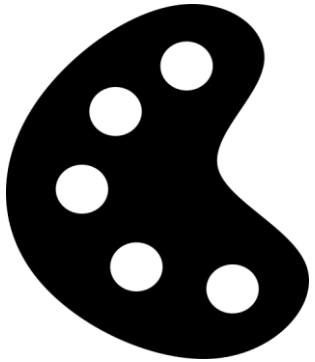


ADM Relative Navigation Test Facility (ART) Development

Clean Space Days 2026

2026.07.01.

ESTEC, Noordwijk (NL)

CONTENT

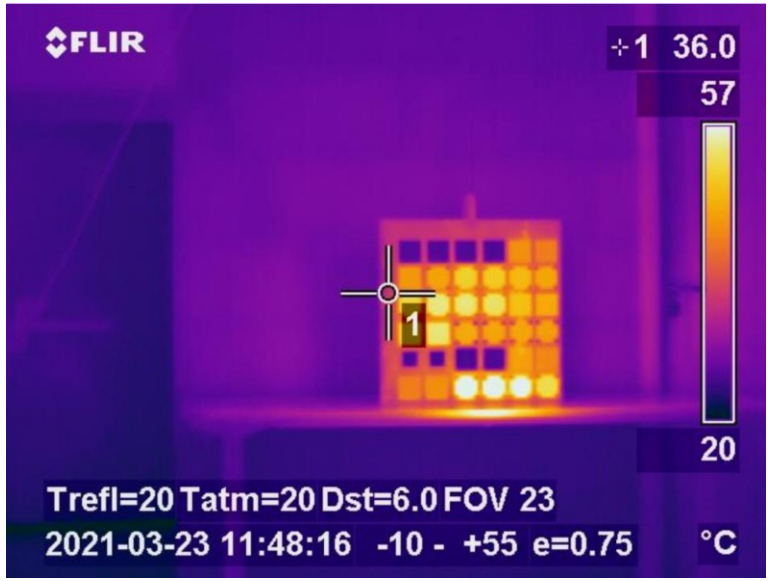
OBJECTIVES

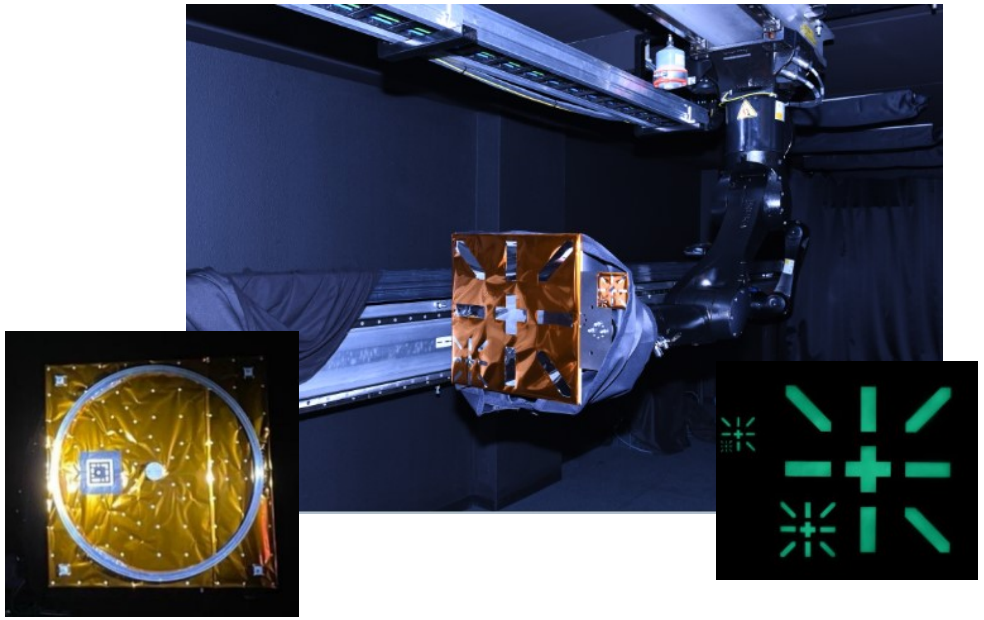
Objective is to develop a test facility for GNC- and IOS-related purposes within two years. Facility would be utilized in technology development and testing for active debris removal, in-orbit servicing and refilling.

INTRODUCTION

BACKGROUND

ADM performed studies on TIR navigation with the GNC section (TIRVOA, PEMSUN) and is currently working with the Space Safety Programme (Cleanspace branch) developing Markers Supporting Navigation (MSN, M2N, PHM).





STATE-OF-THE-ART

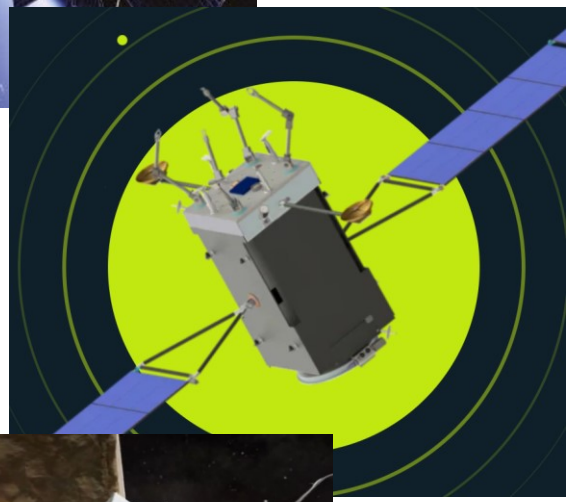
Testing RPOC (Rendezvous, Proximity Operations, and Capture) system designs and control algorithms require the simulation of the following parameters:

1. **Kinematics and dynamics of six degree-of-freedom (6DOF) relative motion of multiple space objects**
2. **Contact dynamics of multi-body systems in microgravity**
3. **Lighting conditions on orbit**
4. **Characteristics of real time space communication links**

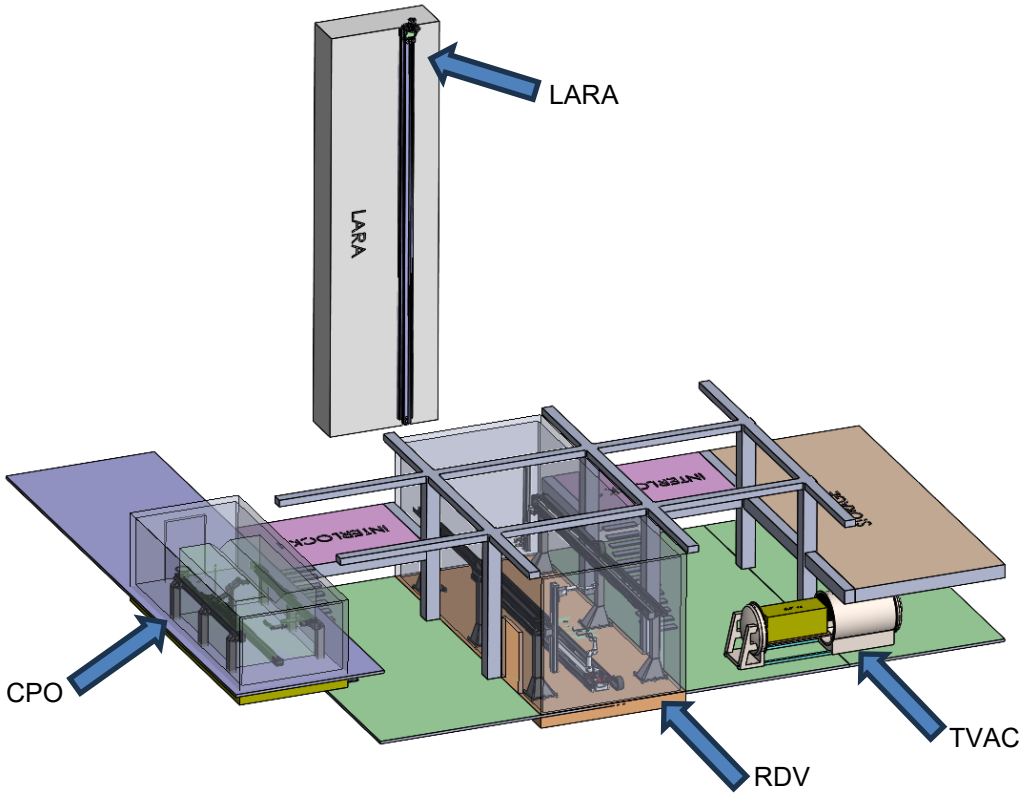
Contact dynamics simulation will not be implemented in ART. It will rather focus on the thermal aspects.

USER NEEDS

Target clients - besides Admatis' own developments – are startups, SMEs and institutes that don't have their own facilities. By 2030, the European in-orbit servicing market is estimated to reach more than 5 billion alone, with a growth rate of 11.5 percent per year.

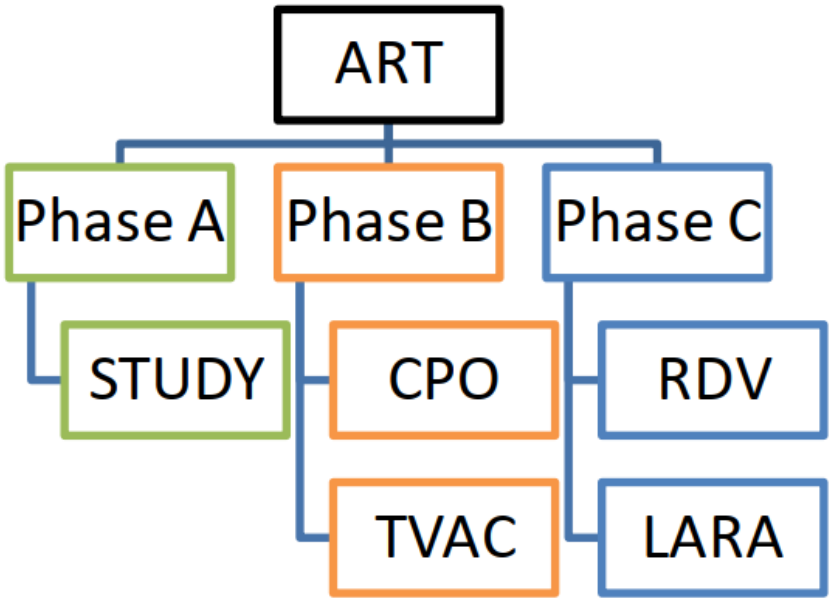


CONCEPTUAL DESIGN



- About 530m2 floorspace has been allocated to the proposed test facilities at ADM's Lorantffy site.
- Interior will be remodeled to provide a clean, ESD-safe working environment to ADM employees and customer representatives.
- Site will be equipped with a PV system to reduce greenhouse gas emission.

CONCEPTUAL DESIGN

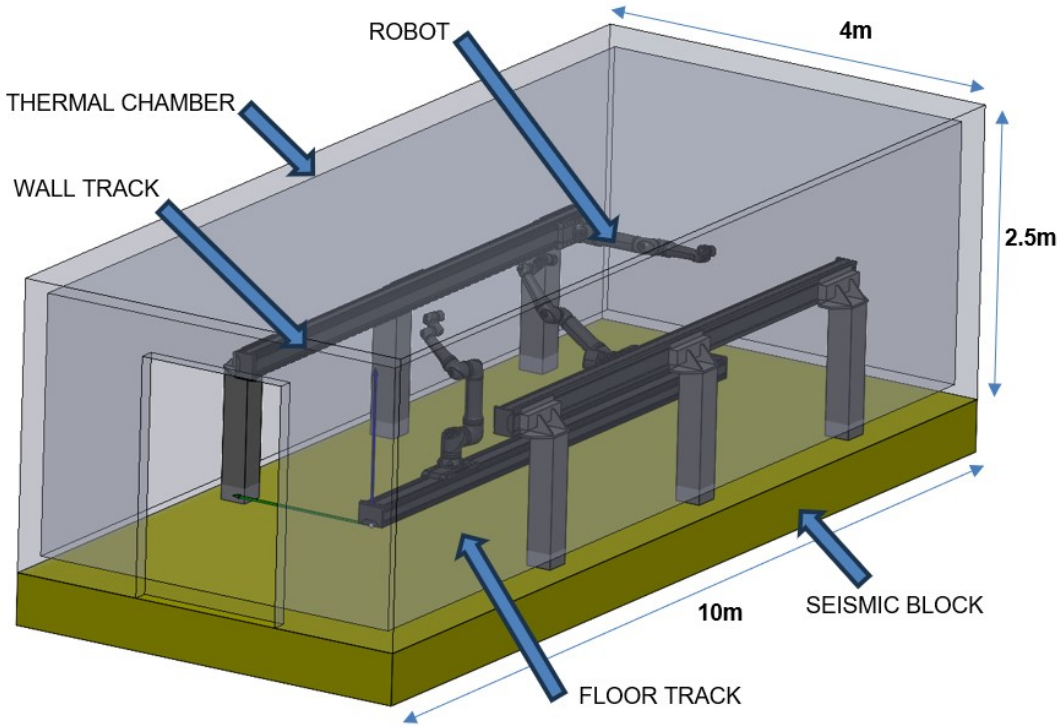


CPO: Close-Proximity Operations Facility
TVAC: Thermal Vacuum Facility
RDV: Rendezvous Facility
LARA: Laser Ranging Facility

Multi-phase development approach is proposed aiming to reach full functionality of the Close-Proximity Operations (CPO) & Thermal Vacuum (TVAC) facilities within 2 years.

CONCEPTUAL DESIGN

CPO FACILITY



- CPO is a robotic facility designed to test GNC hardware within their operational temperature range.
- Components are mounted onto a thermally insulated seismic block and surrounded by custom thermal chamber capable to maintain the temperature of the enclosure between -30°C and +50°C.
- Platform features three (3) linear motor-driven robot tracks compatible with the above-described temperature range. Tracks provide 5micron repeatability over their 5m travel distance. Each track is equipped with a 6DOF universal robot having 30kg maximum payload capacity and 1.3m maximum reach.

CONCEPTUAL DESIGN

BASELINE ROBOTS

- 5m long, linear motor-driven robot track with 350kg payload capacity and -30°C to +70°C operational temperature range (TBC).

- 6DOF cobot with 30kg payload capacity, 1.3m maximum reach and 0°C to +50°C operational temperature range.

CONCEPTUAL DESIGN

BASELINE ILLUMINATION SYSTEM

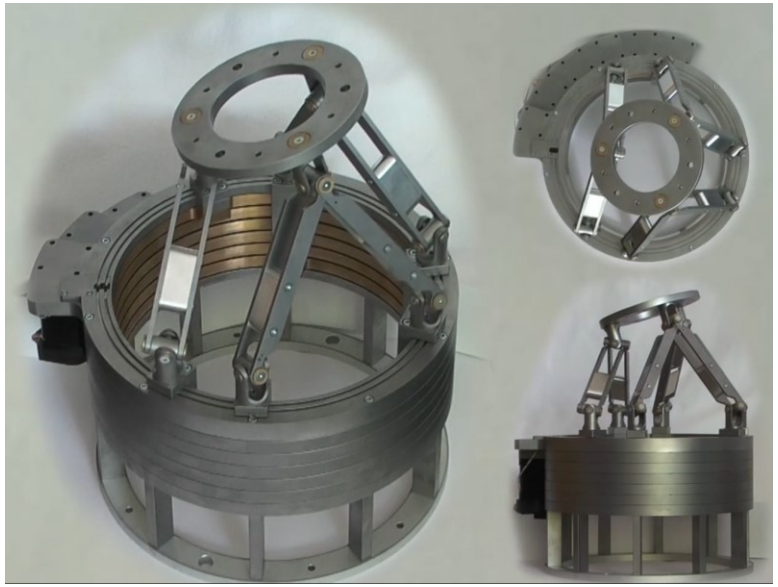
Sunbrick™ AM0 Solar Simulator for Aerospace

- Class AAA <20 cm by 20 cm
- Up to 36 tunable LED channels to allow you to probe spectral regions of interest
- Replicate AM0 to AM 1.5 or beyond with the click of a button, for all altitudes of flight
- Python API and LabView DLL to enable automation and scripting for cycling and long-term testing.

CONCEPTUAL DESIGN

OPTIONAL ROBOTS

- 6DOF precision hexapod with 30kg payload capacity and 0.1micron repeatability.
- Operational temperature range is -10°C to +50°C.



- 6DOF precision rotatable hexapod with 15kg payload capacity and 1micron repeatability.
- Operational temperature range is -30°C to +50°C (TBC).

CONCEPTUAL DESIGN

ADM CONTRIBUTION TO CPO

- **ADM owns a Prosilica GT4400 VNIR camera having 4432 x 4436 pixels resolution and 3.45micron cell size. The operational housing temperature range is -20 °C to +50°C.**

- **ADM owns a GOBI 640+ GigE TIR/LWIR camera having 640 x 480 pixels resolution and 17micron cell size. The operational housing temperature range is -40°C to +60°C.**

CONCEPTUAL DESIGN

OPTIONAL CPO CAMERAS

- Goldeye Pro G5-530 TEC1 VSWIR camera having 2592 x 2056 pixels resolution and 3.45micron cell size. The operational housing temperature range is -20 °C to +55°C.

- JenaOptronic µRVS LiDAR having 40° x 40° FoV and 1-70m operating range. The operational housing temperature range is -30°C to +50°C (TBC).

CONCEPTUAL DESIGN

BASELINE CPO TRUE POSITION MEASUREMENT SYSTEM

- ADM owns a Creaform 3D optical measurement system which has about 17m^3 measuring volume at 70microns accuracy.
- System can be upgraded to be able to track up to 6600 targets with <0.1mm accuracy.
- The operational temperature range is 5°C to +40°C.

CONCEPTUAL DESIGN

OPTIONAL CPO TRUE POSITION MEASUREMENT SYSTEM

Leica Absolute Tracker AT960

Leica T-Mac

- 7DOF measurement data for real-time robotic control using a laser tracker in combination of several control sensors.
- Measuring range is 60m at 70microns accuracy.
- The operational temperature range is 0°C to +40°C.

CONCEPTUAL DESIGN

TVAC FACILITY

- Core element is an LN2-cooled thermal vacuum chamber capable to reach -180°C to +150 °C in high vacuum or inert gas atmosphere
- Baseline solution is a standard HVT1000 chamber having 0.94 m^3 working volume and 600 x 900 mm thermal plate size.
- This version would provide about 1:5 test distance reduction compared to CPO.

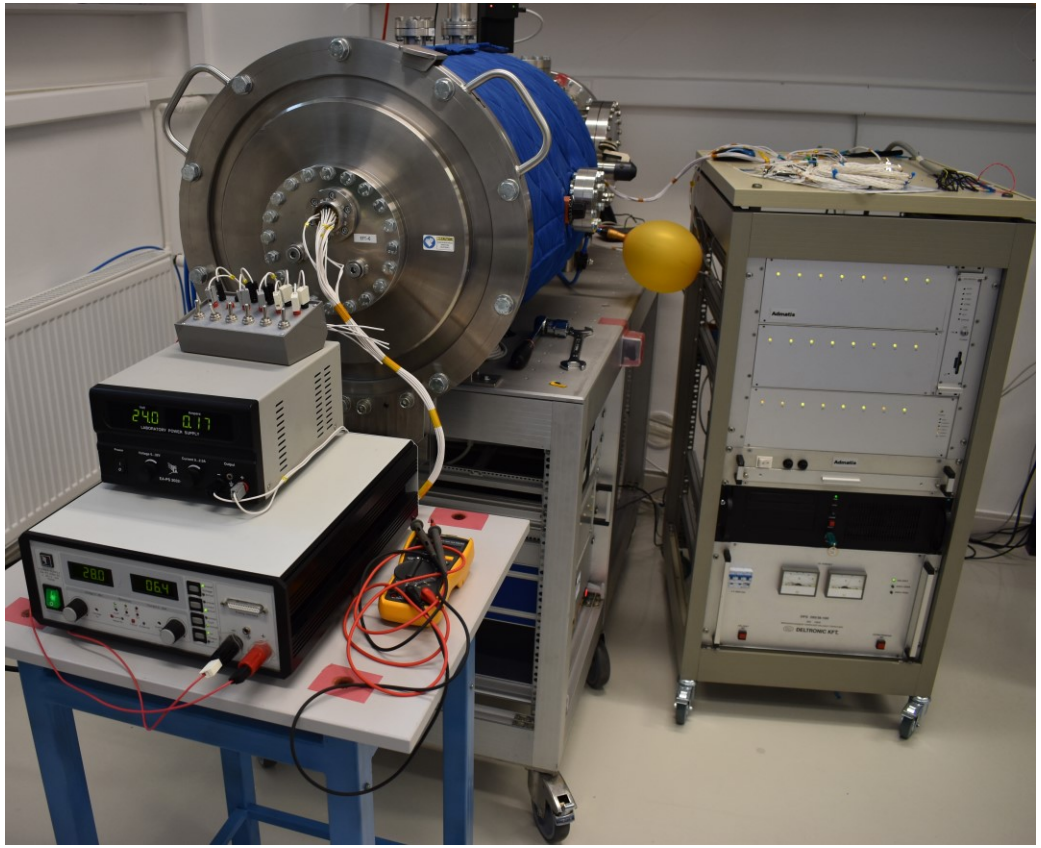
CONCEPTUAL DESIGN

TVAC FACILITY

- Optimum solution would be an extended length version of the HVT2700 system with a 2.2m long thermal plate.
- This version would provide about 1:2 test distance reduction compared to CPO.
- Chamber will be equipped with IR transparent inspection window for detectors, and TQCM + RGA equipment for contamination monitoring.
- TVAC facility will operate in ISO 8 cleanroom (ISO 5 clean tent is an option)

CONCEPTUAL DESIGN

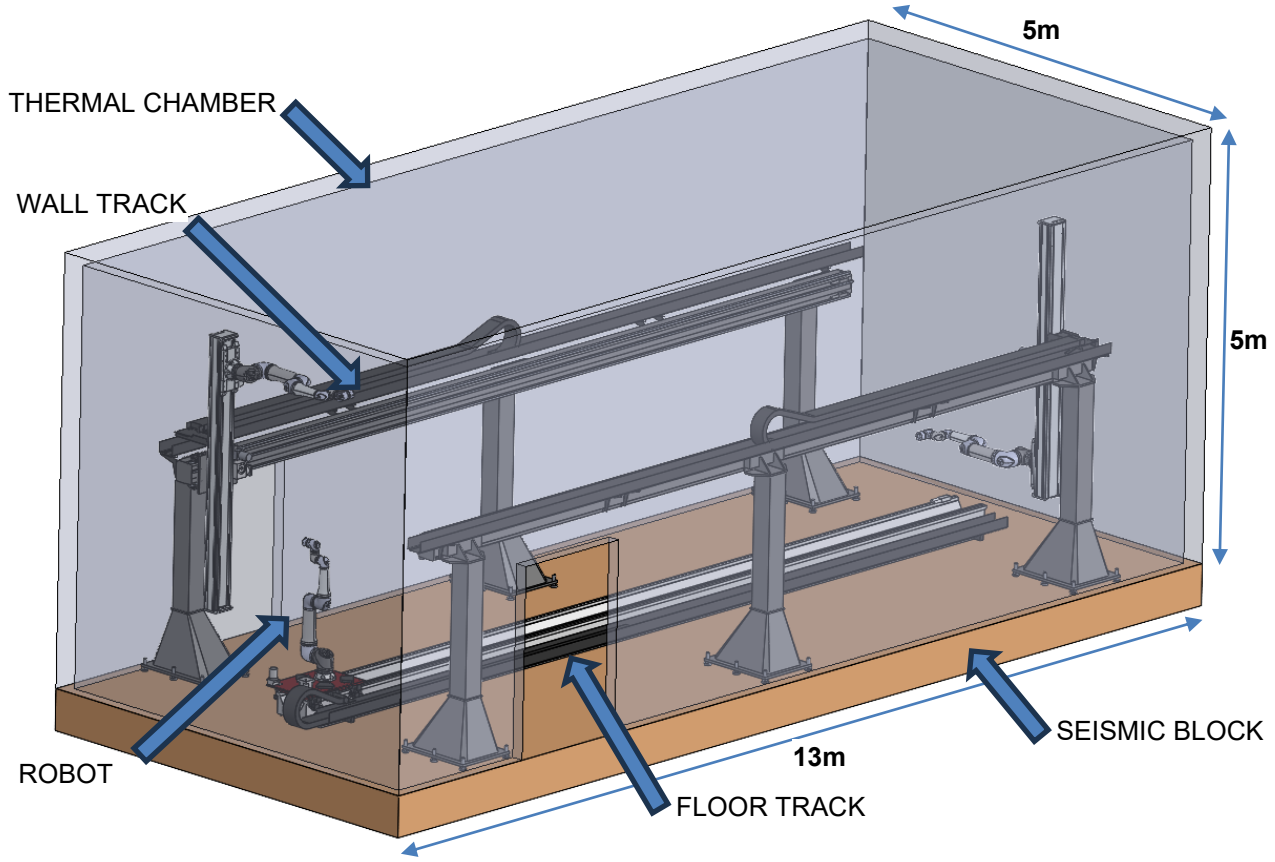
ADM CONTRIBUTION TO TVAC



- ADM owns a small TVAC chamber which covers the -70°C to 120°C temperature range without cold shroud.
- ADM owns a special EGSE which is capable to control up to 24 heaters and to measure up to 48 thermistors or thermocouples.
- Variety of thermal sensors are also available for test instrumentation.

CONCEPTUAL DESIGN

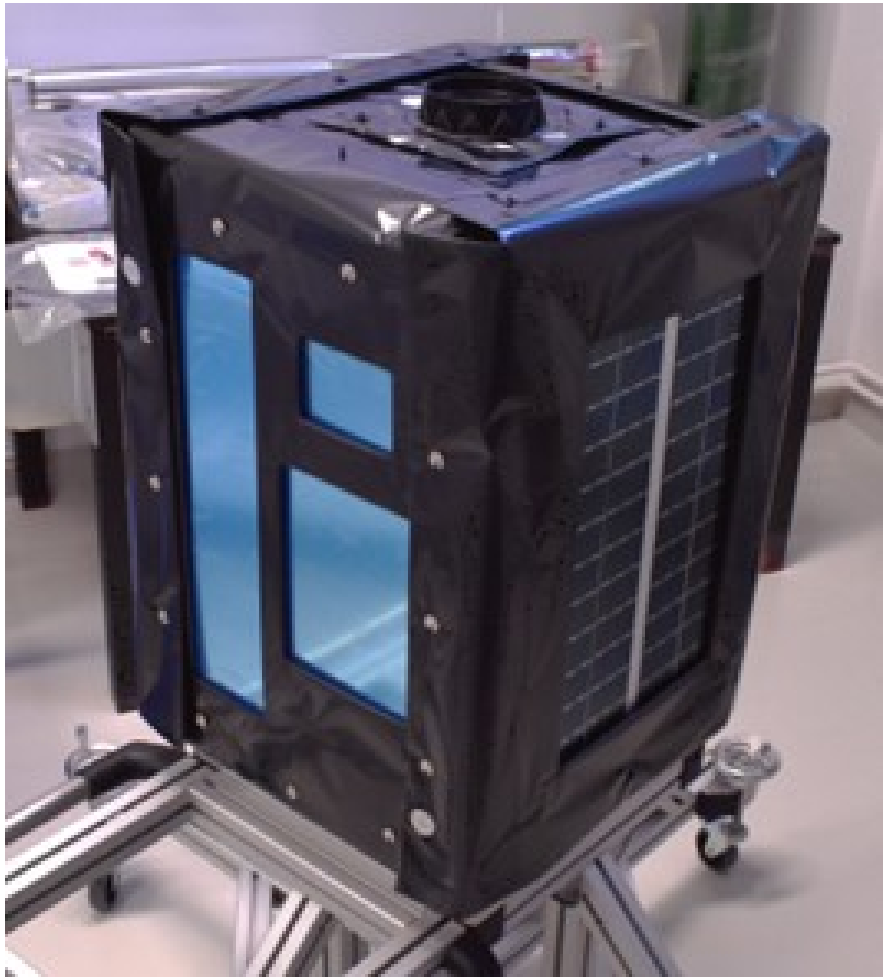
RDV FACILITY



- Components are mounted onto a thermally insulated seismic block and surrounded by custom thermal chamber capable to maintain the temperature of the enclosure between +5°C and +45°C.
- Significantly increased size, which also requires constructing the two wall-mounted robotic tracks as 2 DOF gantry-style systems in order to fully utilize the room's ~5 m ceiling height.
- Floor track is oversized to 2.5tons capacity to allow customer-provided robotic arms to be tested in the facility.
- ISO 8 cleanroom environment with ISO 5 option.

CONCEPTUAL DESIGN

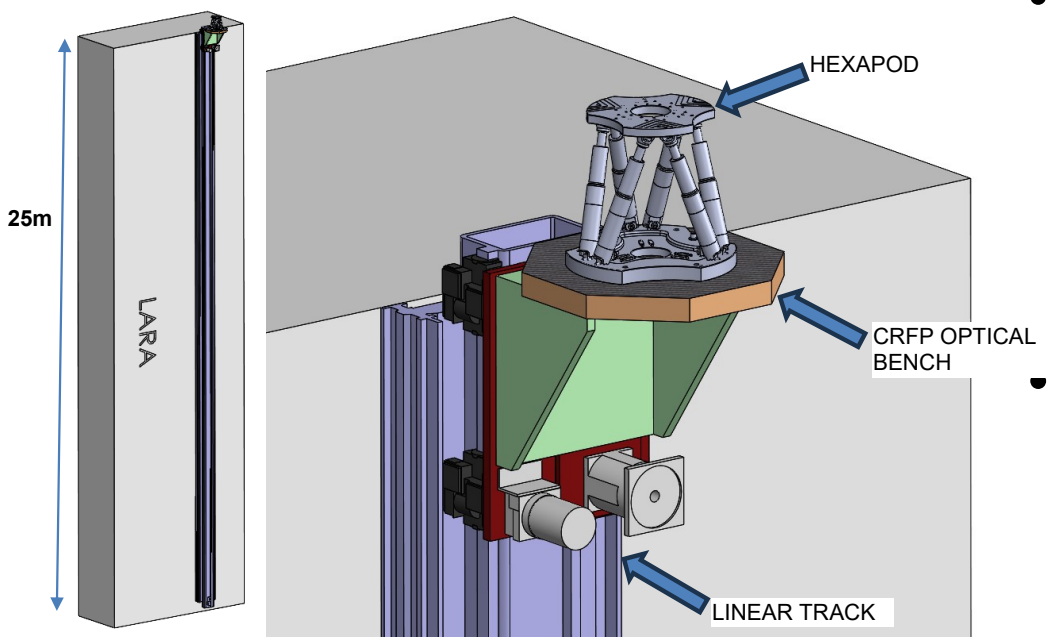
ADM CONTRIBUTION TO RDV



- ADMASAT is a 400 x 400 x 600 mm constellation satellite mock-up.
- It features different thermo-optical coatings, MLI, camera mock-up, hot and cold radiators, active thermal control, solar cells and interfaces for further hardware or appendages.
- Mock-up can be made thermally active during GNC test scenarios.

CONCEPTUAL DESIGN

LARA FACILITY



- The purpose of the LARA facility is to allow detection scenarios from extreme (~1 km) distances in uncontrolled conditions.
- LARA facility is composed of an outdoor platform tower of approximately 25 m height: a robotic linear track runs along its height, with a stable CFRP optical bench mounted on its carriage plate, upon which a precision hexapod is fixed.
- The variations in the platform tower's dimensions can also be characterized using a theodolite measurement system with targets placed on the tower.
- Main focus is on laser ranging with retroreflectors and LIDAR-based detection for navigation, but it might be also suitable for ground testing laser communication systems.

CONCLUSIONS

- ADM is capable to develop a test facility for GNC- and IOS-related purposes within two years at ADM premises.
- Facility will focus on the thermal aspects of technology development and testing for active debris removal, in-orbit servicing and refilling.
- Target clients - besides ADM’s own developments – are startups, SMEs and institutes that don't have their own facilities.