

Annexure-1 for Demand No.1300002779

**Design, Fabrication, Supply, Erection & Commissioning of Pralay
Integration Jig - 2 Sets.**

Scope of Work - Technical Specifications - List of Deliverables -
QC Requirements

1. SCOPE OF WORK

- 1.1. The scope of the Vendor is to design as per technical specifications given in Section 2, fabricate and supply Integration Jigs to meet the Pralay geometry given in enclosed Schematic Proposal Drawing in Appendix-1.
- 1.2. This scope of work includes **Two Sets** of Integration Jigs.
- 1.3. The detailed design along with fabrication drawings shall be submitted as a report to RCI within 6 weeks of placing Supply Order. This shall be reviewed by a Committee formulated by Project Director.
- 1.4. The review comments shall be incorporated in the report as well as in the fabrication drawings and resubmitted for approval of the committee within 2 weeks from the date of above review. The Firm shall implement all changes / modification in design recommended by the RCI Committee.
- 1.5. The Firm shall initiate the procurement of raw materials and fabrication as per the design and drawings approved by the Committee of RCI.
- 1.6. The integration jigs shall be made for each and every flight sections of the flight vehicle. The section wise list of integration jigs and respective load carrying requirements are provided in table below.

Table 1: Jigs and respective characteristics

S. No.	Section	Load Carrying Capacity (kgf)	Length (mm)	Sectional Diameter - Start & End (mm)
1	Section - 1	200	770	φ 248 - φ 507
2	Sec - 2	200	330	φ 507 - φ 624
3	Sec - 3	2000	1420	φ 624 - φ 740
4	Sec - 4	500	700	φ 740 - φ 740
5	Section - 5	8000	5008	φ 740 - φ 740
6	Section - 6	400	810	φ 620 - φ 620

- 1.7. The Firm / Vendor shall conduct Load Test on the Jigs at 1.5 times of the rated load mentioned above in presence of RCI representative at Vendor's premises and submit complete test document with all detailed observations.
- 1.8. The Firm shall arrange all necessary loads required for conducting the Load Test.

- 1.9. Vendor shall intimate every stage of manufacturing process to RCI representative for regular stage inspection.
- 1.10. One set of complete integration jig as per scope of work shall be delivered within 20 weeks of placement of Supply Order (S.O.) and remaining one set within 24 weeks from placement of S.O.
- 1.11. The drawings delivered to RCI will be a property of RCI and shall not be used for any other purpose without the written consent of the Project Director-Pralay.
- 1.12. It shall be noted that there may be minor changes in the length of the individual flight sections particularly up to 3220 station. This is due to the concurrent R&D activity being undertaken during the lead period between initiation of tendering process and until the placement of supply order. Vendor shall be prepared to absorb these changes without any additional cost before placement of supply order in the interest of the Project and they will not call for any change in the total length of the flight vehicle or the integration jig.
- 1.13. The Vendor shall be asked to present their technical proposal of the design of integration jig before a TEC (technical evaluation committee).
- 1.14. The Vendor shall quote the cost for design; fabrication; load tests and installation at RCI, separately. Among all TEC qualified Vendors, the Vendor with minimal grand total of all individual budgets will be the deciding factor for TPC (tender purchase committee) negotiations.
- 1.15. The Vendors are invited to have a look at similar Integration Jig available at Directorate of Systems Integration (Mechanical), RCI for a similar flight vehicle. This would serve the Vendor in assessing the requirements of Design, Fabrication and Installation before submitting the quotes.

2. TECHNICAL SPECIFICATIONS

- 2.1. Jigs shall be contoured to fully support the outer profile of flight section bulkheads at front and rear stations through annular cradles that are separable to place the flight section inside and lock.
- 2.2. Front and rear sectional supports shall be rigidly connected to each other to avoid flexibility in sectional supports.
- 2.3. Rotating arrangements shall be provided in the cradle to rotate the flight section to about $\pm 45^0$ with respect to R₂T-R₂B reference plane.
- 2.4. The cradle shall be positioned on a platform which can be given a transverse movement of ± 200 mm with respect to R₂T-R₂B reference plane. This movement can be featured with LM rails of THK or equivalent make.
- 2.5. The above platform together with cradle can be positioned over a structure that can move over rails positioned on both long-sides without any limitation and can be locked on demand.
- 2.6. In summary, the following controlled movements are required for the flight section and shall be featured in design of integration jig.
 - Rotation = $\pm 45^0$ with respect to vertical (R₂T-R₂B) reference plane
 - Transverse motion = ± 200 mm with respect to vertical (R₂T-R₂B) reference plane
 - Longitudinal motion = Unlimited over rails
 - Vertical motion = ± 200 mm with respect to horizontal (R₁L-R₁R) reference plane.
- 2.7. Integration jigs shall be positioned to stand or move over a 15m lengthy rail.
- 2.8. The parallel rails on both sides shall be rigidly connected and provided with leveling jacks at regular distance in order to level the entire length of rails perpendicular to gravity.
- 2.9. Sprit levels shall be fitted at minimum four locations along and across the rails.
- 2.10. Positive locking feature shall be provided for every flight section placed on jig. The design shall ensure individual degrees of freedom of integration jig to be controlled and locked on demand.
- 2.11. Standard structural steel as per IS:2062 shall be used for structural sections and can be used in combination with medium carbon steel (C30/C40) material.
- 2.12. All pins, pivots, roller spindles, and other important load bearing components shall be made of En24 as per BS:970, Part 3 and heat treated to 34-38 HRC or equivalent material.
- 2.13. The above elements shall be chrome plated for corrosion resistance.

- 2.14. Individual section Jigs shall facilitate joining of two flight sections and shall not protrude and obstruct the intersection joining process at lab and test site.
- 2.15. Top surface of rails shall be surface hardened to 50-55 HRC and machined flat within 0.05mm over a 1 m length to facilitate alignment between flight sections.
- 2.16. The design shall be ergonomically featured to ensure ease of integration and shall be sized to provide a factor of safety of minimum 5.
- 2.17. All rolling / rotating elements shall be featured with sealed ball or taper roller bearings depending upon the nature of load acting on them. Bearings shall be of SKF/equivalent make.
- 2.18. All sharp corners wherever accessible to human shall be rounded off suitably to avoid injuries.
- 2.19. Section support wheels shall be made of Teflon material and shall be obtained from standard / reputed brand, viz., Rexellow, Pioneer, etc.
- 2.20. Above rollers shall be provided with a mechanical braking feature to stop the rotation of wheel on demand. The rollers shall be of minimum 50mm width.
- 2.21. Sufficient features shall be introduced in each sectional supports to resist toppling tendency of the individual integration jig after placement of flight section.
- 2.22. The integration jig of a flight section having front and rear supports shall be featured to move together over rail and braked on demand.
- 2.23. Measuring scales shall be fitted at appropriate places in the integration jig to provide measured translational, transverse, vertical and angular motions to the flight section.
- 2.24. There shall be necessity for reliefs to be incorporated in cradles of Section-5 and Section -6 for fairing covers, wings and fins of flight vehicle whose details will be shared after placement of supply order and shall be implemented after basic integration jig design is completed.
- 2.25. An attachment shall be provided in-between two integration jigs to push one flight section with respect to other by locking one over the rail. This shall be a pneumatic jack operated by a handle and this handle shall be concealed in the integration jig. This is particularly essential before Section-4 and Section-5.

3. LIST OF DELIVERABLES

- 3.1. Two sets of complete integration jig for five flight sections over individual rails.
- 3.2. Material test certificates (chemical & mechanical) for the materials used in fabrication of integration jig.
- 3.3. One Design Report updated with all recommendations suggested by RCI Committee in hard copy as well as in a soft copy in a CD.
- 3.4. Two sets of complete drawings finalised and approved by RCI in hard copy; One set of drawings made in latest version of AutoCAD in soft copy in a CD.
- 3.5. Load test reports on integration jigs.
- 3.6. Dimensional and material inspection reports.

4. QUALITY CONTROL REQUIREMENTS

4.1. General

- 4.1.1 Supplier shall check hardness of all components made of aluminum alloy and EN-24 material before plating.
- 4.1.2 Supplier shall prepare 3 numbers of tensile test specimens according to ASTM-A370 for steel and ASTM-E8 for aluminium alloy from the heat treated material and subject to tensile test at approved test laboratories.
- 4.1.3 Supplier shall report to RCI representative if there is any variation in procedure / dimensions.
- 4.1.4 Supplier shall supply all components duly packed properly with 100% inspection reports.

4.2. Machined Components

- 4.2.1 Supplier shall do machining of all rods / bars / plates as per the dimensions and tolerances finalised in the approved drawings for all of the components and adhere conformance by carrying out 100% dimensional inspection.
- 4.2.2 Supplier shall subject all the welded components to DP Test for detection of the surface defects if any as per IS: 3658 — 1981 before painting. Surface defects will not be entertained.

4.3. Painting

Supplier shall do painting with two coats of enamel paint over red oxide paint on all Carbon steel and mild steel materials wherever they are non contacting.

4.4. Cadmium Plating

- 4.4.1 All components made up of EN-24, AISI-4340 and high strength alloy materials and fasteners of 10.9 class shall be Cadmium plated to Cd-8 as per IS:1572-1986.
- 4.4.2 Pre-plating stress relieving shall be carried out as mentioned in IS:1572-1986 at 190°C to 230°C for one hour.
- 4.4.3 Hydrogen de-embrittlement shall be carried out within 4 hours after plating operation and after picking them out of plating bath in accordance with IS:1572. Temperature Cycle shall be 190°C to 220°C for 8 hours.

4.4. Ultrasonic Inspection

Supplier shall carryout Ultrasonic Test after heat treatment on each bar / rod / sheet of high strength material. Acceptance Criteria shall be Class-A (2 mm FBH for single discontinuity) as per SAE AMS 2630 B.

4.5. Fasteners

- 4.5.1 Supplier shall use only 10.9 class fasteners and procure all fasteners from a standard and RCI approved manufacturer viz., Unbrako, LPS etc.
- 4.5.2 All Fasteners shall be of property class 10.9 and nuts will be of class 10. Hardness of the fasteners shall be of 28 - 32 HRC.

4.5. Packing

Supplier shall supply all finished components in proper packing and install at RCI with the following information written legibly:

- Manufacturer Name & Address
- Month and Year of Production
- Supply Order No. and Date

Appendix-1 to Annexure -1 of Demand No.1300002779

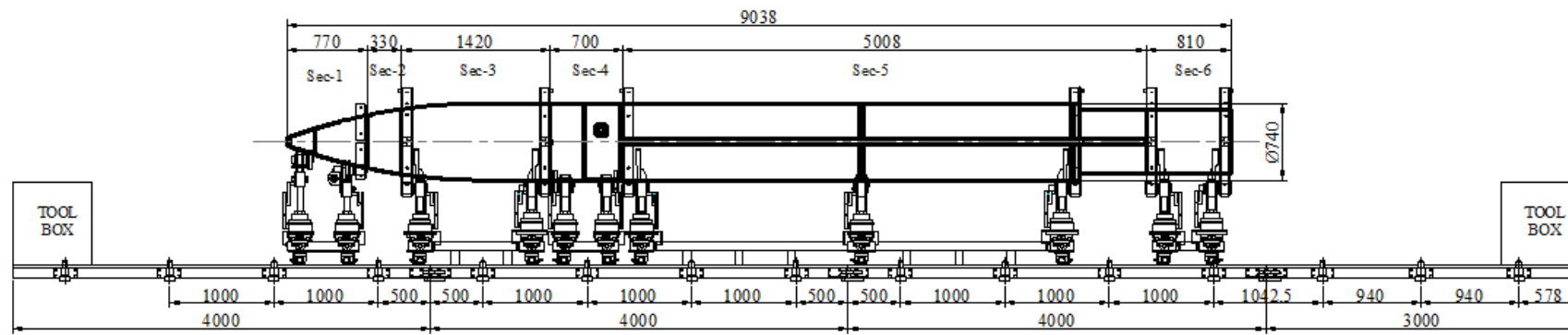


Figure: Schematic proposal drawing of the Integration Jig