	Acceptance test data analysis, plotting, documentation
25	Harnessing on hardware
26	Supporting trial suiting and assembly
27	Realization of instrumentation set up
28	Measurement plan, T & E Document
29	T & E for test
30	SRC test Preparation at article side
31	SRC test, data analysis, data acquisition & documentation
32	Posttest activities
33	Support for match mate checks
34	Support for vibration & thermos vacuum tests
35	Realization SS wire heater coil – prime and redundant
36	Coordinating PCM for magnet bonding with pusher plates
37	Realization nichrome fusing coil – prime and redundant

### 3.2 Operation Documents

Documents (Configuration Controlled [CC released]) will be supplied for each mechanisms preparation which contains the details of all the mechanical & instrumentation activities. Operational Log books are also provided for carrying out mechanical and instrumentation activities, where all details of personnel's like operators, QC inspectors,

supervisors, engineers etc. are entered. All operations carried out are to be recorded in real time, and it provides the details of components used for the activity, any observations/reworks. This documentation provides easy traceability of the flight preparation activities.

## 4 Responsibilities

Responsibilities of industry and VSSC in preparation of mechanisms for flight are described in this section.

### 4.1 Responsibilities of Industry

The industry is expected to carry out the following

1. To deploy assembly and testing team at VSSC for carrying out the above-said works.
2. Party shall appoint a Head/Manager who will lead the team and carry out the work through assembly and testing team. Head/Manager shall serve as interface for communicating the decisions from VSSC to the working team
3. Assembly, fitting works, testing, instrumentation, electrical checks, inspection of functionally critical dimensions and delivery of flight integration ready mechanisms of PSLV & LVM3 from the supplied component using the facilities at the premises of VSSC. Party's team shall have skills in terms of the functional requirements of Assembly, Testing (includes DP testing), Dimensional Inspection, Instrumentation, Electrical checks and Documentation.
4. The activities are executed at three campuses of VSSC, Thiruvananthapuram viz Valiamala/MVIT and TERLS campuses. The Supervisor shall deploy the required working teams depending on the activities planned at various campuses in consultation with VSSC focal point.
5. The assembly and testing team should consist of quality control engineers and technical assistants in the assembly and testing team for carrying out the above-mentioned activities in VSSC facilities. Team's **Quality Control Department (Mechanical & Electrical)** shall be responsible for online inspection of mechanical, instrumentation and electrical activities, stage level clearance and final clearance of the mechanism for flight.
6. Party shall strictly adhere to the process and quality control procedures proposed by VSSC. All activities are to be supervised and certified by the party's quality control department in the facility. Technical observations like rework, deviations from normal observations/process, rejections etc during the progress of job shall be recorded in a logbook meant for each mechanism. Specific observations about the assembly, testing, instrumentation and electrical checks shall be recorded in the above logbook. Such observations are to be highlighted to VSSC committees for approval.
7. Party's quality control department shall participate in the inspection of assembly critical parameters and report shall be prepared in the specified format and submitted to VSSC for verification.
8. In addition to assembly critical parameter inspection, the team shall carry out inspection of critical dimensions as and when demanded by VSSC.

9. Non-conformance, if any observed during assembly, inspection, instrumentation and testing activities shall be highlighted through a snag sheet to the department for disposition. Team shall support all instrumentation and electrical activities for bonding of strain gauge, acceptance of solenoid pin pullers and other instrumentation items.
10. Party shall support all mechanical, instrumentation and electrical requirements during flight acceptance testing like proof loading, bearing acceptance test etc. Team shall operate and maintain (Preventive Maintenance activities) drilling machines, hydraulic loading equipment's, DP test facilities and other equipment's given in the facility for carrying out the flight component assembly.
11. Scheduling & day to day planning of the activities for mechanism preparation & testing as per the VSSC requirements. In case of exigencies of work, the party's team shall be ready to work beyond office hours and on holidays to meet the VSSC requirements.
12. The team shall maintain proper records for all the issued manufactured parts and bought out items along with the usage details, which will be periodically verified by VSSC
13. Day to Day management of the facility & maintenance.
14. Industry shall responsible for day to day cleaning of the shop floor, rest rooms and surrounding areas adjacent to the facility
15. Tool crib & stores operation: All the tools, components, consumables, etc must be stored and issued as per standard stores operational procedures with proper logging of distribution & consumption data. Separate stores must be in operation for mechanical & instrumentation items.
16. Calibration and Maintenance of tools, fixtures, tackles, support structures, equipments, etc. Periodic Proof loading of all ground and flight assembly fixtures to be done (once in a year).
17. Team shall co-ordinate with VSSC to get equipment's calibrated and ensure that equipment's and tools are in operable condition throughout the year.
18. KELTRON is an VSSC approved soldering school. All technicians and QC supervisors of team involved in the soldering operation (required for section 3.1.20) have to undergo mandatory training at KELTRON Soldering school and qualify themselves. The cost of which if any has to be borne by the party.

#### **4.2 Responsibilities of VSSC**

1. To impart necessary training for carrying out the above-said activities for two PSLV & two LVM3 flights. Thereafter the party shall be entirely responsible for delivering the flight integration ready mechanisms for the remaining PSLV & LVM3 flights.
2. To provide dedicated facility (One at Valiamala campus & another at TERLS Campus) for carrying out the mechanical fitting works and assembly, instrumentation, electrical checks & FAT. All other facilities will be on sharing basis.

3. To maintain Annual Maintenance Contract (AMC) for calibration of tools and equipment's with external agencies. Necessary payments for calibration AMC shall be done by VSSC.
4. To supply flight and standby components (Mechanical & instrumentation).
5. To supply fasteners, standard components, flight consumables for each and every flight.
6. To supply Work benches, support fixtures, platforms, tools, inspection tools, Containers
7. To provide documents for mechanisms preparation and instrumentation activities.
8. Quality assurance of flight mechanisms being delivered.
9. Participation of experts during flight acceptance testing (wherever criticality exists) and review at site
10. To provide UTM, BTR, vibration, thermo vacuum and DP testing facility support.

## **5 Insurance & Safety**

Party's Team is responsible for the safety of the facility including the flight components/equipment, safety of the man power in the dedicated facility. The party shall ensure proper insurance coverage for the working team personnel in line with the statutory requirements.

## **6 Payment terms**

- Payments will be made against activity carried out for a particular system. For each system, levels of payment stages will be given in the RFP.
- Industry should submit the necessary clearance papers and stage clearances to confirm that all required activities are completed without any deviations/non-conformances.
- Invoices submitted by the Industry, after completing the activities in the stages identified for payment, shall be cleared by a Joint Review Board constituted by Department.

## **7 Requirements from Industry for Expression of Interest**

**Party should be at least fabricator of aerospace components.** The interested party shall submit the following details to VSSC for evaluation of EOI:

1. Profile and Engineering skills of the company. Company registered under company act only will be considered.
2. Staff strength with relevant skill set in fabrication/assembly and testing of mechanisms.

3. **Willingness to deploy assembly and testing team at VSSC for a minimum period of 3 Years.**
4. Copies of purchase orders to substantiate the expertise and experience in aerospace field for the last two years. Client details handled by the party shall also be furnished.
5. ISO certification details if available.
6. Copy of IT returns for the last three years
7. Certified copies from Chartered Accountant for Annual financial turnover and balance sheet showing profit/loss to be furnished for the last three years

**Note: The party shall not sub contract the works related to Assembly & Testing**

## **8 Submission and evaluation of EoI**

- Mode of submission of EoI: Vendor shall furnish their interest in participating in this bid in their own letterhead with details of Contact person(s). **No mention of price shall be given in the EoI.** Vendor shall furnish the EoI in the following format
- **Part A:** A covering note, expressing the interest to participate in the bid. This is to be prepared on company's letter head and signed by the authorized signatory.
- **Part B:** Declaration on the understanding by the vendor about the work as per the details given including, plan of activities, plan of manpower identification and deployment, mechanical assembly, electrical testing, and handling of assemblies.
- **Part C:** Documentary evidences towards fulfilling the eligibility criteria as given in above sections
- **Part D:** Filling up the check-list given as Annexure-1

## **9 Basis of Short listing**

Short listing of parties, responding to EOI, will be done on the basis of several factors which include

- Experience in similar activities in defence and aerospace areas where End to End implementation of sub-assembly preparation & testing including mechanical, electrical testing activities
- Staff strength with necessary skill set & experience. Permanent Staff strength with relevant skill set of at least 100 nos. with technical qualification background is required.
- Profile of the company- companies registered under Indian company Act1956 only will be considered. The company should have been in existence for a minimum period of five years prior to the date of quotation.
- Financial standing with an annual turnover of Rs 15 crores minimum and having net profit for the last three years.
- Purchase Orders executed for a minimum cumulative value of Rs 2 crores for similar nature of work in the last five years.

- If required, an audit of the industry will be carried out by VSSC team prior to finalisation.

## **10 Secrecy and Confidentiality Clauses**

- The vendor and all their personnel shall abide by INDIAN OFFICIAL SECRETS ACT 1923 invogue and shall provide information of awareness of the above in writing.
- The vendor shall ensure appropriate protection of Intellectual Property Rights involved in the work, consistent with VSSC policy.
- Details of any document, whatsoever, submitted to vendor by VSSC shall not be disclosed to any third party.
- All information and documents exchanged pursuant to the contract should be kept confidential by the vendor. The vendor shall not use the information for purposes other than that specified.
- All confidential information provided by VSSC shall remain as exclusive property of VSSC. The vendor shall agree this contract and the disclosure of the confidential information do not grant or imply any license, interest or right to the vendor in respect to any intellectual property.
- The vendor shall not sub-license, assign or sub-assign partly or fully the activities, rights, obligations, permissions, etc. received from VSSC in the contract to third parties, under any circumstances

## **11 Mode of Tendering & Final selection**

- Invitation of Expression of Interest from industry. Party shall submit to VSSC the details asked in Section 8.
  - Industries responding to EOI will be shortlisted based on the above factors (Described in Section 8). If required, an audit of the industry will be carried out by VSSC Team before shortlisting the party. Shortlisted parties will be issued a Request for proposal (RFP) document.
  - RFP document is made in two parts- Technical & Commercial. Technical part gives the details of all assembly related activities which will help the shortlisted parties to get a very good understanding about the work content expected of them. Commercial part addresses the general commercial terms, schedule, format for quote, payment terms etc.
  - Pre-bid meeting with the party will be conducted at VSSC after RFP document is issued to party.
  - Party shall get doubts on technical and commercial terms clarified during the pre-bid meeting.
  - After the pre-bid discussions, party shall submit a quote for carrying out the above said works (Section 3) for a period of three years.
- .....

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**12.Disclaimer**

This call for EoI shall not be treated as a firm commitment or contract from VSSC/ISRO with any of the participating vendors.

## Annexure - 1

Checklist for the supporting documents (Filled checklist to be submitted by the Vendor along with the Expression of Interest)

#	Document / Proof	Attached / Not with EoI	Remarks
1.	Company registration details		
2.	Proof for experience of the vendor in the area of aerospace harness fabrication, testing, mechanical assembly etc.		
3.	Certified copies from Chartered accountant for balance sheet showing profit/loss for the last 3 years		
4.	Income tax statements for the last 3years		
5.	Company profile, financial standing and line of business		
6.	Certified copies of the annual reports for the last 3 years		
7.	Details of major customers of the Company		
8.	Willingness to abide by the terms and conditions in the EoI document and to comply with the vendor's requirement given in the EoI document.		
9.	Company brochure		
10.	Copies of similar purchase/work Orders executed by the Company		
11.	Vendor should have valid registration of GST. Vendor should submit GST registration details		
12.	Vendor should submit PAN card - Details		
13.	Vendor should submit bankers - Details		
14.	Copies of PO released by ISRO to the party for last 3 years in the related work (at least 3)		
15.	Skilled man power availability for instrumentation, fabrication, electrical testing, DP testing, quality surveillances, mechanical assembly of systems.		