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PRO+ACT

Planetary Robots Deployed for Assembly and Construction of Future Lunar ISRU and Supporting Infrastructures

PRO-ACT testing campaigns 2020/2021

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PRO-ACT Overall details

- Funding: Horizon 2020, Grant agreement ID: 821903
- Programmes:
  - H2020-EU.2.1.6.1. - Enabling European competitiveness, non-dependence and innovation of the European space sector
  - H2020-EU.2.1.6.2. - Enabling advances in space technology
- Start date: February 2019
- Duration: 24 months
- Consortium: 9 organizations, 6 EU countries
- Website: https://www.h2020-pro-act.eu/

Consortium

Space Applications Services, Belgium

DFKI, Germany

PIAP Space, Poland

AVS, Spain

GMV, Spain

University of Cranfield, UK

Thales Alenia Space UK

LAAS CNRS, France

La Palma Research Centre, Spain

PRO-ACT Abbreviations

- ISRU – In Situ Resource Utilisation
- RWAs – Robot Working Agents
- OGs – Operational Grants
- CREW – Cooperative Robotics for Enhanced Workforce
- TRL –Technology Readiness Level
- ICD – Interface Control Document
- ICU – Instrument control unit
- EST – Environment simulation tool
- IMU – Inertial Measurement Unit
- ESA – European Space Agency
- ICU – Instrument Control Unit
- DEM – Digital Elevation Model
- CSLAM – Cooperative Simultaneous Localization and Mapping
- VSLAM - Visual Simultaneous Localization and Mapping
- F/T – Force/Torque
- COTS – Commercial Off-The Shelf
- VO – Visual Odometry
- FMS – Fluid Management System

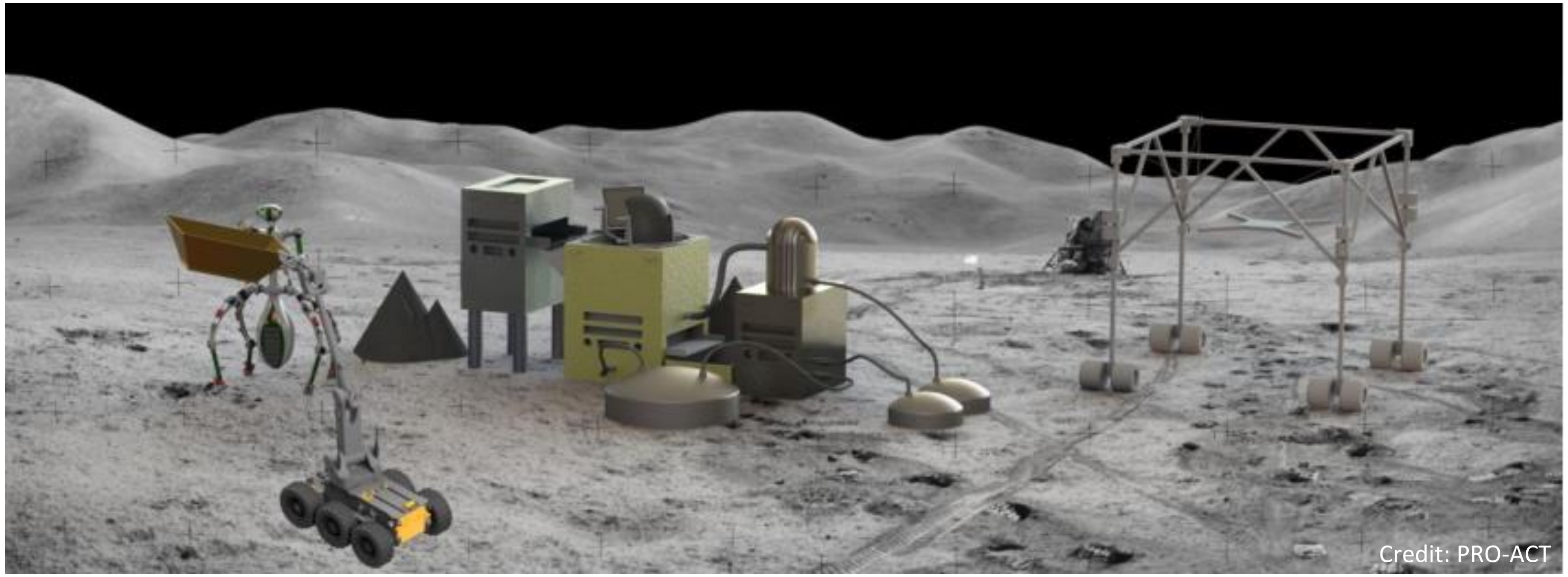
Concept and approach

The Moon is considered the next step in space exploration

In-Situ Resource Utilisation with lunar resources will enable developments

ESA wants to demonstrate the feasibility of ISRU in the next decade

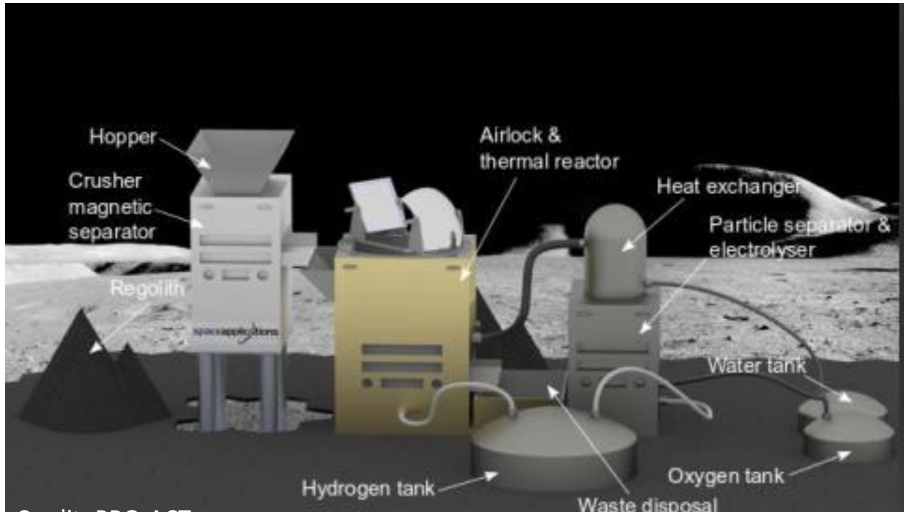
PRO-ACT deploys robots for collaborative approach as a precursor lunar base with essential capabilities in preparation of commercial exploitation of in-situ resources by assembling an ISRU plant and a mobile gantry for 3D printing building elements for future human habitation



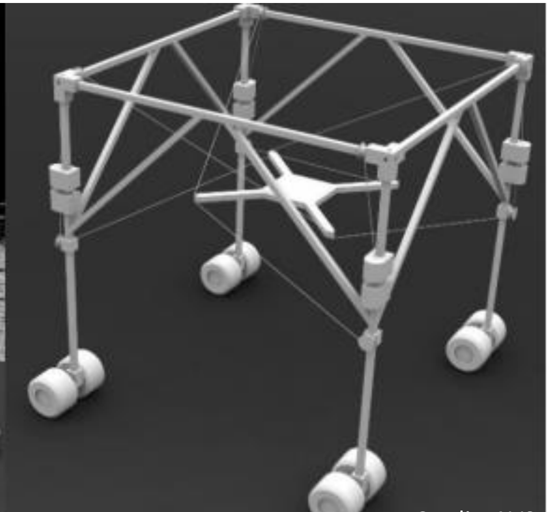
Credit: PRO-ACT

Concept and approach

- Cooperative scenarios will be based on:
  - 1) Fine scale surveying of areas prior to construction work
  - 2) Site clearing by grading stones and debris
  - 3) Unloading equipment/construction elements and transportation to assembly sites
  - 4) Assembly of specific modular components of an ISRU plant
  - 5) Assisting partial assembly and mobility of a gantry
  - 6) 3D printing of modular building elements from pseudo-regolith simulant
  - 7) Sample assembly of printed elements to construct sections of storage, habitation spaces or dust mitigation surfaces



Credit: PRO-ACT


Credit: AVS

Main objectives

- Implement and demonstrate the cooperative capabilities of the multi-robot system in a Moon alike environment, replicated at two analogue sites
- Review, extend and integrate previous OGs – Operational Grants - outcomes as part of a comprehensive multi-robot system
- Develop robust cooperation capabilities allowing joint interventions (navigation in close vicinity and joint manipulation actions) in mixed structured/unstructured environments
- Make the capabilities available within a CREW module
- Customize existing mobile robotic platforms and prepare facilities to perform tests and demonstrations in a selection of relevant scenarios of Moon construction activities

Impact

- PRO-ACT provides tools in preparation of the commercial exploitation of in-situ resources by assembling an ISRU system, essential for a future human settlement on the Moon
- PRO-ACT's vision of ISRU focuses on the extraction of oxygen from lunar regolith to serve as the oxidizer for fuel and artificial atmosphere generation within habitats and 3D printing of relevant structures using regolith for construction purposes (tiles for roads and elements for shelters). The mineral ilmenite, found in lunar rocks, is the perfect target for the ISRU platform as it contains oxygen, iron and titanium as construction materials
- Technology will reach a TRL 4/5 (depending on scenarios subparts), supporting exploration of the Moon in the next decade

The scenario

Site selection for an ISRU Plant

Approach the lander spacecraft and identification of the components to be unloaded

Unloading modules from the lander – ISRU plant components and 3D printer

Transporting mobile gantry trusses, beam connectors and ISRU plant components to assembly site

Assembly of the mobile gantry structure

Positioning the mobile gantry at a required location

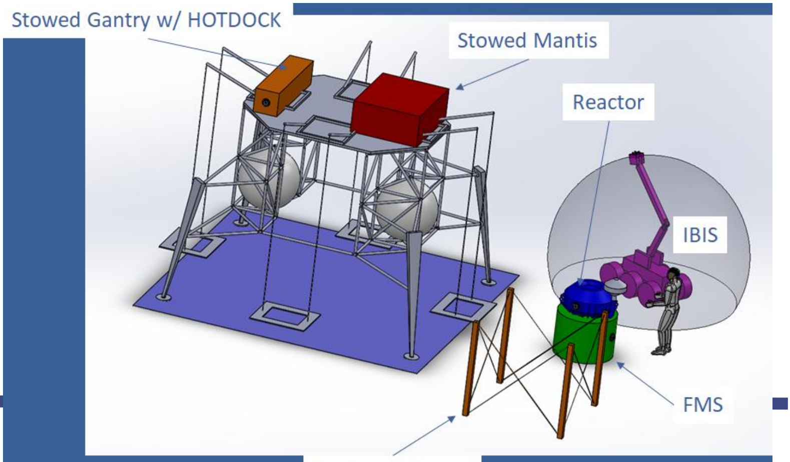
3D printing construction elements by the gantry

Preparation of dust mitigation surface around ISRU plant by laying 3D printed tiles or bricks

Drilling anchor points for pillars of the base of the ISRU plant

Assembly of the ISRU plant with all 3 RWAs

Loading regolith into the ISRU plant for extraction of resources

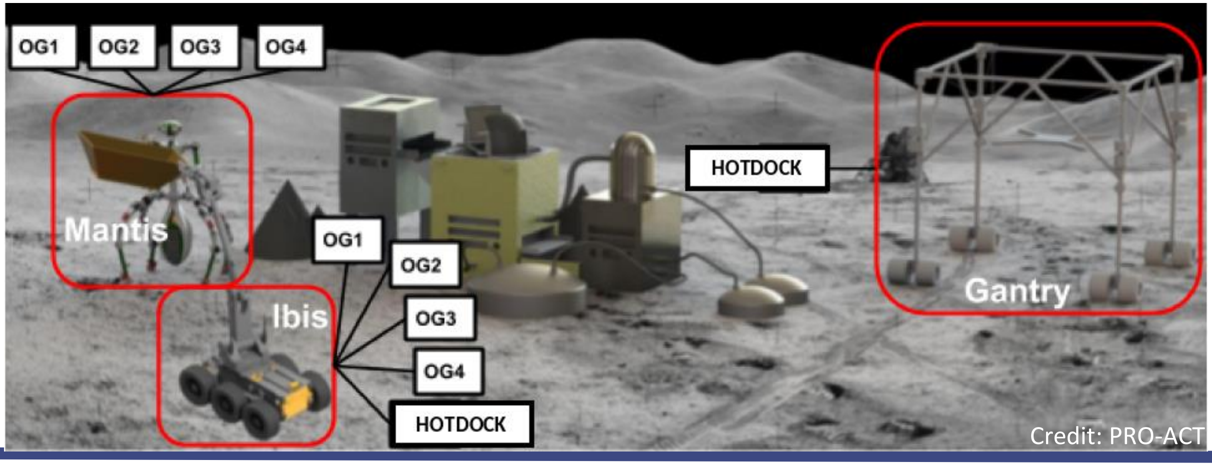


Credit: PRO-ACT

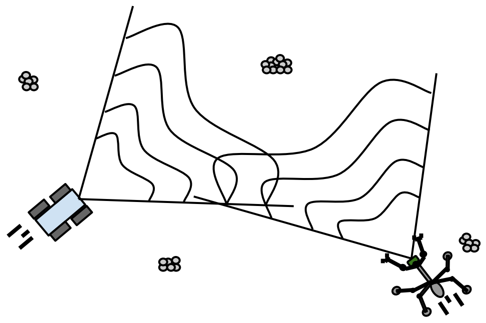
PRO+ACT

The scenario

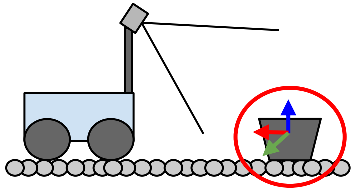
- The mission scenario links high priority scientific goals with the intention to utilize lunar resources, and human exploration scenarios, providing an excellent basis to demonstrate the technology
- Following the described scenario, the key robotic elements, namely the mobile rover Veles, the six-legged walking robot Mantis and a mobile gantry are outlined according to the corresponding mission architecture. The ISRU plant is sized to be representative of a future lunar mission, with grasping points to assist robotic manipulation capabilities and considering the effects of reduced lunar gravity
- The project aims to demonstrate the integration of common building blocks for robots that are composed to create functional and intelligent robotic agents



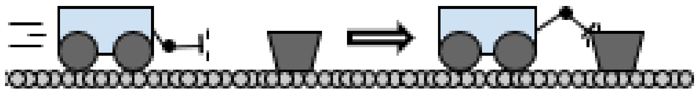
The scenario - tests



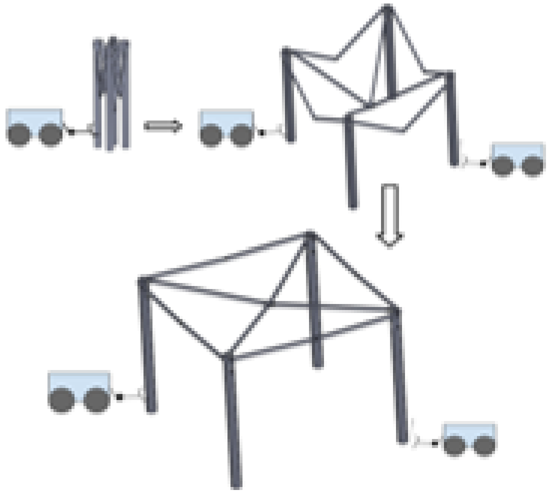
Cooperative area mapping



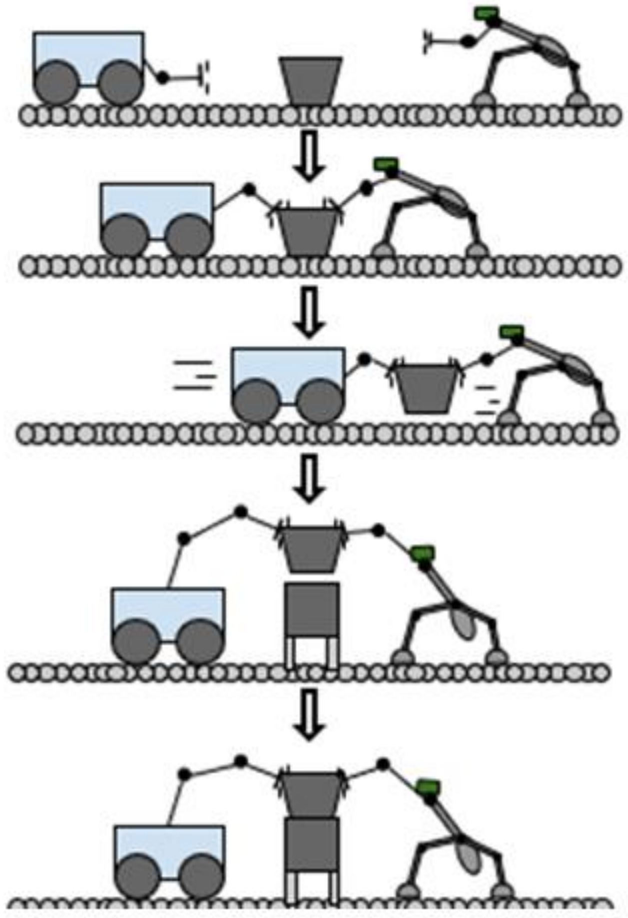
Detection and tracking of assets



Rendezvous and grasping



Gantry deployment



Cooperative manipulation (assembly) and transportation

The robots

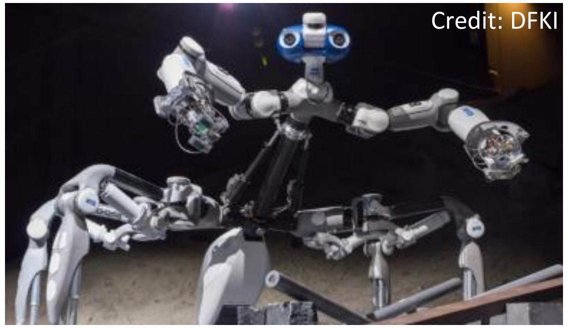
Veles

Characteristics
- Dimensions: 135 x 88 x 125 cm (LxWxH)
- Total mass: 300 kg
- Manipulator's maximum lift: up to 50 kg
- Manipulator's maximum range: 3,3 m
- Max radio transmission range: 600m
- No. of robot's cameras: 4
- Gripper
- Selection two COTS end-effectors: adapted drill and shovel
- Selection of COTS bucket for regolith transport

Credit: PIAP Space

Mantis

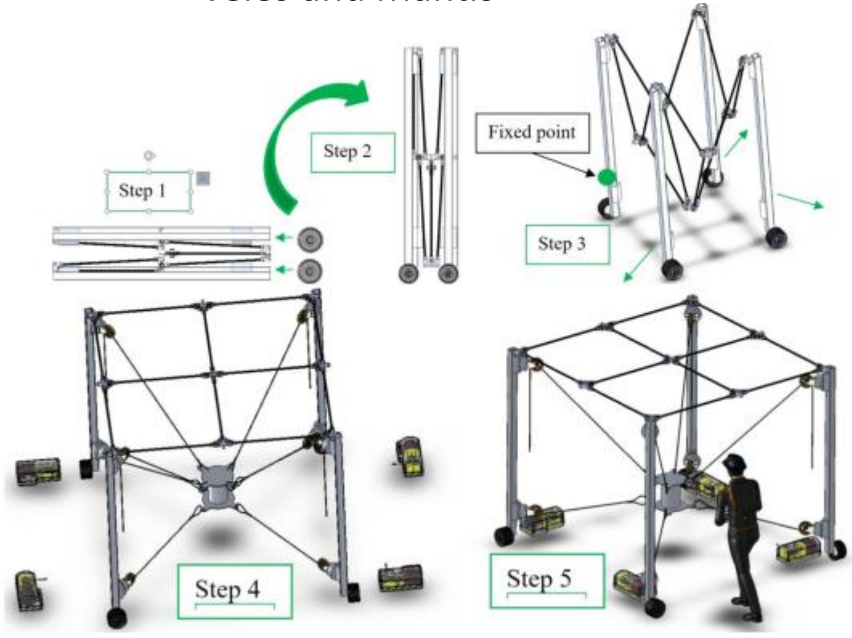
Characteristics
- Multi-legged robot with six extremities
- Flexible
- Total mass: 110 kg
- Locomotion mode – movement in difficult terrain
- Manipulation mode - dual-arm manipulation while being firmly grounded
- 3D laser scanner
- IMU



Credit: DFKI

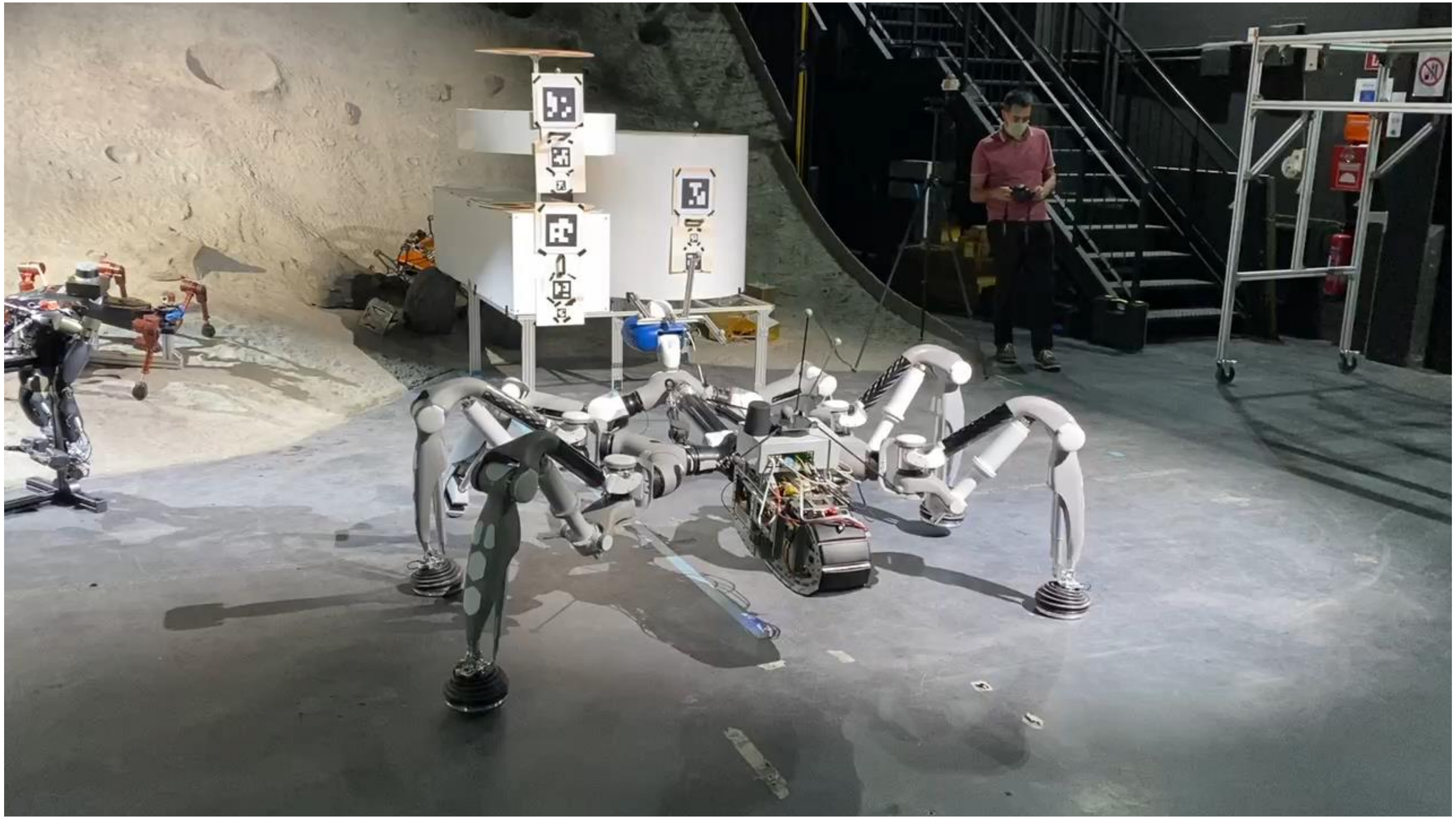
Mobile Gantry

Characteristics
- Modular mobile gantry solution for lifting, positioning and 3D printing
- Will be mounted with the help of Veles and Mantis



Credit: AVS

Lunar analogues and testing



Credit: PIAP Space

Credit: AVS

The PRO-ACT lunar analogue

- Lunar analogue: replicates the real lunar environment for testing purposes
  - Natural Analogue (outdoors)
  - Artificial Analogue (indoors) -> Final demonstration
- Advantages
  - Control the inside/outside environment (weather conditions)
  - Less logistical preparations and costs
  - Increased overall test-time
  - Facilitates outreach and dissemination activities

The PRO-ACT lunar analogue

- Where: Space Exploration Hall in Bremen, Germany (DFKI)
- Critical features for a more analogous setting:
  - Earth material as representative of lunar regolith
  - Space for the tasks/scenarios that need to be performed

- However, before the actual indoor demonstration…
  - Tactical preparation of the lunar analogue
  - Configuring for realistic simulation conditions
  - Handling logistics, working areas and power supplies
  - Preparing ground truth data
  - Adjusting lighting conditions

Description of the indoor lunar analogue layout

- Newly built regolith testbed within the actual Space Exploration Hall
  - Wooden frame, filled with simulant **~25 cm**
  - Connects into the crater area – **48 m2**
  - Weight is **~18 tonne**, density of sand of **1320 kg/m³**
  - Volume of sand is **~13,6 m3**
- Wooden gate (**width = 2,00 m**) and a removable ramp
- The regolith can be shaped by using available rakes
  - Hills, slopes and other terrain features can be set

Description of the indoor lunar analogue layout

- Regolith/Simulant - Sand from the Baltic Sea area
  - Shows adequate properties for the tests
  - Weight = **~18 tonne**
  - Light (**1320 kg/m3**) when compared with basaltic simulants (~3000 kg/m3)
  - Grain size = **0.1-1.0mm**
  - Respects Health and Safety guidelines (less dust)
  - Accommodates the movement and tasks of all robotic elements

Comparison between different simulants

Simulant	Size fraction	Composition	Advantages/Disadvantages
Baltic Sea Sand	**0,1-1mm**	**Granitic**	**Easy to access** **Low shipping costs** **Fits health and safety criteria** **Lacks some of the best physical qualities**
EAC-1	0,2-1mm	Basaltic	Used by the European Astronaut Center Special mixture of 0.2-1.0mm (65% 0.2-0.5mm and 35% 0.5-1.0mm), but very dusty and hazardous to health in enclosed rooms
HORNBACH Rhine Sand	0,1-2mm	Granitic	Costly Difficult to obtain and transport Lacks some of the best physical qualities

Comparison between different simulants

Baltic Sea Sand (chosen)

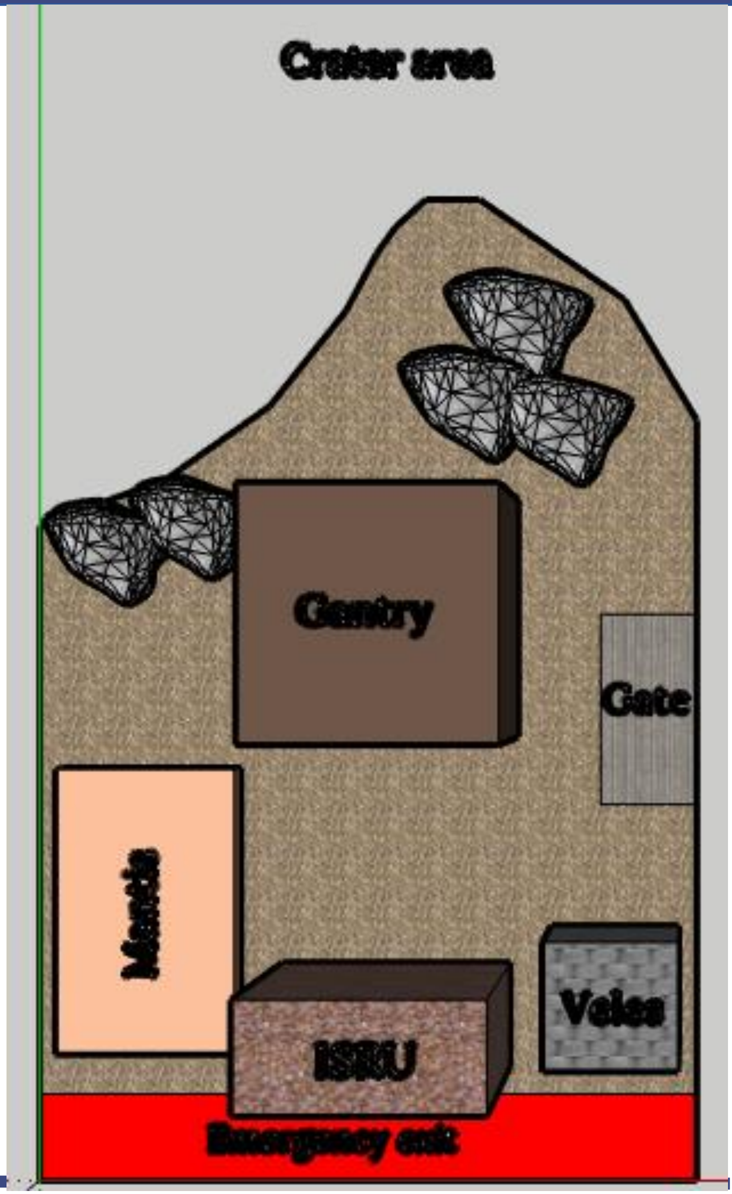
Beach sand

EAC-1

Description of the indoor lunar analogue layout

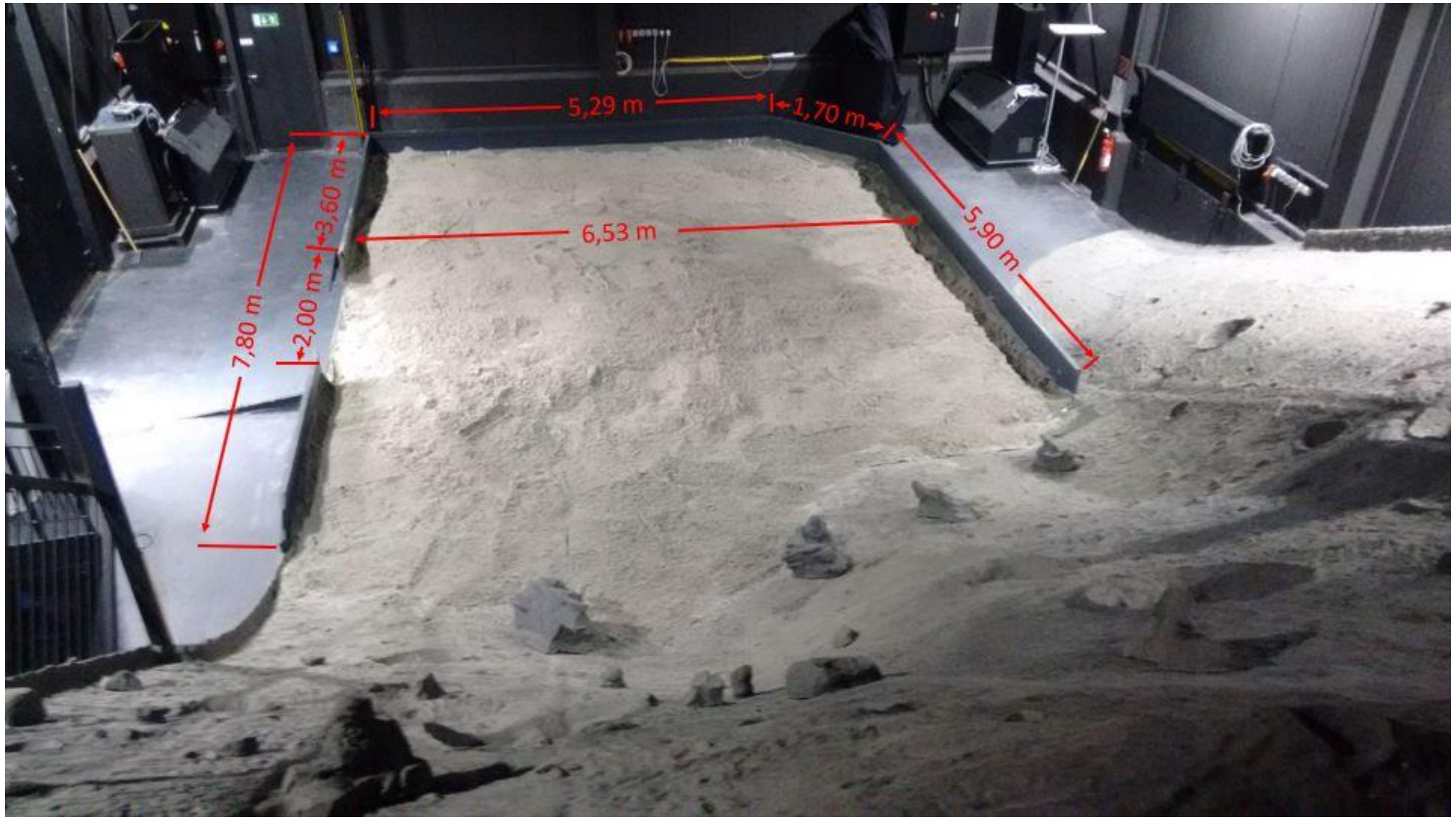
- Due to limited space…
  - Plan deployment in advance
    - 3D modelling software was used (SketchUp)
  - Various layouts were envisaged and designed

- Final setup considers the space available, the area to deploy elements and area for their movement/tasks



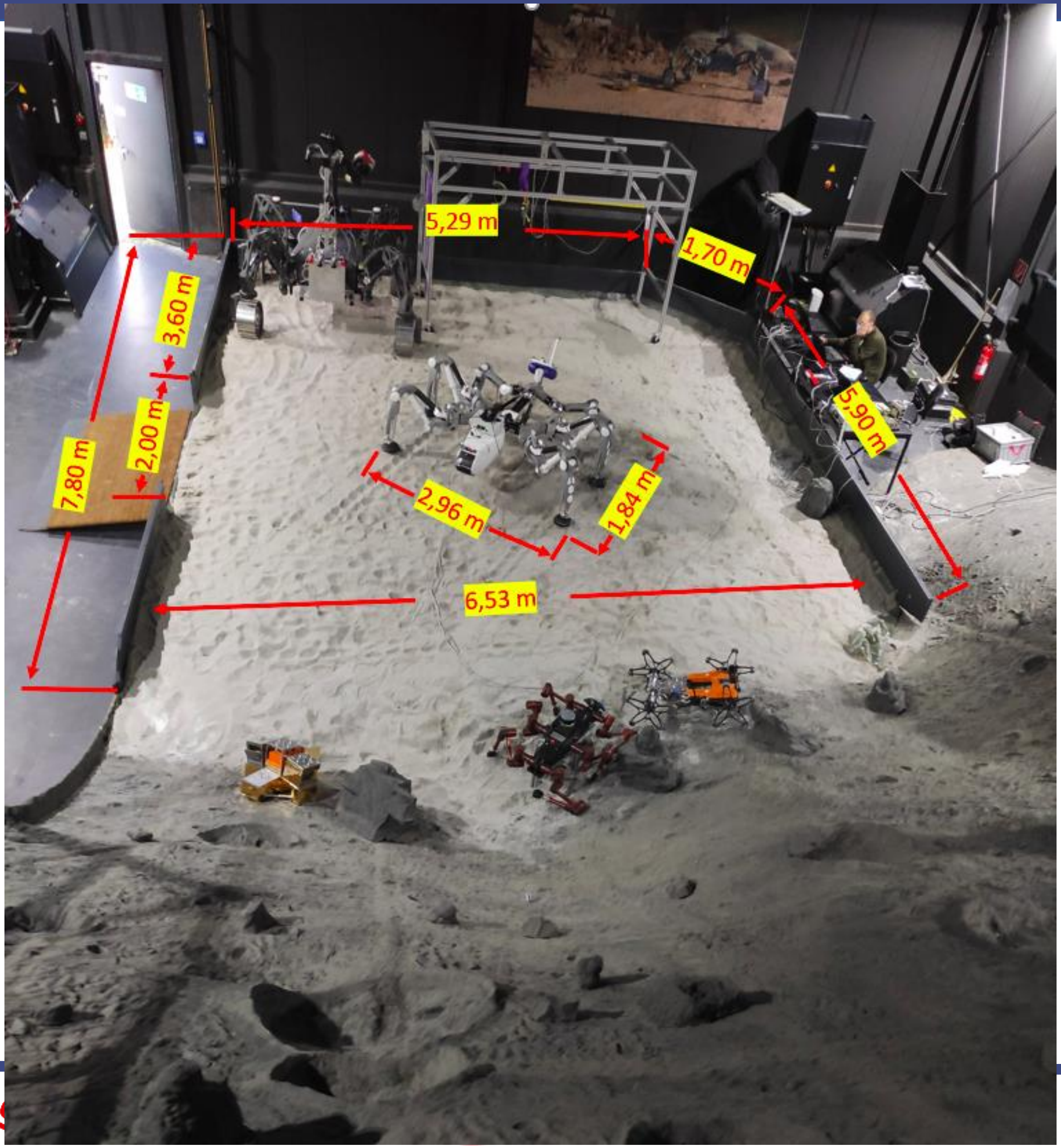
Description of the indoor lunar analogue layout - specifics

- Space Hall Area: **288m2, with 10m high**
- Dimension of the available and usable area for testing purposes (the test bed): **48m2, 10m x 7m** with **20-30cm** height of simulant



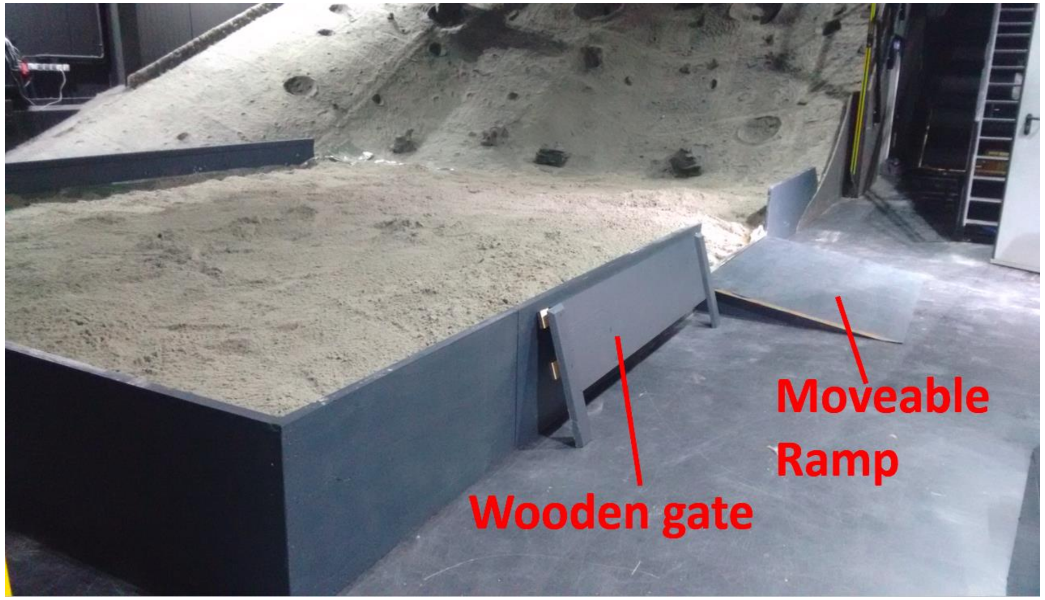
Description of the indoor lunar analogue layout - specifics

- Gantry: **300kg, 0.5 x 0.5m** (folded); **2.5x2.5x2.18m** (open)
- Mantis: **110kg, 2,96 x 1,84 x 0,32m**
- Veles: **300kg, 1.35x1.28x1.30m**
- Lander + ISRU mockup (3 modules): **15-20 Kg, 2.4 x 1.1 x 1.44m**



Description of the indoor lunar analogue layout - specifics

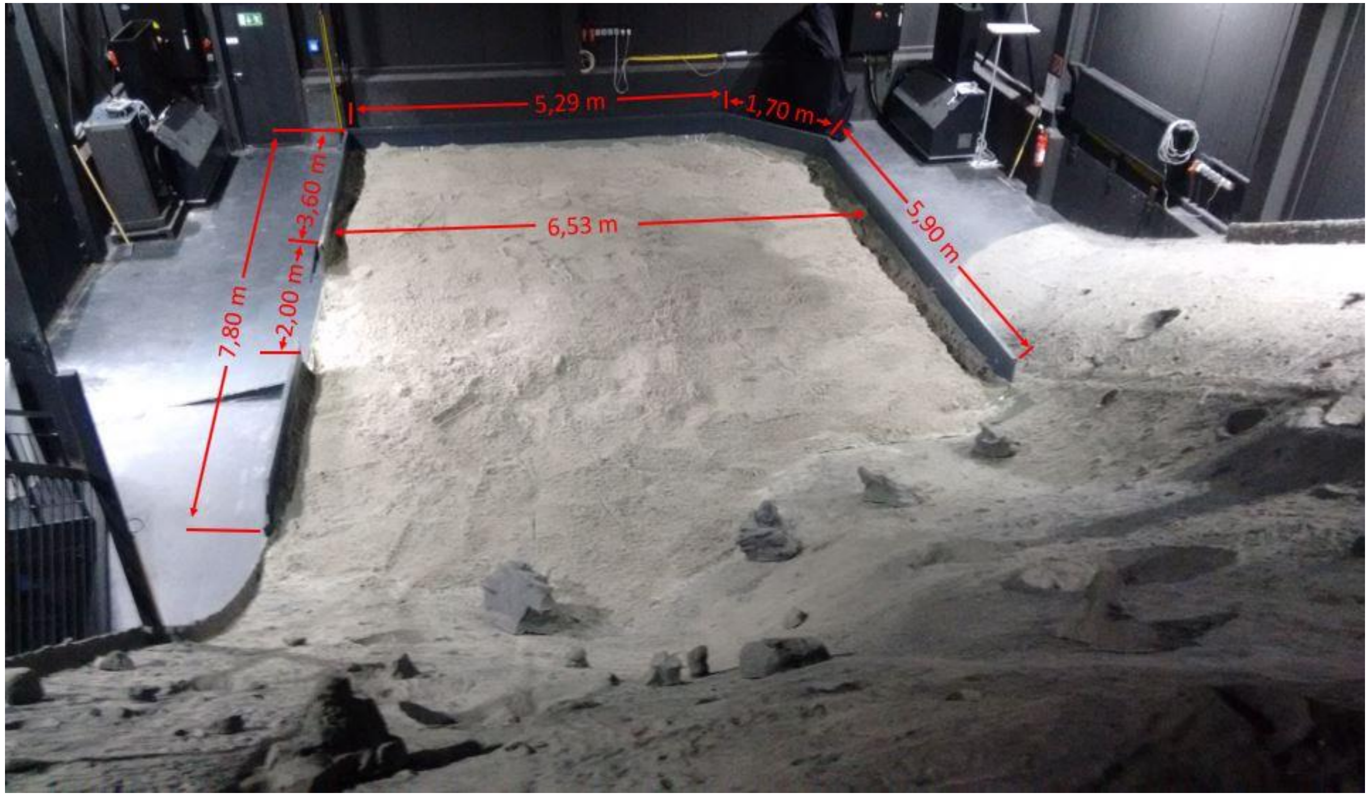
- Gate/platform: the entrance is **2 m** wide and has a removable wooden gate and removable ramp



- Emergency exit: the emergency exit is a **1 m** width path along the wooden test frame

Description of the indoor lunar analogue layout - specifics

- Rocks: various sizes and appearing in clusters next to the crater area (fake rocks)
- Crater area: gradients of **15° to 45°** for experiments. There are three continuous paths with a slope with **25°, 35**° and **45**°. It is **9m** wide.
- Slopes
- "Supporting area"):
  - Control room
  - VICON Tracker system
  - Headlight system



Integration, testing and Final Demo

- **Phase 0**
  - June-August 2020
  - Remote integration
- **Phase 1**
  - September-November 2020
  - Remote preparation + onsite integration and testing
- **Phase 2**
  - December 2020-January2021
  - Remote integration and testing
- **Final demonstration**
  - March 2021
  - Remote demonstrations

Phase 0 – Integration and testing

- **M17 - M18 tests [June - August 2020]**
- **Incremental remote integration tests**
- **Objectives:**
  - Unit tests to validate developments [SW and HW]
    - Simulator
    - Datasets
    - HW emulation
    - HW tests
  - Integration tests
    - Installation SW on robots
    - Interfacing w/ robots (remotely)
    - Interfacing between SW components

Phase 0 - Integration and testing

- **Internal Unit and Integration tests**
  - ESROCOS and ERGO
  - Task Allocation
  - Cooperative Manipulation Planner and Control
  - InFuse
  - I3DS
  - HOTDOCK
  - Mantis
  - Veles
  - Gantry
  - Simulator
  - Communication Systems
  - Analog Setup
- **Remote integration tests**

Phase 1 – Integration and testing

- **M19 – M20 [September – early November 2020]**
- **Tests performed at DFKI Lunar Analogue**
- **Objectives:**
  - Remote preparations
    - Mantis + gripper + ICU + sensors + s/w installation preparation
    - Veles + ICU + sensors + s/w installation + sensors preparation
    - Sample data acquisition for perception and control
    - H/w shakedown tests
  - Integration tests
    - Re-testing installed s/w on robots & ICU with sensors
    - Communications setup, GT tracking and Mapping
    - Data acquisition for perception + data analysis
    - Task allocation preliminary remote test
- **Post-test Technology Updates**

Phase 1 – Integration and testing – Outcome – 14th

- Ultrasound setup indoors
- Integration and tests IP mesh installation both robots
- Veles unpack, EBOX & sensors installation, startup teleoperation
- S/w re-check on both robots - Ultrasound, infuse, robot client API, Vicon, loggers

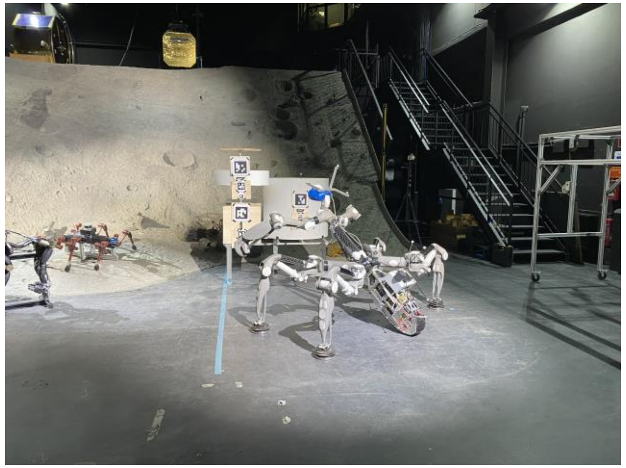
Phase 1 – Integration and testing – Outcome – 15th

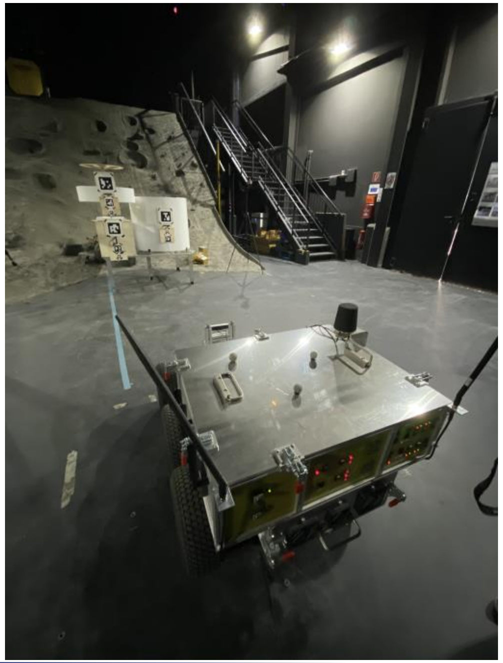
- DEM data acquisition using stand alone setup + Ultrasound + vicon
- IP mesh now also had internet for partners + ISRU installation
- ICU issue was fixed by reverting to non-FPGA build
- Mantis had a power issue while in motion – fixes were done
- Integration of Vicon beacons
- First Veles data acquisition using all sensors, odometry and Ultrasound and Vicon tracking of ISRU
- First Mantis data acquisition using all sensors, odometry and Ultrasound and Vicon tracking of ISRU

Phase 1 – Integration and testing – Outcome – 15th

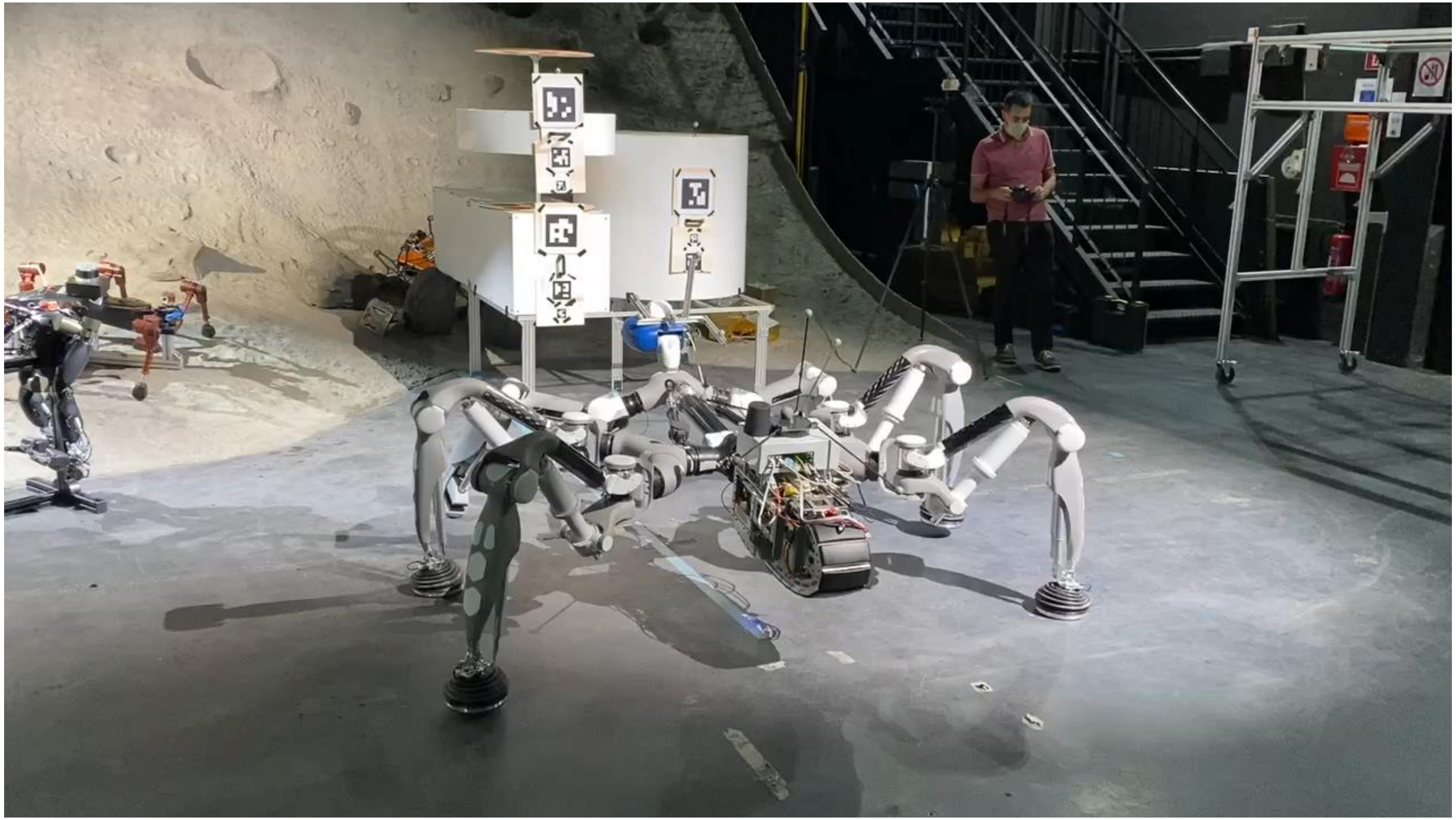
Phase 1 – Integration and testing – Outcome – 16th

- IP mesh cable broke and heating issues of IP mesh
- Ultrasound tracking issue – configuration corrupted – took some time to reset to factory setting and reconfigure
- RG was integrated with Mantis robot client API – using odometry for controlling the Mantis constants resets of RG triggered
- RG was integrated with Veles robot client API – using odometry for controlling the Veles reduced resets of RG triggered
- Logged data for post day analysis & perform late evening fixes
- Started Infuse Client API integration with ERGO





Phase 1 – Integration and testing – Outcome – 16th



Phase 1 – Integration and testing – Outcome – 17th

- Updated RG tested with Mantis for commanding it's motion and issue fixed.
- Updated RG tested with Veles for commanding it's motion and issue fixed.
- Try to provide remote access to Veles over DFKI and Mesh network
- Data acquired for GT with RG
- Continue integration of infuse client with ERGO for closed loop tests – using recorded data sets
- Breakage in one link of Mantis and many links were replaced
- First outdoor test run to gather data for VO

Phase 1 – Integration and testing – Outcome – 17th

Phase 1 – Integration and testing – Outcome – 18th

- Integration of infuse client with ERGO - minimal setup tested RG with Veles with US localisation feedback. Minor issue with coordinate frames but closed loop test complete.
- Outdoor calibration using handheld laser range finder of ultrasound for max coverage
- Provided access to UCITY for installing CLSAM updates and remote access to sensor data
- Veles stereo camera tests at different angles for outdoors CSLAM datasets

Phase 1 – Integration and testing – Outcome – 19th

Phase 1 – Integration and testing – Outcome – 21st

- Outdoor area setup of work place + equipment + moving robots
- Re-calibration of UltraSound
- Remote fix on reoccurrence of ICU issue on adjustment of exposure.
- Prepared a clear ppt for each traverse for us to follow
- Veles multiple traverses - also replicated mantis traverses
- Mantis performed startup motion tests, but had a power issue, so were fixing it. Mantis performed 2 traverses after issues fixed on site
- Downloading data from both robots + partially share a few GBs to UCITY for overnight evaluation

Phase 1 – Integration and testing – Outcome – 22st

- Quick outdoor setup
- Provided new camera and terrain configuration based on previous day data sets + new traverses
- Veles multiple traverses and data was logged
- Multiple traverses and data was logged. Final H/w issue stopped tests as the main carbon fiber tube started to fail.
- Downloaded all the data from both robots
- Packing of Mantis for shipment

Phase 2 – Preparation and testing

Final phase before the final demonstration.

Performed remotely due to COVID-19 constraints: 08/12/2020 - 18/12/2020 + January 2021

OBJECTIVES:

- Installation of advanced Partners' SW and dependencies on RWAs
- Remote interfacing of software modules RWAs through VPN
- Interfacing among Partners' SW components
- Task Allocation and ERGO planner integrated tests
- Rover Guidance and Localization closed loop tests
- Remote Gantry control from the ROS wrapper
- CM2C tests with Force/Torque sensor data
- Datasets collection in indoor scenarios

Phase 2 – Preparation and testing - overview

- Ground truth tracking fully ready - including transforms
- Sensors + ICU data interfaces + infuse data converters integrated
- Robot client API + infuse data converters integrated
- IP mesh communications ready + Loggers of all data available
- RG and robot client API’s integrated
- Infuse client API + ERGO integrated closed loop perception + planning RG done further tests needed
- Online deployment of infuse DFPCs tested qualitative analysis to be done on data sets
- Large data sets for Cooperative VO and mapping
- Veles platform robustness demonstrated
- ISRU mockups ready with markers and data sets available

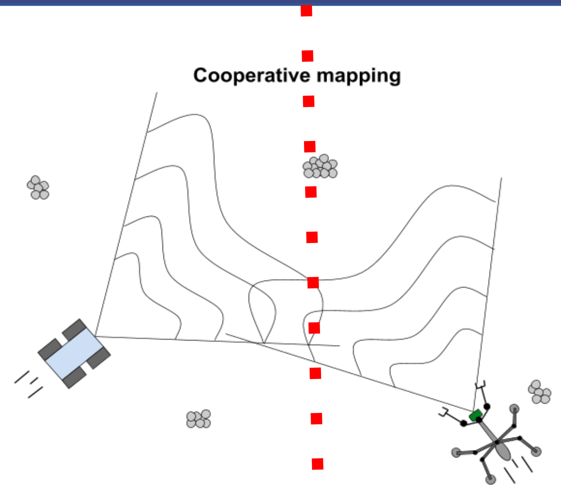
Phase 2 – Preparation and testing - overview

- Mantis platform hardware robustness – replacement of links
- RAMP further tested in Simulation which also had updates
- Task allocation integration with ERGO tested with first set of interfaces
- FPGA acceleration of stereo processing results were available
- Visual Odometry on synthetic black surface of indoor hall unusable - outdoor was ok
- DEM generation, Aruco marker benchmarking, object detection & tracking, 3D mapping using data sets
- Post-processing of data for Cooperative VO and mapping preliminary results
- Analysis of F/T data from Mantis for CM2C
- Preliminary remote tests with CM2C

Final demonstration

- Final demonstration of the project's goals
- Performed remotely during March at Germany, Poland, Spain and France
- Following the re-adaptation of the scope of the final demonstration, the scope of this final phase was to validate and demonstrate the following:
  - Mapping, localization, ICU and sensors with Mantis and Veles
  - MP-MCS interactions with CREW Multi-Robots/Agents System.
  - CREW Multi-Agent Cooperative Task Allocation, Planning & Execution
  - RG and RAMP with Mantis and Veles with perception/localisation
  - Physical manipulation collaboration with two Pandas arms
  - Deployment, mobility and end effector control of the mobile gantry
  - Remotely demonstrate the RWA capabilities and integrated software

Scenario 1 & 2: Cooperative Mapping



Environment Setup (Initial Conditions):

- Same area region (virtual square) for both robots (Coop. Task Allocation and InFuse).
- MP-MCS running on GMV laptop and remotely connected to the Robots VPN.
- InFuse MCS running on SpaceApps laptop and remotely connected to the Robots VPN

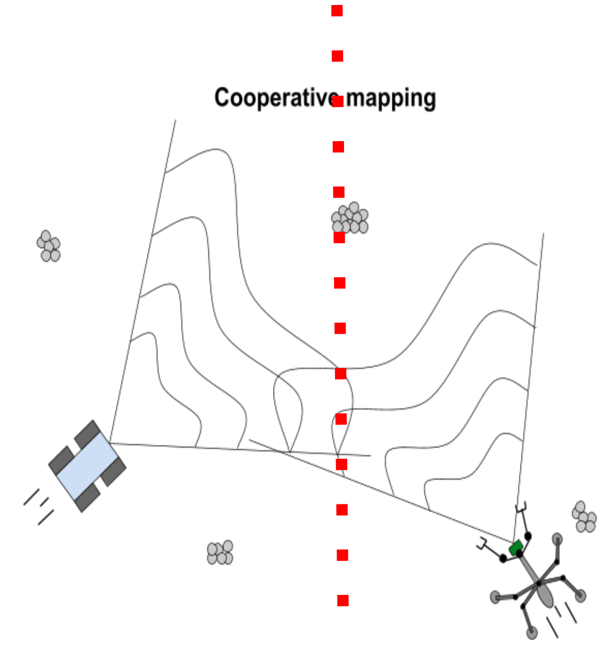
Sequence / Steps:

1) MP-MCS/PUS-Console remotely sends a cooperative mapping goal on the previously defined area.
2) Both Agents receives the battery level.
3) MCAR of Leader Agent requests to Coop. Task Allocation the allocation of the goals.
4) MCAR receives and distributes allocated goals (by Coop. Task Allocation) to each robot to map each part of the area.
5) Each MPR plans its allocated goals.
6) Each MPR requests to InFuse the robot pose and DEM production.
7) Traverse goals are executed by each RG robot in closed-loop with InFuse and Robot Client API.
8) Each robot maps the area observed during its traverses - To be shown by InFuse MCS

Scenario 1 & 2: Cooperative Mapping

Expected Validation:

- MP-MCS/PUS-Console/VITRE
- PUS Services & PGCI
- MCAR + Coop. Task Allocation: Multi-Agent roles handling, Multi-Agents Coordination, Multi-Agent Coop. Task allocation.
- Agent Mission Planner Reactor (Stellar).
- MASR; Multi-Agent Communications and synchronisation between robots.
- InFuse and Agent integration with production of DEM and fused poses (SLAM
- GT DEM of Space Exploration Hall using Vicon and Mantis (cameras + lidar)
- Rover Guidance integration with Robot Client API.
- Mantis locomotion & integration with OG4/I3DS, InFuse and Agent (RG).
- Veles locomotion & integration with OG4/I3DS, InFuse and Agent (RG).
- InFuse MCS visualising mapped areas of both robots.
- Mantis & Mantis MCS.



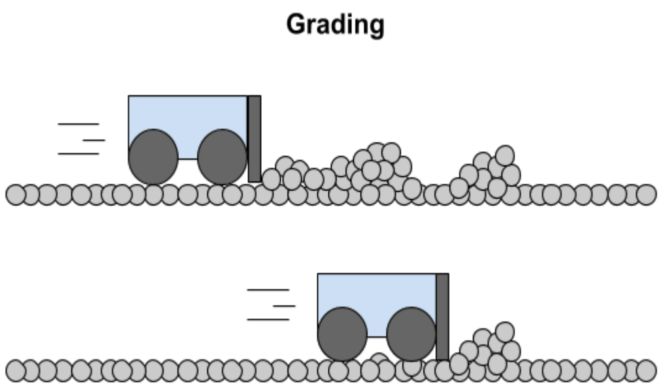
Scenario 3: Grading and Tool exchange

Environment Setup (Initial Conditions):

- PIAP-Space indoor/outdoor area with regolith simulant
- Grading blade attached to Veles
- EF tools – gripper and shovel poses w.r.t manipulator base known

Sequence / Steps

- Grading via Teleop check grading bucket height + risks to veles
- DEM generation before grading
- Offline waypoints for RG to follow for grading execute
- Post-grading DEM generation
- RAMP moves arm to a pre-defined pre-grasping pose
- RAMP moves arm to docking pose
- HOTDOCK latching via PIAP-MCS
- Gripper activation tests



Scenario 4 (& 6): Cooperative unloading & assembling modules

With two fixed Panda arms

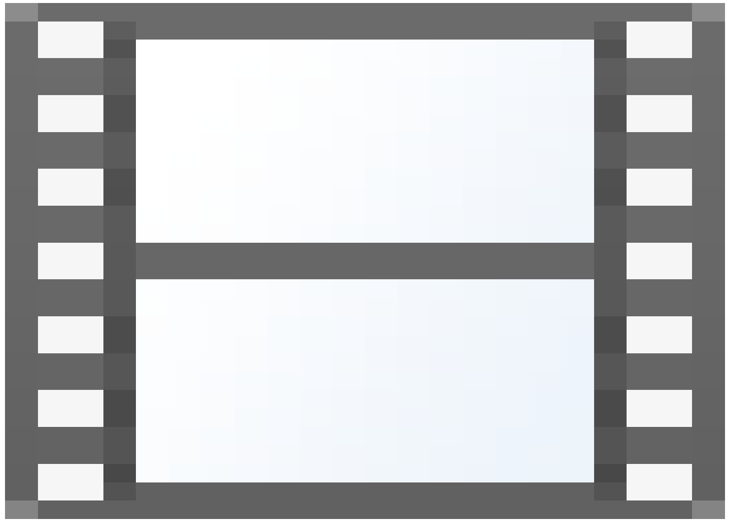
Two declinations:

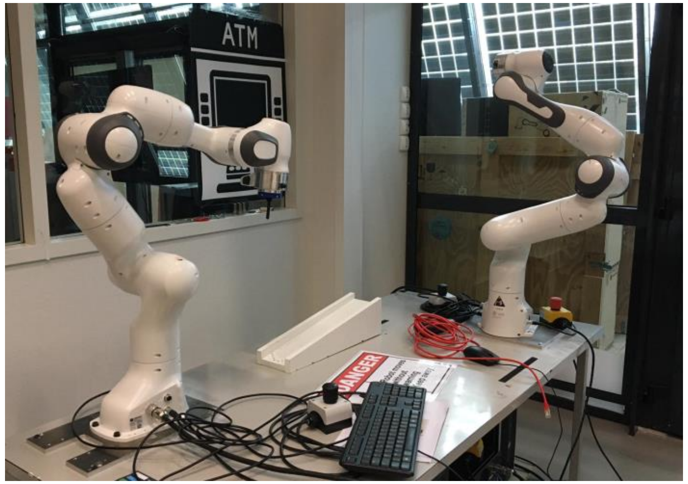
- Disassemble / assemble
  - Start and end of the object trajectory constrained
- Cooperative motion
  - No constraint on the object trajectory

Processes involved: CM2P, CM2C, overall coordination

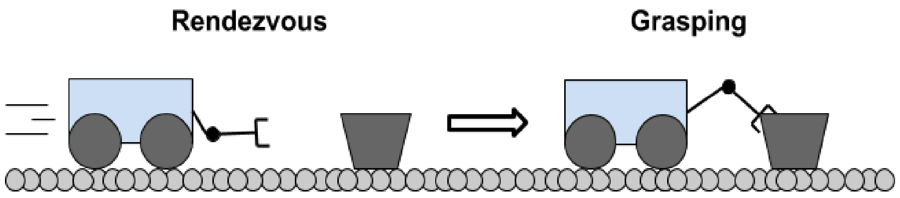
Picking and Placing of Object

Robustness tests of CM2C: motions in contact + manual perturbations of free motions





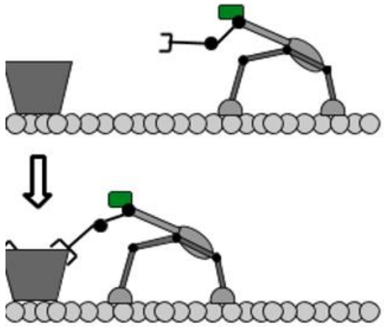
Scenario 5: Cooperative Manipulation (virtual) & Transport



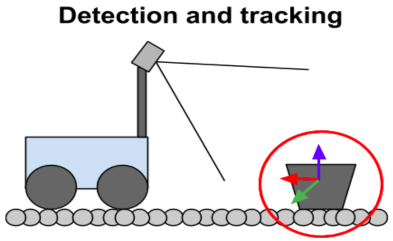
Environment Setup (Initial Conditions):

- Same area (virtual square) for both robots (Coop. Task Allocation and InFuse).
- MP-MCS running on GMV laptop and remotely connected to the Robots VPN.
- InFuse MCS running on SpaceApps laptop and remotely connected to the Robots VPN
- Object marker re-printed and strategically located (visible and detectable from Mantis/Veles initial starting point)

Sequence / Steps



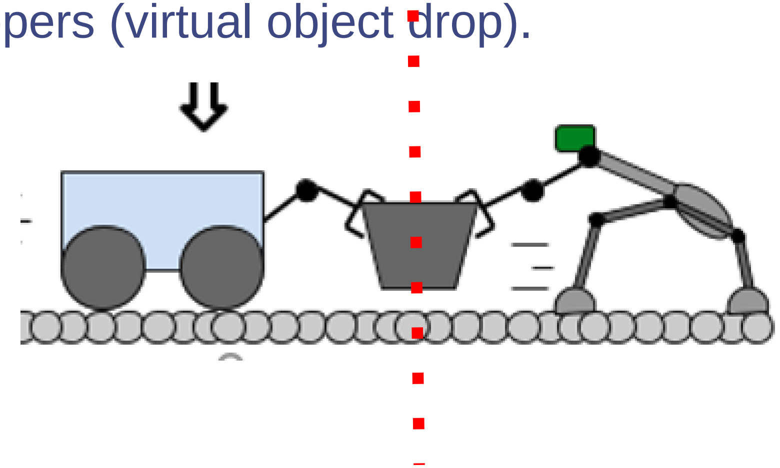
1) MP-MCS/PUS-Console remotely sends a cooperative object manipulation goal is sent to both robots.
2) Both Agents receive the battery level.
3) MCAR Leader requests to Coop. Task Allocation the allocation of the cooperative object manipulation goal.
4) MCAR Leader receives and distributes allocated goals (by Coop. Task Allocation) to each robot.
5) Both Agents request to InFuse the rendezvous pose (object detection and identification).
6) Both Agents (MPR) plan and execute their allocated goals (traverse to rendezvous pose, simulated object grasping, simulated object transportation and traverse to came back home).
7) Both Agents request to InFuse the local DEM production.
8) Both Agents execute their traverses to their rendezvous poses.
9) First robot in complete the traverse & pinking waits for the other robot does the same.



Scenario 5: Cooperative Manipulation (virtual) & Transport

Sequence / Steps

10) One robots are at their grasping base pose, both request to InFuse the pre-grasping ARM poses
11) Both robots move their arms to their pre-grasping arm poses.
12) Virtual and simulated object grasping: Both robots request open & close (virtual pick) with respective grippers.
13) First robot in complete the simulated pick (open & close gripper) waits for the other robot does the same.
14) Virtual cooperative object transportation: both robots execute a traverse to the target object pose (goal param.)
15) Once both robots end their traverses, they open & close again their grippers (virtual object drop).



No tested:

- CSLAM (not possible)
- **No actual physical interaction for Cooperative Manipulation and Transport.**

Scenario 5: Cooperative Manipulation (virtual) & Transport

Expected Validation

- MP-MCS/PUS-Console/VITRE
- PUS Services & PGCI
- MCAR + Coop. Task Allocation: Multi-Agent roles handling, Multi-Agents Coordination, Multi-Agent Coop. Task allocation.
- Agent Mission Planner Reactor (Stellar).
- MASR; Multi-Agent Communications and synchronisation between robots.
- InFuse and Agent integration with production of DEM, robot poses (SLAM) and object detection & relative pose estimation
- Rover Guidance and RARM integration.
- Robot Client API.
- Mantis base locomotion, robotic arm and EE (gripper).
- Mantis integration with OG4/I3DS, InFuse and Agent (RG).
- Veles base locomotion, robotic arm and EE (gripper).
- Veles integration with OG4/I3DS, InFuse and Agent.
- InFuse MCS visualising mapped areas of both robots and makers detection and identification process.
- Mantis MCS.
- Veles MCS.

Scenario 5: cooperative transport (with object)

No demonstration with two mobile Panda arms possible.

However:

- Demonstration of planning capacities (CM2P):
  - with holonomic bases OK
  - with turn-on-point bases OK
  - with non-holonomic bases NOK (at the moment)

- Demonstration of CM2C robustness wrt arm base perturbations (from Mana minimally)

Pertubations

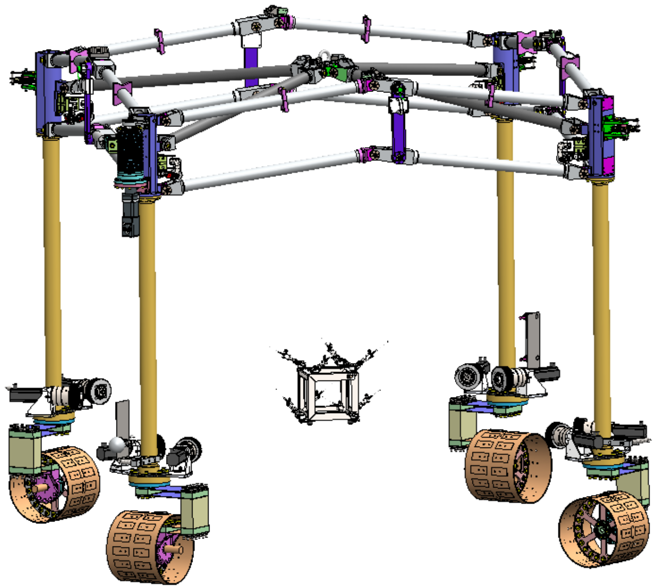
Scenario 7: Remote Gantry deployment

Environment Setup (Initial Conditions):

- Gantry at AVS lab
- Remote VPN connection with SpaceApps

Sequence / Steps

- Connect to Gantry server & status check
- Send command to deploy at fixed velocity remotely
- Monitor deployment telemetry remotely until completion
- Send EF command to set EF desired pose
- Monitor EF until reaching desired pose



Thank you!

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Project website

https://www.h2020-pro-act.eu/

More information

https://cordis.europa.eu/project/id/821903