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Date : 18th Mar. 2020

***Procurement Technical Specification
of
Trailer
for an Integration Jig
of
Large Antenna***



BEML LTD

Ministry of Defence (Govt. of India Undertaking)
R&D (Defence), Unity Buildings, JC Road
Bangalore - 560 002, Karnataka, India.

Technical Specifications of Trailer for an Integration Jig of Large AntennaDocument No.: GAT/R&D/Mobile Trl/2019/1042 - Rev01 Dtd: 18th Mar 2020

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	Prepared By	Checked By	Approved By
Name	RAGHURAM K	NARASIMHA PRASAD N	SHIV KUMAR V APPA
Designation	Manager	Sr. Manager	AGM

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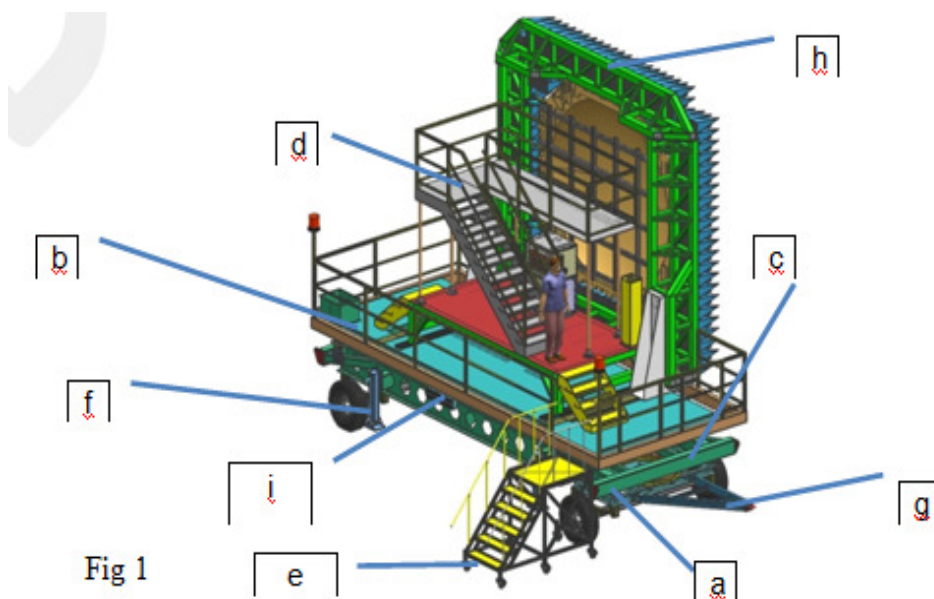
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1. INTRODUCTION

There is requirement of the design & development of Trailer for an Integration Jig of a Large Antenna, This will be an infrastructure development and there is a requirement of 2 Nos. Trailers for the transportation of an integration facility of a large antenna within the Factory premises.

2. SYSTEM DESCRIPTION:

- a. Trailer with pneumatic tires.
- b. Electrical or mechanical moving platform, antenna turntable that will include traversing, and locking for work integration.
- c. Leveling system, for antenna calibration which can be raised (to reduce the length of the trailer) on both sides of the trailer,
- d. A work platform on rods adapted to the Customer's design.
- e. Steps to climb on the work platforms of the trailer.
- f. Four EM jacks to raise the trailer's wheels into the air, as per the specifications mentioned below.
- g. Drive pole for trailer maneuver to the range.
- h. Aluminum Cage with eccosorb rubberized,
- i. Connectors panel



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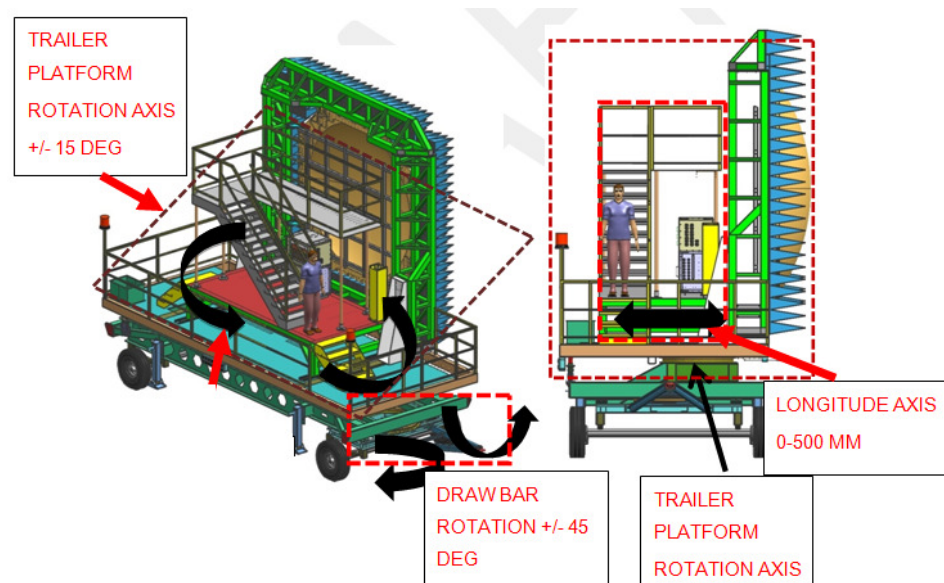
The weight of the equipment on the Trailer includes

- Antenna – 2.1 tons
- Cable support net – 0.25 tons
- miscellaneous bases – 0.5 tons
- Integration facility – 3 tons
- Antenna crane – 1.5 tons
- Work platforms – 1 ton (estimate)
- Personnel and equipment on the platforms – 0.5 tons
- Additional Counter Weight - Approx 3 tons
- Total with 10% safety margin: Approx **12 tons**

3. GENERAL FUNCTIONALITY REQUIREMENTS

3.1 REQUIRED SPECIAL FEATURES FOR THE TRAILER

1. The work platform lateral axis the movement should be 0-500 mm with lockable provision (Horizontal movement)
2. Trailer platform rotation axis is ± 5 deg will be achieved by adjusting the height of 4 outriggers on either side of the trailer
3. Pole axis rotation angle (trailer platform rotation) is ± 15 deg considered
4. Drawbar rotation is ± 45 deg considered



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3.2 THE WORK METHODS WITH THE TRAILER SHALL BE AS FOLLOWS:

- Following assembly of the antenna on the integration facility, the facility (together with the antenna) will be lifted by straps by a crane and assembled on the Trailer's turntable.
- All work areas and platform design will be subject to MIL-STD-1472F
- The trailer will be towed to a range on the plant's premises on paved road.
- At the range, the entire trailer will be elevated until the center of the antenna is at a height of 5.5 m off the floor, and it will be leveled on all three spatial axes which result in the antenna front face to be parallel to range calibration horn.
- In this position, the platform and cable carrying net will be assembled. The transmission units will then be assembled on the antenna and the power and optic cable will be hooked up to them.
- At the conclusion of the test at the range, everything will be disassembled in the reverse order of the assembly.

3.3 MECHANICAL DESIGN REQUIREMENTS

1. Shall be as shown in the illustration (example of design) at Appendix A of the document.
2. The speed of the trailer on all types of surfaces at the plant (asphalt, integrated flooring, and unpaved road) should be up to 20 km/h. The travel speed when fully loaded will be less.
3. One number spare tyre with mounting facility to be provided.
4. It should be possible to go over cable covers found at the plant.
5. The trailer should be equipped with pneumatic tires suitable for the load and road conditions.
6. The wheels should be lockable, parking brake facility should be there.
7. The trailer will be equipped with wheel chocks to prevent rolling when stopped.
8. Four EM jacks or parking legs will be installed to ensure that the trailer can be raised about 650 mm to 700 mm off the ground, until the wheels do not

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- touch the ground, and the Trailer stability level to a accuracy of ± 0.5 deg. Auto levelling should be provided.
9. The jacks will also enable leveling on an inclined surface of ± 5 deg in every direction.
 10. It is required to raise the center of the antenna to a height of 5.5 m off the ground.
 11. To measure the leveling, two levels should be placed on the trailer bed and protected against damage. The levels will have an accuracy of ± 0.02 deg.
 12. Two collapsible shafts poles to enable 45° traverse in every direction without damaging the equipment on it during movement. The shafts will enable towing and pushing by forklift or truck. (Front side it is ± 45 deg rotation on either sides & at rear side only fixed draw bar without rotating table)
 13. A lifting points will be installed on the trailer to enable it to be raised in its entirety. A certification by a certified inspector is required.
 14. Proof of the Trailer's stability during travel and parking at a maximum angle and wind speed of 50 km/h on the equipment is required.
 15. The maximum permissible sinking of the fully loaded trailer bed on the jacks is 0.7 mm to 7 mm.
 16. The frequency of the fully loaded trailer on the jacks will be at least 8 Hz.
 17. The stability and rigidity tests will be performed by the manufacturer with a dummy load.
 18. All the welding will be as defined in the blueprint. Critical welding, as defined by the manufacturer and/or the customer, will be tested by MIL-STD-6866 standard or equivalent standard liquid penetrant.
 19. The electricity cabinet: an electricity cabinet to be installed on the trailer in compliance with the Indian Standard for outdoor electricity cabinets. It should includes:
 - a. One or two cabinets with a total of 20 single-phase sockets for a 15A current

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- b. Hook-up to a 24V flashing light, which will be fed via a suitable insulated transformer and a cable with a length of at least 10 m.
 - c. Central internal and external grounding with a bolt attachment to the cable
 - d. Discharge switch against electrocution
 - e. A sign that conforms to the standards will be placed on the electric cabinet
 - f. Multi meter for checking the continuity check
20. A grounding point on the trailer plus an extension cable with a length of at least 20 m and cable collector.
21. **Cooling pipes:** The antenna is cooled by coolant from the refrigeration system that reaches the Trailer by pipes from outside the structure. The Trailer will have a partly rigid and partly flexible pipe that connects the coolant pipes with the antenna, which is located on the moving part of the turntable. The pipe should include taps, air drainage units, flow gauges and a coolant discharge tap. The manufacturer will conduct pressure and washing tests of the system before the pipes are used for the first time.
- a. No. of taps 2 entry and 2 exit.
 - b. Inflow pipe: 2" pipe with a splitter box to two flexible 1" pipes with a total length of up to 8 m.
 - c. Return pipe: two flexible 1" pipes that are connected to the collection box from a 2" pipe exits to the return line
22. Cable support: the manufacturer will prepare conduits for the passage of the power cables and information and optic cables from outside the trailer to the antenna and the other units on the trailer.
23. The manufacturer should prepare places for inserting the supports in the trailer bed, which should be adjusted to the full load in order to support it without the jacks. The manufacturer should also prepare the supports of quantity four nos. Equivalent design shall be provided.

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- 24. The trailer will be built so that it can be transported on or towed by a truck with unrestricted movement.
- 25. Rings will be installed on the trailer to lash and anchor it to the ground.
- 26. BEML quality should approve the trailer:
- 27. In addition to the antenna, three platforms and a cable support net, defined by the customer, will be installed on the trailer.
- 28. The manufacture will install light bodies on the roof of the platform and below to provide work environment in poor lighting conditions.
- 29. Full Cover sheet cloth (Rain/UV/Dust) will be supply with the Trailer with lock strap to the trailer frame, provide protection to the Trailer assembly when parked and storage.
- 30. All trailer assembly structure will be painted according to

Painting instructions: (Guideline)

Primer: Application of fluid-resistant epoxy primer

Thickness: 15 - 25 microns.

Top coat: Application of camouflage, high solids

Polyurethane Coating as per PS 613 .

Thickness: 40 - 50 microns.

Color: Yellow per FED-STD-595B, color no. 13538.

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3.4 THE WORK PLATFORM

1. Design for Safety work by two workers with equipment.
2. Stairs climb to the platform from the trailer floor.
3. BEML Quality will approve the work platforms:

3.5 PRESSURE DISTRIBUTING PLATES

The OEM should provide pressure distributing plates. These plates need to improve weight distribution and to avoid floor damage.



3.6 ENVIRONMENTAL CONDITIONS

1. Temperature: 10-45° C (CoC to be provided)
2. Humidity: up to 95% (CoC to be provided)
3. Dust: up to 11 gr/m3 at a wind speed of up to 50 km/h (FE analysis report to be provided)
4. Road conditions compliance: Pursuant to the Indian standard, known and approved by the customer. (CoC to be provided)
5. Salt Corrosion test of sample pieces as per JSS 55555 (Certificate to be provided by carrying out physical Testing for all type of metallic parts used in this projects, from NABL certified Labs).

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3.7 MARKS AND SIGNATURES

1. The signs will be in English pursuant to the standards in India.
2. The trailer identification sign will, at a minimum, include the following information:

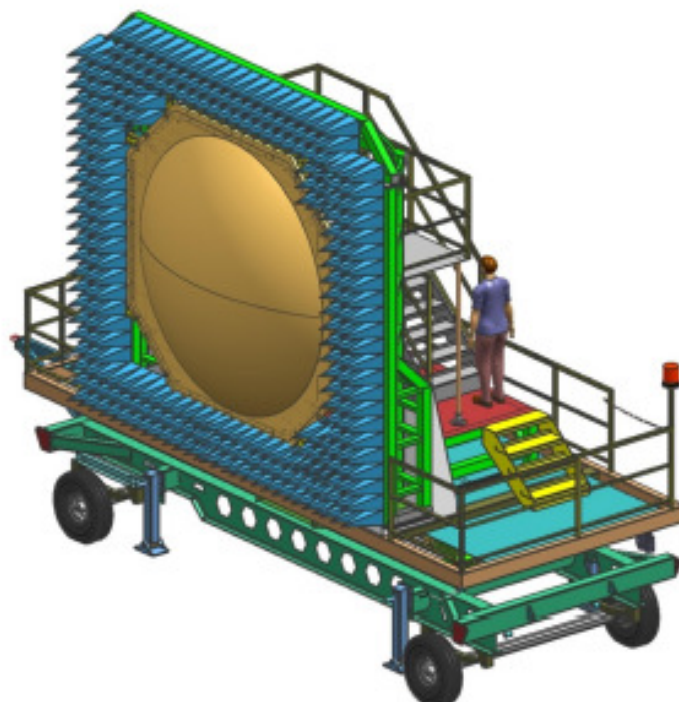
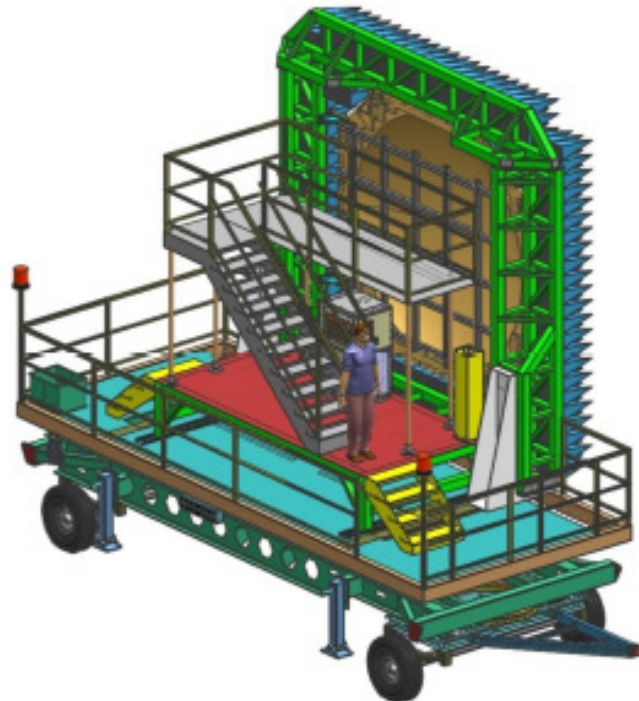
- Name: **TRAILER FOR AN INTEGRATION JIG**
- Manufacturer's number: **BEML LTD**
- Serial number: xxxxxxxx
- Date of manufacture:, xxxxxxxx
- Customer product number: **C72404001097**

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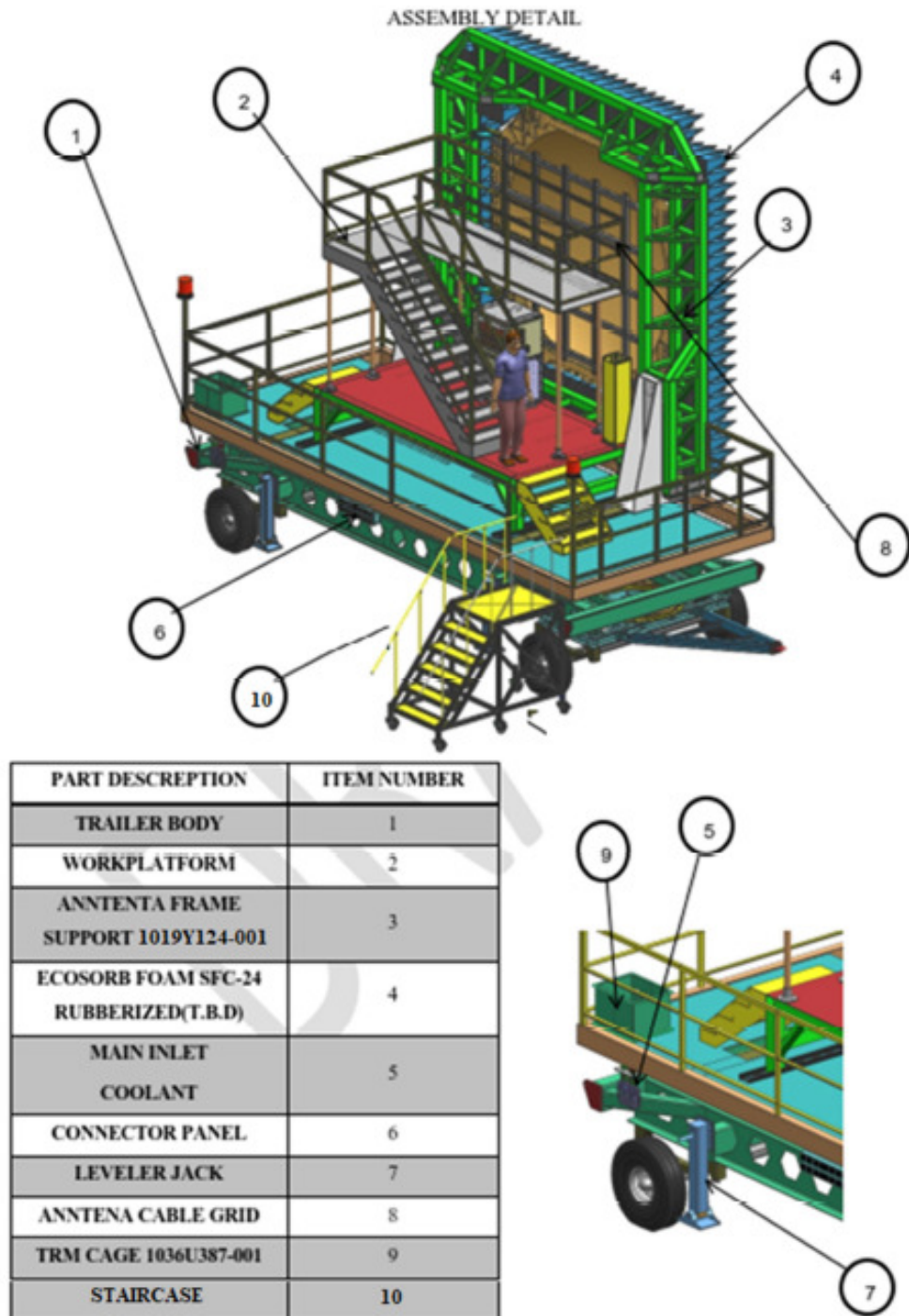
APPENDIX A

ILLUSTRATION 1: Schematic depiction of the trailer with the tool for assembling the antenna frame and beams assembled on it



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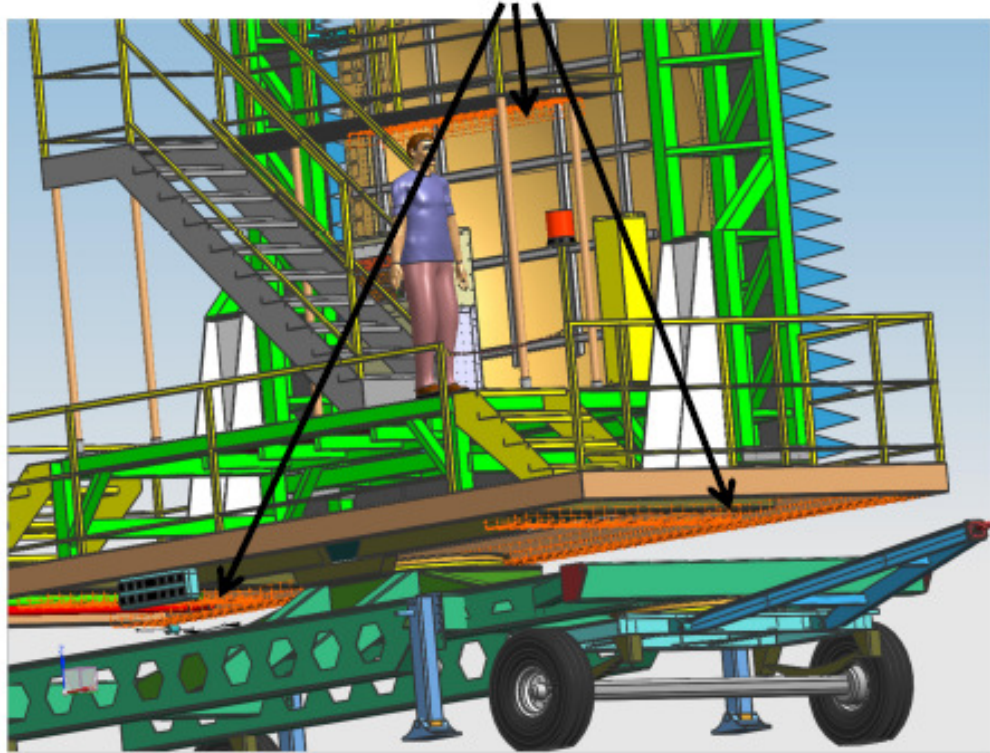
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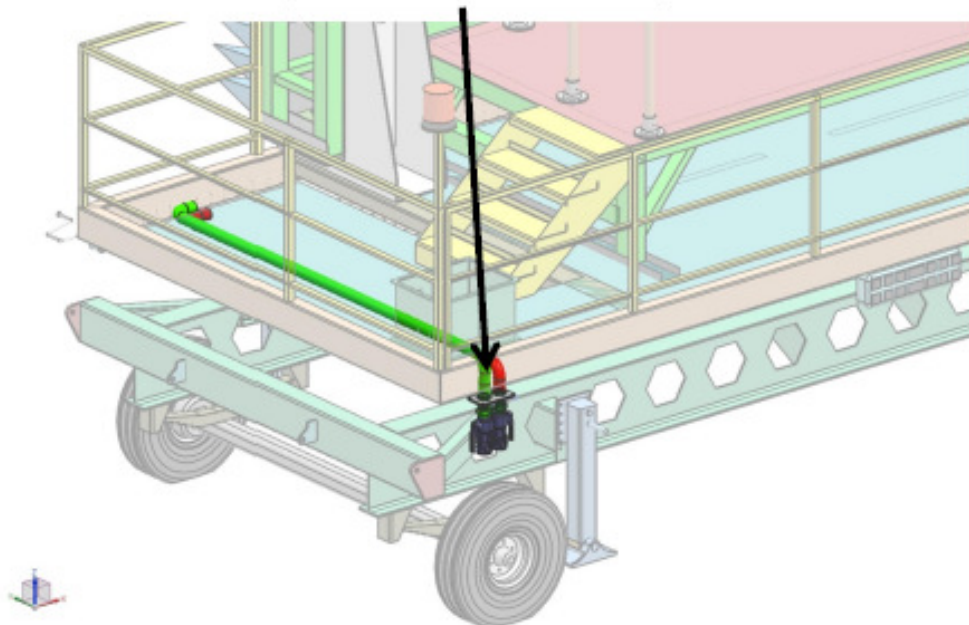
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CABLE CANAL AND PIPES LOCATION

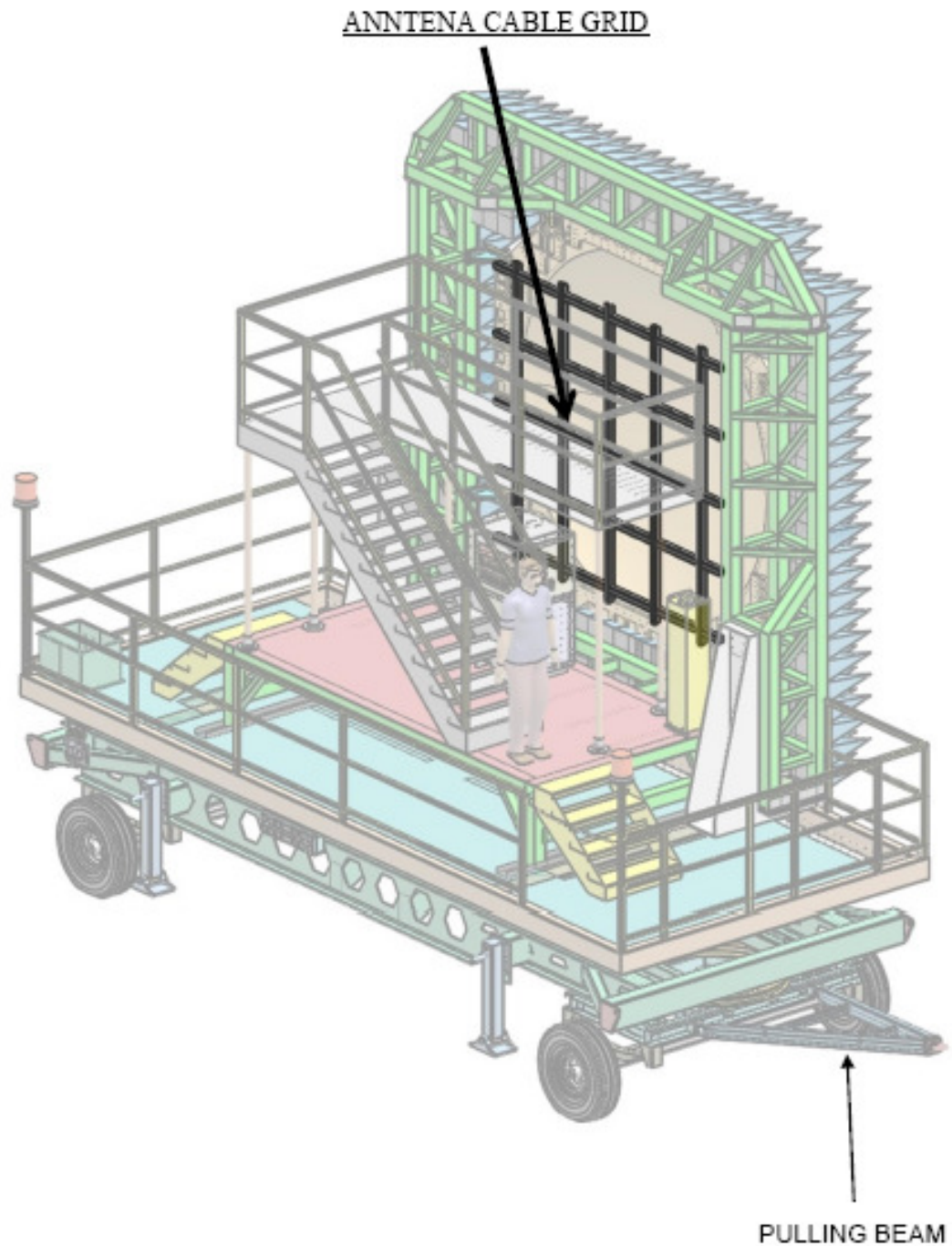


HEAT/COLD PIPES LOCATION



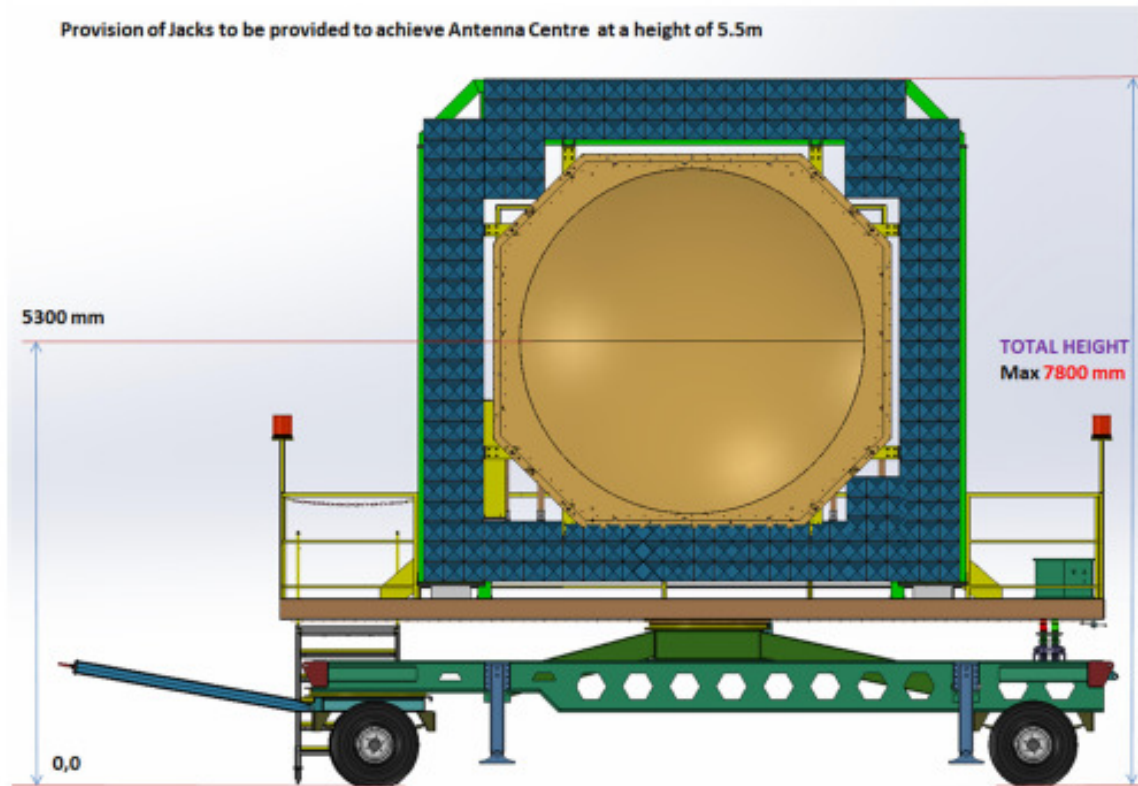
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Notes:

1. Pulling beams should be of detachable type.
2. Maximum length of the trailer should be within 7810 mm.
3. Maximum width of the trailer should be within 3.3 m excluding staircase to climb the trailer from chamber floor.
4. Maximum height of the trailer with Antenna frame support mounted should be 7800 mm.
5. Maximum weight of the trailer including antenna mount should be within 20 tonnes (including the Dead weight / Counter weight to be added for stability purpose)
6. Wheel base of the trailer should not be less than 2m.
7. Ecosorb Foam SFC-24 is not in vendor scope.

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4. PROGRAM STAGES

Program staged considered as follows

1. PO Placement - T0
2. Preliminary Design review - T0 + 5 Days
3. Detailed Design review. - T0 + 10 Days
4. Preparation for production & Development- T0 + 15 Days
5. Factory Acceptance and integration tests at vendor facility - T0 + 40 Days
6. Delivery - T0 + 45 days
7. Support during integration and Factory Trails - 1 week
8. Training to BEML & customer - 2 Days

5. PRELIMINARY DESIGN REVIEW: (will be scheduled after 5 days from the release of PO)

Conceptual Design (3D model) will be provided by BEML

OEM should provide the following technical details to full fill the PDR requirement.

1. OEM should make the preliminary design, design document to be provided
2. 3D model to be carried out based on the design, to be submitted
3. Finalize all the features of Trailer as listed in Technical specification document.
4. OEM should participate in Design review meeting with BEML at Bengaluru
5. The above deliverables will be reviewed & accepted by BEML.

6. CRITICAL DESIGN REVIEW (CDR) : (will be scheduled after 10 days from the release of PO)

OEM should provide the following technical details to full fill the CDR requirements.

1. Detailed 3D models of Assy. Trailer to be provided in Pro/E Wildfire (Ver. 5) preferably / STEP neutral format shall be provided in case of other 3D modeling software used.

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2. 2D installation and assembly drawings of Assy. Trailer to be provided along with the BoM.
3. Finite element analysis (Stress & Displacement), analysis report to be submitted along with the verification report.
4. Stability analysis for the Trailer with Payload, analysis report to be submitted.
5. Proof of the Trailer's stability during travel and parking at a maximum angle and wind speed of 50 km/h on the equipment is required. (FE analysis / Hand calculation to be carried out & report to be submitted.
6. Plan for Factory Acceptance Test (FAT) which will be conducted at OEM premises along with the time schedule.
7. Design Calculations for Assy. trailer, counter weight required on the trailer to compensate the payload (Jigs with Antenna mounted, which is eccentric on the trailer platform)
8. Full specification, design assumptions, strength calculations for structural durability and accuracy under antenna weight, safety proof, lifting facilities that serve the workers on the facility, and facility testing and reliability. In addition, 2 D drawings and models to be presented, describing the form of realization, dimensions and weight estimation. Do not change the product without written permission of the technical coordinator of BEML after this review.
9. List of Spares for Maintenance & Repair of Trailer to be supplied as part of Contract to be shared.
10. ATP documents to be prepared & submitted for approvals
11. OEM should participate in CDR meeting at Bengaluru & make a presentation.
12. The above deliverables will be reviewed & accepted by the BEML.

7. DEVELOPMENT

1. Development activities of the Assy trailer (including the procurement of materials and hardware items, bought out items) shall be started based on the approval of design with CDR recommendations.

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2. The Assy trailer should incorporate all the features that are finalized in the PDR and CDR.
3. The bought out items are to be procured and inspected as per specifications.
4. The integration work is to be reviewed and necessary modifications are to be carried out where applicable.
5. Cleaning: All steel parts to be painted shall be ensured, complete removal of grease, rust, scale, corrosion, slag etc.
6. OEM shall recommend the spares for Assy Trailer.
7. OEM shall agree for Life Time Buy (LTB) with 30 year product support.
8. Design and Development IP rights for the Trailer will be property of BEML.

8. SCOPE OF SUPPLY

8.1 Storage, Packing, Crating and Marking

- The OEM shall provide all packing, crating and markings necessary for logistics during delivery of the complete set of Assy Trailer as per the specification, associated spare parts, special tools and testing equipment. Each component / Assy. shall be packed to withstand transit damages.
- The OEM shall provide the instruction for proper storage, handling and functions of components supplied by the OEM.
- All items shall be labeled with the maker's name and the type, discrete serial number and rating, and the data of manufacture of the equipment.

8.2 Deliverables

S/N	BEML P/N	Description	Qty / Eqpt
1	651 ZZ 02001	Assy Trailer for an Integration Jig of Large Antenna	1 No
2	651 ZZ 02002	Spares and tools required for Trailer	1 Set

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1. Design related document consists of the following (Sl. Nos 1.1 to 1.8) - Qty: Each one set soft copies (in DVD), one set hard copies.

1.1	BoM in Excel
1.2	2D installation and assembly drawings in AutoCAD
1.3	Detailed 3D Model of entire Assy Trailer for an integration Jlg of Large Antenna [Pro/E Wildfire (Ver. 5) preferably / STEP neutral format shall be provided in case of other 3D modeling software used.]
1.4	Design & Analysis Documents (Manual & FEM and other analysis for part & assembly)
1.5	Final Configuration documents
1.6	Detailed Technical Feasibility Study Report including all analysis
1.7	Activity Plan (PERT, GANT & Road Map)
1.8	Parts Catalogue (Salient features & specifications with 3D illustrations and exploded views)

2. Manufacturing Documents consists of the following (Sl. Nos 2.1 to 2.5) - Qty: Each one set soft copies (in external hard disc/CD) and one set hard copies.

2.1	Quality Assurance Plan (QAP)
2.2	QT/AT & Acceptance Test Plan (ATP)
2.3	Inspection Report Sheets (IRS)
2.4	Necessary material certificate is emphasized. But heat treatment sample and certificate shall also be supplied
2.5	Welding test certificates

3. Users Documents consists of the following (Sl.Nos 3.1 to 3.4) - Qty: Each one set soft copies (in external hard disc/CD) and two sets hard copies (this should supplied for each vehicle)

3.1	Technical Description manual (TDM)
3.2	Technical Repair manual (TRM) consisting of maintenance, overhaul, repair, etc.,
3.3	Operating Instruction and User Manual

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3.4	Illustrated Spare Parts List in text & Album (ISPL)
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4. Approvals for all the manuals should be obtained from BEML before delivery.
5. Performance Guarantee & Warranty as detailed further in the document.
6. The OEM should supply the Maintenance spares, special tools for periodic maintenance activities of the Assy Trailer for the specified period (2 years).
7. Inspection check lists for safe operation of the Trailer
8. Tools: The tools shall be categorized as follows:
 - General Maintenance tools: OEM to provide all necessary tools
 - Special maintenance / over hauling tools: OEM to provide all necessary special maintenance tools required for overhauling.

9. ACCEPTANCE CRITERIA

QUALITY ASSURANCE REQUIREMENTS

9.1 ACCESS TO QUALITY ASSURANCE

The manufacturer should operate pursuant to the quality assurance procedures defined by ISO 9001.

9.2 ACCEPTANCE TESTS

- The acceptance tests will be performed at the customer's site and will also include installation of the equipment / antenna on the trailer.
- The manufacturer should prepare the acceptance procedure, which will be based on the verification of all the items in the specifications. The manufacturer should submit the procedure for approval.
- The acceptance of the products is subject to the approval of the technical coordinator or the person customer authorizes, and approval of the plant inspectors.

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9.3 TESTING [Factory Acceptance tests (FAT)]

1. Trailer should be tested as per the ATP document finalized by BEML at OEM premises.
2. Electronics items used shall have certification for having qualified environmental tests as per the technical specifications.
3. Testing of Assy Trailer to be carried out with the following test conditions.
 - i) No load condition
 - ii) With load condition (Dummy load to be demonstrated to check the stability of the trailer similar to the Antenna mount)
 - iii) Checking the parts against BoM
4. FAT schedule will be informed well in advance to BEML.
5. For any failures during FAT, OEM shall, at his own expense, take necessary action to rectify including design changes (if any), to the satisfaction of the BEML.
6. Following points shall be complied during FAT:
 - i) The BEML and OEM shall present a mutually agreed comprehensive FAT Program before the commencement of actual testing.
 - ii) All the costs incurred during rectification / failure analysis shall be borne by the OEM.

10. SUPPORT DURING INTEGRATION & TRIALS

OEM shall also participate at BEML during integration / performance evaluation tests at customer site, if required.

11. TRAINING:

1. The OEM should provide Training to BEML reps for a day. The training shall cover the following minimum topics
 - i. Operation
 - ii. Mounting & Dismounting
 - iii. System safety
 - iv. Maintenance

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- v. Replacement of spares, etc.,
 - vi. OEM shall provide tentative training program & schedule.
 - vii. Do's and Dont's
2. OEM should provide 1 set of Hard & soft copies for all the necessary training aids & materials. After completion of the training, training aids and materials used shall become the property of BEML.

12. WARRANTY

Notwithstanding inspection & acceptance by BEML of the hardware under this contract or any clause concerning the conclusiveness thereof, OEM shall provide warranty for a period of 24 months from the date of delivery of Trailer & acceptance by BEML at EM division, KGF, that hardware is free from defects / failures due to workmanship, material or manufacturing non-conformance. The OEM shall be responsible for any defect or failure of trailer, special tools, test and diagnostic equipment, maintenance and unit exchange spares due to defective design, material or workmanship.

The repair and/or replacement of failed components and installation of repaired/replaced components shall be taken by the OEM on his own charge at the Site.

The OEM shall bear custom duty, freight charges and all other expenses involved in collection of defective components and equipment from the Site, and transportation to the manufacturer's works in India or abroad and its return to Site after repairs.

Further, OEM should do any design modification required to any components or equipment as a consequence of failure analysis and modification shall be carried out free of charge.

The OEM shall carry out all replacement and repairs under the warranty promptly and satisfactorily on notification of the defect by BEML immediately.

13. MATERIALS AND WORKMANSHIP

The OEM shall be responsible for meeting the requirement of constructional details, materials & workmanship. All materials and workmanship shall be in every respect in accordance with the proven up-to-date best practice.

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All the components used in the construction of this supply shall be from fresh and present stock and not from older stocks. OEM shall provide necessary material certificate to this effect.

100% visual inspection of all components shall be carried out and the components/assemblies shall be free from any defect. Stage inspection to be carried out. All threaded fasteners should turn freely without jamming and to be lubricated wherever called for.

14. PRODUCT SUPPORT:

The OEM shall be required to confirm that, he is in a position to provide product support in terms of maintenance, material and spares for a period of minimum 30 years. The OEM must provide at least 2 Years notice to BEML before closing the production line so as to enable "LIFE TIME BUY" of all the material & spares before closure of the production line. All upgrades & modifications carried out on the equipment during the life cycle must be intimated to buyer.
