**Annexure-I**

# File: Development of Indigenous Crew Seat Liner Prototype

## Terms and Conditions

**Parties shall comply to the technical requirements stated in the compliance sheet. Detailed compliance status/remarks shall be provided against each compliance terms.**

**I. SCOPE OF WORK:**

The scope of work is as follows:

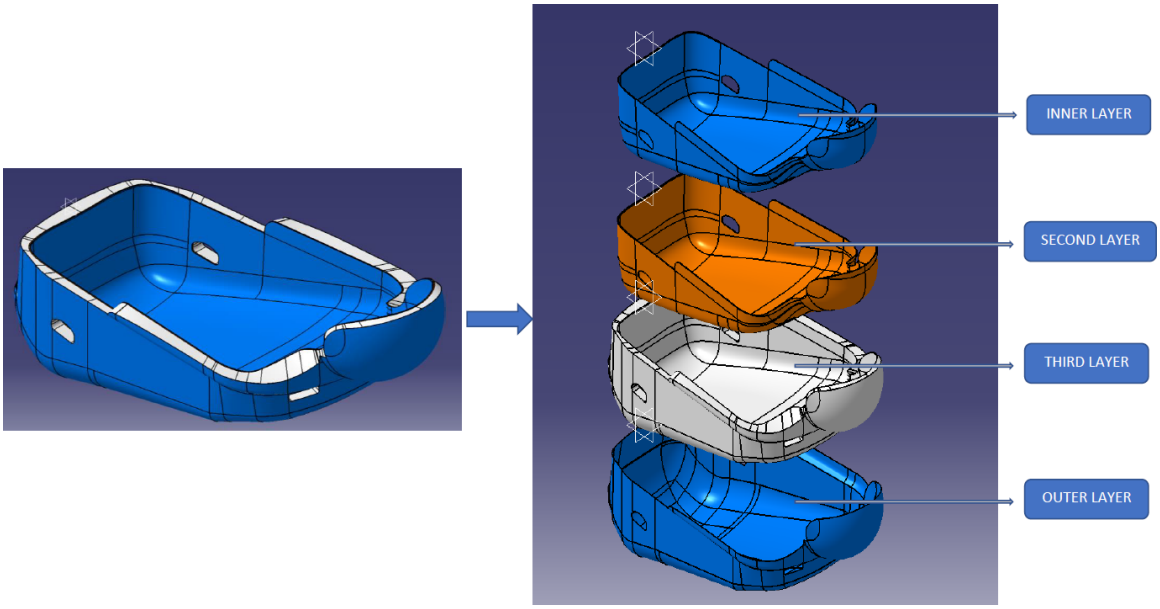
1. Detailed study, Engineering and generation of Fabrication drawings for the crew seat liner hardware- 2 Types, as per the 3D models supplied by the Department.
   (a) Test Liner Engineering Prototype-FAA ATD-M : ***CSBL-T-FM ;*** Qty: 01 No
   (b) Test Liner Engineering Prototype- Auto ATD-M : ***CSBL-T-AM ;*** Qty: 01 No
2. **Note-1:**
   ***3D models for the 2 types of prototypes, a & b, with the details of each part in the liner hardware will be supplied by Department, along with the PO copy.***
   ***The .pdf drawing of a typical liner with dimensions of each layer is attached as Annexure-V for estimation of materials and fabrication costing.***
3. Procurement of the raw materials required for the liner fabrication, including Foam, Fabric, etc., except the GFRP pane which will be supplied by Department as Free issue material (FIM), as per the details provided in the below sections.
4. Fabrication of the liner hardware 2 Types, as per the 3D models supplied by the Department.
5. Inspection of the realised hardware and report generation.
6. Packing & Supply of the liner hardware 2 Types to HSFC, Bangalore.
7. Fabrication of jigs, fixtures, moulds, patterns, Toolings etc. wherever required are to be fabricated by the manufacturer. No separate cost shall be claimed for these activities/units.
8. Party shall carryout the 3D scanning of the realised hardwares and provide the data to be matched with the supplied 3D CAD.
9. Pre delivery inspection will be done by HSFC & clearance will be given for packing & delivery.

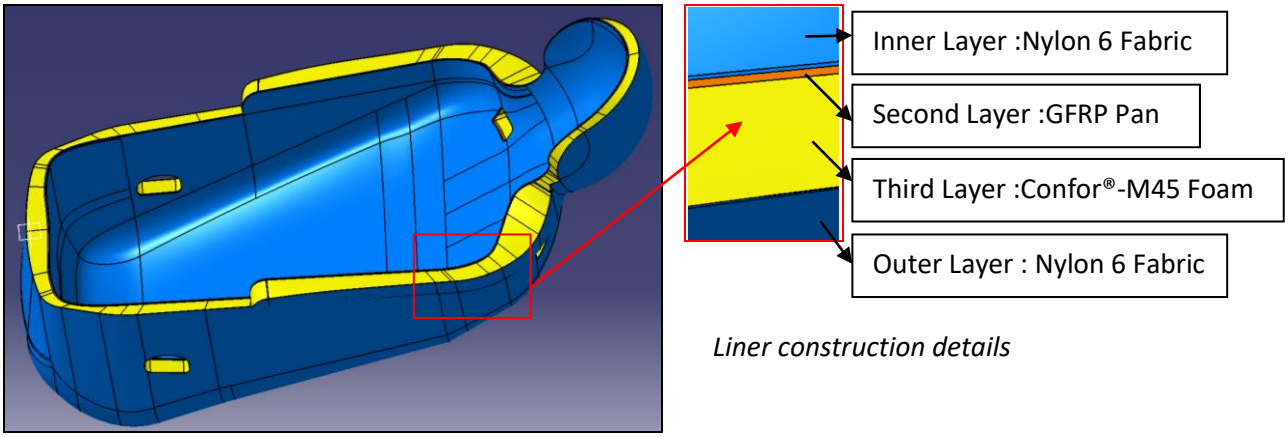
**Note-2:**

***Minor changes in the design, if any, during the execution of the order, should be undertaken without any additional cost. If the changes are appreciable (>10%), it may mutually be discussed & agreed upon.***

## II. Liner Details

The image of the typical configuration of the crew seat liner is shown below.




*Liner construction details*

## III. MATERIALS:

The material details for the construction of the liner hardware is shown below.

### 1. Inner Layer:

- Material: Nylon 6
- Thickness: 2.1 mm
- Breaking load: 63-79kgf
- Tensile strain: 116-148%
- Tensile strength: 12-15MPa
- Flammability Compliance: FAR 25.853

**Note:** Party may propose the similar fabric with same or better properties, which is best suiting ergonomically and functionally for the aerospace application.

**2. Second Layer: - Not to be fabricated- Will be Supplied as Free issue material (FIM)**

- Material: Composite- GFRP
- Reinforcement: Glass cloth
- Resin: Epoxy (DGEBA)
- Thickness: 2.0 mm

**3. Third Layer:**

- The foam material to be used in these liners is: **ConforFoam-M45 (CF-45M)** ONLY
- The foam shall be purchased form OEM: **M/s AeroTechnolgies LLC, or its authorized suppliers.**
- Typical Properties of the ConforFoam-M45 is listed below:

| Property | ConforFoam-M45 (CF-45M) |
|---|---|
| **Density**<br>Nominal kg/m$^3$ (lb/ft$^3$)<br>ASTM D3574 | 96 (6.0) |
| **Flammability** | |
| UL 94 | Listed HBF @ 3mm |
| FMVSS-302 | Meets |
| California Flame 117-2013 | Passes |
| **Ball Rebound (%)**<br>ASTM D3574 | <1.0 |
| **Thermal conductivity - (K Value)**<br>ASTM C117 W/m.K (BTU in/hr ft$^2$F) | 0.040 (0.28) |
| **Compression Set (%)**<br>ASTM D3574<br>22 hr at 22°C (72°F)<br>Compressed 50% | 1.0 |
| **Indentation Force Deflection**<br>ASTM D3574 Test B1 (modified)<br>25% Deflection 12"x12"x2" sample:<br>22°C (72°F) at 50% Relative Humidity N (lbf) | 213 (48) |
| **Tensile Strength kPa (psi)**<br>ASTM D3574<br>51 mm/min (20 in/min) | 117 (17) |
| **Tear Strength kN/min (lbf/in)**<br>ASTM D3574<br>51 cm/min (20 in/min) at 22°C (72°F) | 0.64 (3.7) |

| | |
|---|---|
| **Compression Load Deflection**<br>ASTM D3574 Test C Modified | |
| 10% kPa (psi) | 3.1 (0.44) |
| 20% kPa (psi) | 4.2 (0.61) |
| 30% kPa (psi) | 4.5 (0.66) |
| 40% kPa (psi) | 5.0 (0.73) |
| 50% kPa (psi) | 5.9 (0.86) |
| 60% kPa (psi) | 7.7 (1.1) |
| 70% kPa (psi) | 12 (1.8) |
| 80% kPa (psi) | 32 (4.6) |
| **RoHS Compliant** | Yes |

**4. Outer Layer:**

- Nylon 6
- Thickness: 1.0 mm
- Breaking load: 39 kgf
- Tensile strain: 24-29%
- Tensile strength: 15MPa
- Flammability Compliance: FAR 25.853

**Note:** Party may propose the similar fabric with same or better properties, which is best suiting ergonomically and functionally for the aerospace application.

- Party shall submit the material TC / Certificate of Compliance for the raw materials being used for the fabrication of liner hardware.
- The Mockup model of the seat Bucket will be supplied to party by Department as Returnable Free Issue Material for carrying out suiting trial with the liner during the course if hardware development.
- Party shall submit the Bank Guarantee (BG) against the FIM value as given in Annexure- IV

## IV. ESSENTIAL CERTIFICATIONS AND FACILITIES REQUIRED:

1. Party shall be a DGCA approved firm for design, manufacturing and releasing aircraft interior systems including seat systems ensuring they meet the required safety and quality standards. Party shall submit the relevant certifications obtained to substantiate the approval claim.
2. Party shall hold the valid DGCA –DOA-Design Organisation Approval allowing it to design and manufacture the aircraft systems or modify existing designs.
3. Party shall hold valid DGCA CAR 21G - Production Organization approval-certification ensuring that the firm is approved to build and certify aircraft parts & the design and manufacturing processes of the aerospace cabin systems are compliant with relevant airworthiness standards.
4. Party shall hold the valid Aerospace Quality Management Standard Certification-AS9100D/ ISO 9001:2015 for its involvement in design, development, production, assembly, and maintenance of aviation/space/ defense products.

5. Party shall have the FAA/EASA/DGCA approved production facility required for the crew seat liner fabrication.
   5.1. Party shall have the adequate inhouse facilities including tools, calibrated testing equipment, and manufacturing infrastructure suitable for aviation-grade fabric processing and testing.
   5.2. The Party shall have the required facilities & proven expertise for cutting, profiling, stitching, bonding, etc. required for the fabrication of the crew seat liner as explained in the earlier section.
   5.3. The Party must possess specific furnishing-related equipment and machines such as:
      - Industrial sewing machines suitable for technical fabrics and leather.
      - Precision cutting tables (manual or automated).
      - Edge binding / Overlocking equipment.
      - Upholstery profiling, contouring machines, and trimming tools.
   5.4. A detailed inventory of the machines/tools shall be submitted to demonstrate readiness and capability.
   5.5. The supplier must have the facility and expertise to design and produce precise templates required for further processing of furnishing items.
   5.6. Party shall provide the detail of the facilities to carry out each of the fabrication activity required for the liner realisation.
6. Party shall have proven experience in fabrication/refurbishment/repair of aircraft seat system/parts.
7. Party shall have the trained and experience manpower, in material engineering, quality control, and regulatory compliance.
8. Party shall have dedicated bonded storage facility with traceability, environmental controls, and access logs for the safe storage of the raw materials.
9. Party shall have access to NABL accredited state of art laboratories for the characterization testing of the raw materials used for the realisation of the proposed crew seat liner.
10. Party shall have an in-house design team for generating required 3D models and 2D drawings required for the fabrication of the liner prototypes.
11. The Party shall have robust supply chain for the procurement of the foam and technical fabric for the realisation of crew seat liner prototypes.

## V. MANUFACTURING

1. 3D model for the 2 types of liner prototypes:
   1.1. Test Liner Engineering Prototype-FAA ATD-M : ***CSBL-T-FM* ; Qty: 01 No**
   1.2. Test Liner Engineering Prototype- Auto ATD-M : ***CSBL-T-AM* ; Qty: 01 No**

   will be provided by the Department.
   Party shall generate the detailed fabrication drawings for each prototypes.
2. Party shall procure the required materials as listed in section III from reliable sources. Party shall provide the Test certificates, CoCs etc. to department for the materials procured.

3. Party shall utilize the facilities approved for aerospace manufacturing only for carrying out the processing of foam, fabrics etc.
4. Party shall carryout the realisation activities as per the inputs from Department and realize the liner protypes.
5. Party shall procure/realize any kind of tooling, fixtures, consumables etc. required for the liner prototype fabrication. No separate cost shall be claimed for these requirements.

## VI. ENGINEERING DOCUMENTS:

1. Party shall prepare the detailed process plan, Dimension Inspection plan & QA/QC plan incorporating operation details, QC stages, facility, machine tools & instrument employed, tooling details covering all stages from raw material to finish product.
2. The process plan & QC plan identifying mandatory QC check points shall be concurred & approved by the Department prior to commencement of work.

## VII. INSPECTION AND ACCEPTANCE

1. Manufacture's quality control department shall be responsible for online inspection, stage clearance & final Inspection of the product as per drawing & specification.
2. All Gauges, Templates, Jigs & Fixtures used for fabrication & Inspection shall be identified & qualified to the satisfaction of the Department. All measuring instruments shall be in good condition & periodically calibrated by authorized agency.
3. Components & assembly shall meet all dimensional & geometrical tolerance stipulated in the fabrication drawings. In case of any deviation, RCA (Root cause analysis) & CAPA (Corrective & preventive Analysis) shall be prepared by the party.
4. Engineer of Department shall carry out surveillance & key point inspection at mandatory stages identified.
5. Inspection report (3 sets) shall be prepared in the specified format & submitted to the quality surveyor of HSFC for verification & countersigning. Non-conformance, if any, shall be high-lighted through a Snag sheet to Department for disposition.
6. Processing shall be systematized & technical observation during the process of job shall be recorded in a shop log book, specifically meant for Department jobs. Specific observations about the process & inspection method, procedures shall be recorded in the above log book.
7. Finished components shall be marked with identification numbers.

## VIII. DELIVERY:

1. Delivery Terms: FOR HSFC
2. Delivery Place: HSFC, Bangalore
3. Delivery Period: within 5 months from the release of PO.

## IX. PACKING AND FORWARDING:

1. Pre-delivery full inspection & acceptance of components/assembly will be done by HSFC at Suppliers works & dispatch clearance will be given by HSFC for packing & delivery.

2. Vendor shall properly wrap the assembly using bubble sheet, gunny bags & pack in weather proof wooden boxes with proper support to prevent transit damages.
3. Packing & loading of hardware should be done by vendor.

## X. GENERAL

1. Supplied information/drawings are confidential and property of HSFC-ISRO. The vendor party has to ensure the secrecy in all aspects.
2. The hardware or its details in parts/assembly shall not be shared with or realised for other agencies/firms.

**Annexure-II**

## File: Development of Indigenous Crew Seat Liner Prototype
## Applicable Quality Document

1. Storage and Preservation of LAS Materials and Assemblies. MME/TT/43.86/QCP/67/ 2012 dtd January, 2012.
2. Quality Control requirements for the "Surface Treatment processes for Satellite and Launch Vehicle components" including Anodisation, Cadmium Plating & Chemical Milling. MME/ST/QCP/066/2012 dtd Jan, 2012.
3. Quality control for Heat Treatment of Aluminium alloy components for Launch Vehicle light alloy structures. MEE/QCG/QCE/QCP/061/2011 dtd Dec, 2011.
4. Quality Control Plan for the Fixing and Inspection of Rivets in Aluminium Alloy Structures. MME/QCG/QCE/QCP/065/2012 dtd Jan, 2012.
5. Position Tolerance Measurement procedure for Ring type components. VSSC/MME/QCG/QCE/QCP/062 dtd Dec, 2011.
6. Quality requirements for Thread Gauging Practices for Space hardware. VSSC/MME/QCG/QCE/QCP/043 dtd Dec, 2011.
7. Installation and inspection procedure of Helicoil inserts. MEE/QCI/43.86/QCP/02/2006 dtd Feb, 2006.
8. Quality control plan for the fixing and inspection of JO bolt in Aluminium Alloy structures. MME/QCG/QCE/QCP/064/2012.Dtd:-Oct 2013.
9. Storage, Distribution and Protection procedure for 15CDV6 & M250 Maraging Steel Raw Materials and Segments. MME/QCG/QCE/QCP/063/2011.Dtd:-Dec 2011.
10. Quality requirements for temperature uniformity survey of Heat Treatment Furnaces (for Aerospace Materials & Hardware's) MME/QCG/QCE/QCP/059/2011. Dtd:- Dec 2011.

(Latest revision of all the above mentioned quality documents shall be applied.)

**Annexure-III**

# File: Development of Indigenous Crew Seat Liner Prototype
# Approved Vendors for various special process

Quality Division External Mechanical
Quality & Reliability Mechanical System Group Systems Reliability Entity
Vikram Sarabhai Space Centre Thiruvananthapuram

| VSSC/SR/Mech/Vendor List-01 Rev.0 | | Date: 22-February-2017 |
|---|---|---|
| **List of Approved Vendors for Special Processes, Calibration & Testing -for Hardware Fabrication** | | |
| **Surface Treatment- Anodizing & Cadmium Plating** | **Location** | |
| Sree Karthika Engineering Enterprise. SPIV/661, Sreesailam, Venjavode, Sreekariyam, Trivandrum - 695 017 | Trivandrum | Anodizing |
| HAL(ASD),New Thipsandra | Bengaluru | Anodizing & Cadmium Plating |
| TAAL(Hosur) | Bengaluru | Anodizing & Cadmium Plating |
| Aerospace & Special Process. No: A1-1 Industrial Estate, Rajaji Nagar, Bengaluru - 560 010 | Bengaluru | Cadmium Plating |
| SVL Metal Finishers Pvt Ltd. Plot No: 17-D/3 Phase - I, IDA Pattancheru, Medak District, Hyderabad | Hyderabad | Anodizing |
| Hyderabad Electro platers | Hyderabad | Anodizing |
| Ranga Enterprises | Hyderabad | Cadmium Plating |
| Balaa Woks. No: 2 Sri Ambal Nagar, 8 th Street, Keelakattalai, Chennai - 600 117 | Chennai | Anodizing |
| Shri Jayasuriya Enterprise, Ponmar Chennai | Chennai | Anodizing & Cadmium Plating |
| Perfect Metal Finishers Industrial Development Plot No: 105, Kalamasserry | Kochi | Cadmium Plating, Passivation & Hard Chrome Plating |
| Brahmos Aerospace Thiruvananthapuram Ltd. Air Port Road, Chakkai Beach Post | Trivandrum | Anodizing & Cadmium Plating |
| **Heat Treatment Facilities** | | |
| Note: *Validity of Temperature Uniformity Survey and Calibration of Thermocouples & furnace instrumentation shall be ensured before sending the job.* | | |
| Therelek Engineers , 70-71, III Phase, Peenya Industrial Area, Bangalore - 560 058 | Bengaluru | TUS qualified up to 1000°C. However, suitability for specific heat treatment processes like Hardening, Tempering, Stress Releiving, Ageing etc for different materials shall be ensured before offering the job. |
| Best Heat Treatment Services, 53, Sidco Indl estate, Coimbatore- 641 021 | Coimbatore | |
| Kortas Industries, Trivandrum 80-B, Industrial Development Area, Veli, Trivandrum- 695 021 | Trivandrum | |
| Brahmos Aerospace Thiruvananthapuram Ltd. Air Port Road, Chakkai Beach Post, Trivandrum - 695 007 | Trivandrum | |
| Wave Current Automotive Ltd. 174/177, SIDCO Industrial Estate, Ambattur, Chennai - 600098 | Chennai | |
| Kaushalya Heat Treatment Services, Vardhman Industrial Area, Bhandup west, Mumbai | Mumbai | |
| ARF Engineering, Ambattur, Chennai | Chennai | |
| National Heat treaters, Ambattur, Chennai | Chennai | Qualified only for the Stress relieving process for SA-515/516 steel hardware (S139 Nozzle Hardware) |
| **Mechanical Testing- Tensile, Hardness & Fracture Toughness** | | |
| Micro Lab, SP-101, II nd Main Road, Indl Estate, Ambattur, Chennai | Chennai | For Hardness & Tensile Testing as per NABL Scope. 250kN UTM is qualified for VSSC Testing activities. |

| | | |
|---|---|---|
| Metallurgical Services Pvt Ltd (An Exova group Company), Ghatkopar, Mumbai | Mumbai | Tensile Testing & FTT |
| **Non-Destructive Testing & Evaluation** | | |
| Jai Inspection Agencies, Ayanambakkam Chennai | Chennai | X-Ray & Gamma Ray Radiography, Liquid Penetrant Testing |
| Scaanray Metallurgical Services, C12 Industrial Estate Mogappair | Chennai | X-Ray & Gamma Ray Radiography, Liquid Penetrant Testing |
| SJS NDT, Hyderabad | Anywhere in India | Ultrasound Testing. |
| ISR NDT Services, Rajackamangalam, KK District Tamil Nadu, Cell: 94867 52885 | Anywhere in India | Ultrasound Testing, RT Film review, Magnetic Particle & Liquid Penetrant Testing |
| Brahmos Aerospace Thiruvananthapuram Ltd. Air Port Road, Chakkai Beach Post, Trivandrum - 695 007 | Trivandrum & Tamilnadu | Ultrasound, Radiography, Liquid & Fluorescent Penetrant Testing at BATL site only |
| **Precision Measurement, CMM & Laser Tracker Inspection** | | |
| TESPA CALIBRATION CENTRE, D-105, FIRST MAIN ROAD, ANNA NAGAR EAST | Chennai | CMM, Roundness & Surface finish testing, and general inspection activities |
| Aero Precision, P K 711170K, Kottukal Panchayath, Trivandrum | Trivandrum | CMM and general inspection activities. |
| Brahmos Aerospace Thiruvananthapuram Ltd. Air Port Road, Chakkai Beach Post, Trivandrum - 695 007 | Trivandrum | CMM and general inspection activities. |
| RIPPLE ENGINEERING SERVICES- info@rippletechnologies.co.in | Bengaluru | Laser Tracker Inspection. |
| **Calibration & Testing Laboratories** | | |
| **Thermal & Electro technical** | Location | Scope & Remarks |
| Sophisticated Test & Instrumentation Centre, Cochin University of Science & Technology, Kochi- 682 022. Tel: 0484- 257 5908, 257 6697 | Kochi | Thermocouples, Furnace Instrumentation and Furnace TUS as per Scope of accreditation. |
| CENTRE FOR CALIBRATION Nagman complex, Nazarathpet, Chembabakkamram, Chennai- | Chennai | |
| RR ELECTRONICS, Adyar,Chennai-600020 Tel: +91 44 24418026 Mob: 9381020485. | Chennai | |
| Godrej- LAWKIM Motors Group, SIDCO Industrial Estate Ambatttur, Chennai-600 098 | Chennai | |
| SAI Calibration & Testing Engineers, 203, Green Land Towers, 6-3-866, Begumpet, Hyderabad. | Hyderabad | Limited to AT SITE Calibration only as per scope of accreditation. (No laboratory facility available) |
| **Universal Testing Machines, Hardness Testers & Extensometers** | | |
| ABS Instrument Pvt.Ltd, Unit 21,Block I SIDCO Electronics Complex, Thiru-vi-ka Industrial Estate,Guindy,Chennai-600 032, | Chennai | UTM, Hardness Testers & ASTM Class B2 Extensometers |
| Blue Star Limited,46 Garuda Buildings, Cathedral road, Chennai 600 86. Tel: +91 | Chennai | UTM & Hardness Testers |
| TECSOL INDIA #4/323, Valluvar Salai,Ramapuram,Chennai-89 | Chennai | UTM & Hardness Testers |
| **Pressure Gauge Calibration & Torque Wrenches** | | |
| CENTRE FOR CALIBRATION Nagman complex, 27th KM Stone Chennai-Bangalore National highway Nazarathpet, Chembabakkamram, | Chennai | Pressure gauges as per Scope of accreditation |
| Godrej- LAWKIM Motors Group No 1 SIDCO Industrial Estate Ambatttur,chennai-600 098 | Chennai | Pressure gauges & Torque Wrenches as per Scope of accreditation |
| **Dimensional Measuring Equipments** | | |
| Central Manufacturing Technology Institute, Tumkur Road, Bengaluru-560022. 080-2337 5081/82/85 | Bengaluru | |
| Godrej- LAWKIM Motors Group SIDCO Industrial Estate Ambatttur, Chennai-600 098 | Chennai | |

| | | |
|---|---|---|
| Accurate Engineering Company Pvt Limited. Regional Lab, Annanagar, Chennai-600 040, | Chennai | All Equipments as per scope of accreditation. Scope of Accreditation and validity of NABL certification shall be ensured before offering the work/job. |
| BAKER GAUGES INDIA PVT 37-40,Nagar Road Pune - 411 014 | Pune | |
| SV Precision Instruments, 11A, 11B, Type III, Industrial Estate, Kukatpally, Hyderabad-500 072. info@svprecisions.com. 040-230 79359, 230 753387 | Hyderabad | |
| Excel calibration (p) Ltd, 101,First floor block A Barkatpura, Hyderabad 500027 | Hyderabad | |
| Aero Precision, P K 711170K, Kottukal Panchayath. Trivandrum | Trivandrum | |
| **Note: (1) Main Contractors shall restrain from outsourcing /sub-contracting VSSC jobs to vendors other than those listed above (in the specified area). (2) Additional sub-contractors can be qualified & listed based on the requirements of Main contractors, after due evaluation/ auditing by VSSC team.** | | |

**Annexure-IV**

## File: Development of Indigenous Crew Seat Liner Prototype

## List of Free Issue Material (FIM)

| Sl No. | FIM Description | Quantity (Nos.) | Cost (Rs) |
|---|---|---|---|
| | FRP Pan for Liner | 02 | 8,50,000 |
| | Crew Seat Bucket Mockup Model (Returnable FIM) | 01 | 1,50,000 |
| | **Total FIM Value** | | **10,00,000** |