

AUTOMATION & ROBOTICS (A&R) IN THE GERMAN SPACE PROGRAM

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**German
Space Agency**
at DLR

AGENDA



- New German Space Strategy
- German Space Robotics Program
- German Robotic Contributions to European/International Missions

German Space Strategy

Status and important fields of action related to Space Robotics



- “German Space Strategy” represents the highest guiding principle/governing document for all areas of German space activities
- The federal government developed this strategy with extensive participation and fundamental contributions from the German Space Agency, academia and industry
- German Bundeskabinett has adopted strategy in its session on 27.09.2023; the previous space strategy was from 2010
- „Priority Strategy“ with political goals and guidelines as well as specific key projects/actions for nine fields of action
- Most important fields of action related to Space Automation & Robotics:
 - Sustainable and environmental friendly use of space
 - High-tech technologies and new space
 - International Space Exploration
 - Security, Strategic Capability and Global Stability

Technical, political and commercial guidance



German Space Strategy

Integration into the German National Space Robotics Program



- Most fields of action from Space Strategy are dealt with since decades in the German National Space A&R Program
 - Sustainable use of space: ISMA, modularity, standardization, cooperative design, ...
 - High-Tech technologies: sensors, controllers, new materials, AI, quantum,...
 - Exploration: analog-missions, rovers, climbers, etc.
- New application field Security and Strategic Capability
 - In the past Space Agency had generally civil character
 - Since 12/2022 new section at Space Agency: Security and Special Tasks
 - Application field Security affects technology sectors like Space Robotics
 - Many technologies in Space Robotics have dual-use character e.g.
 - In-orbit servicing and assembly (Rapid Response Capabilities)
 - Capabilities for approach, rendezvous, docking, capturing and inspection (Satellite protection)

Revision of German Space A&R Program in progress

German Space Strategy

International Space Exploration



- On 14.09.2023 Walther Pelzer, Director General of the German Space Agency at DLR, signed the Artemis Accords on behalf of Germany



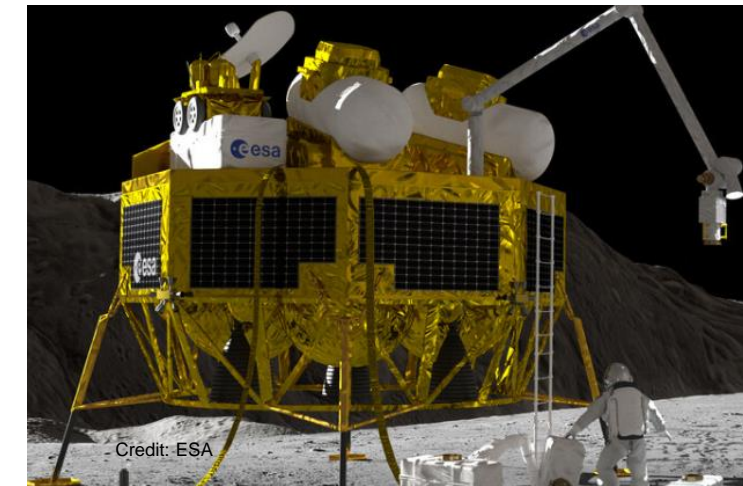
Credit: NASA

- “Artemis offers a multitude of new opportunities for industrial activities and scientific research in Germany.”* Walther Pelzer said.



System capability → analog deployments Contributions to international missions

Technology transfer



EL3/Argonaut lander

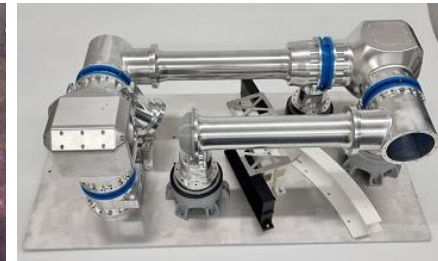
Stipulate A&R foci for planetary exploration

German Space Strategy

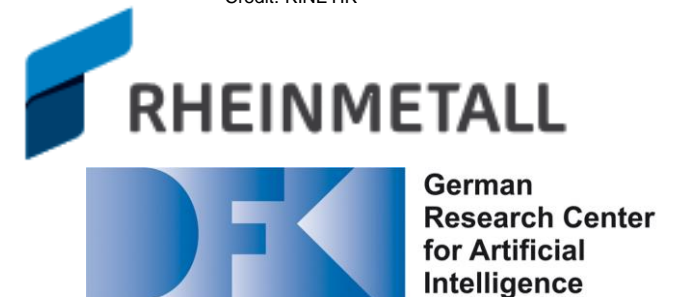
New Space and Start-Up News



- *“The German Space Strategy focuses in particular on advancing private-sector initiatives in space, known as New Space, ...”*
- Foster cooperation between academia and industry, support technology transfers
- Increase exchange between terrestrial and space domains
- Assist start-ups like
 - KINETIK Space
 - founded as a spin-off of the DLR Institute of Robotics and Mechatronics
 - Key product is the TINA robotic-arm
 - Yardstick-Robotics (YARO)
 - co-founded by Rheinmetall AG as a leading international systems supplier in the defense industry and DFKI
 - Serving niche markets (e.g. space, defense) with robotic solutions



Credit: KINETIK





Strengthen interaction of technology domains

Current German Space Robotics Program

Harmonization and Programmatic



- Current Program is harmonized and coordinated with ,  EU and other European space agencies mainly through EU-Horizon PERASPERA activity
- PERASPERA ended in mid-2023, **but harmonization and coordination will not**
- Open for bi- (multi-) lateral cooperation with agencies and associations



Programmatic Goals of the Robotics Program:

- Transformation of classical space flight into “New Space” through operational robotic solutions
- Toughen up space and terrestrial industries to tap into new (space) markets and applications
- Space systems being produced, operated and maintained along concepts in terrestrial industries.
- Unlock next generation technologies (AI, Quantum computing,...) for Space A&R
- Create pioneering technologies and scientific results for the benefit of society

Create and foster international relationships and cooperation

Current German Space Robotics Program

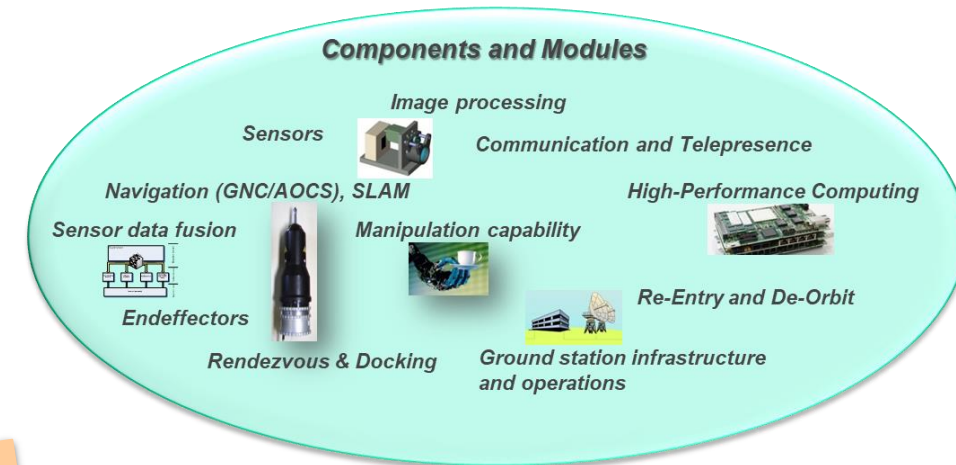
Technology funding corridors

Robotic Servicing Modules

Providing Services (PS):

Development, qualification and production of mobility, handling and assembly capabilities incl. all relevant subsystems and components as well as their integration into a complete space robot.

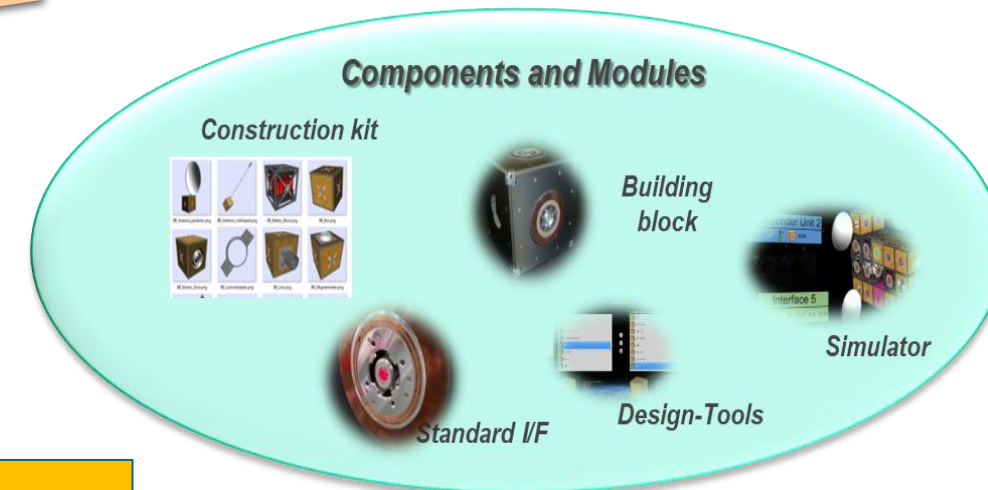
The space robot provides services for the missions.



Construction kit & interface

Receiving Services (RS):

Development, qualification and production of modular space infrastructure elements consisting of subsystems and components designed to be assembled, maintained and modified by robotic means. The space infrastructure element receives service during its mission.



Two main strategic areas

Current German Space Robotics Program

Exemplary A&R technologies and projects

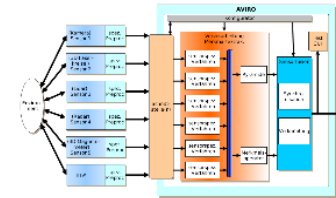


Astrone – KI

AI-supported extended surface mobility for interplanetary science platform – agile, autonomous, robust

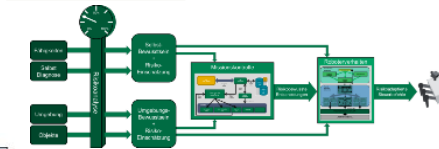
AVIRO 3

Multiple sensor data fusion



IntelliRISK2 → **Session 5c, 7b**

Risk conscious robot systems with active learning capability



PerSim → **Session 5c**

Perception for resource identification and long-term simulations of environment



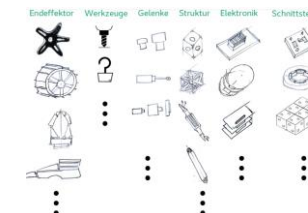
TAMARIW

Semi-autonomous assembly and re-configuration in space



MODKOM

Modular building blocks für application specific configurable space robots



German contributions to European IOS Missions

In Orbit Servicing Missions in Europe



■ ESA S2P ADRIOS

- Clear-Space-1: LEO Debris-De-Orbiting
- ENCORE: GEO-Lifetime extension
- RISE: GEO-Lifetime extension
- Financed until next ministerial 2025

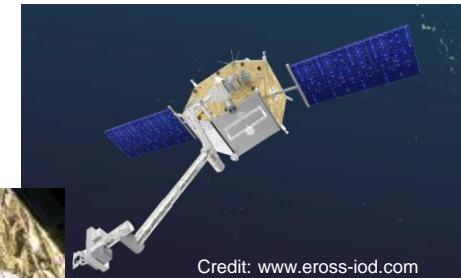
DE supports RISE-Mission, possible robotic contributions: KINETIK (Manipulator), DLR (Testenvironment), iBOSS (Interface)



■ EU EROSS IOD

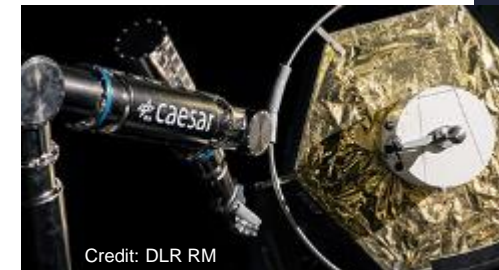
- LEO/GEO In-Orbit Servicing Mission
- Phase B2/C financed until CDR (03/2025)

DE part of EROSS consortium, robotic contributions: DLR (Manipulator)



■ ASI IOS

- LEO In-Orbit Servicing and De-Orbiting Mission
- Contract to Thales Alenia Space 235 M€



Potential A&R contribution from Germany: Robotic Servicing Module (RSM)

International IOS developments

Regulations, Standards, Strategies, Plans & Consortia

■ United States:

- White House Office of Science and Technology Policy released
 - ISAM National Strategy 04/2022
 - National ISAM Implementation Plan 12/2022
- NASA creates In-Space Servicing, Assembly, Manufacturing Consortium (COSMIC) in 04/2023
- DARPA initiated the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS), in 12/2022 CONFERS converted into an independent global trade association
German Space Agency at DLR plans to become government observing member



■ European Commission:

- PERASPERA European Operating Framework (EOF) delivered [Handbook & Guidelines Document](#) for On-Orbit Services 12/2022



■ ESA:

- In 10/2021 ESA published Guidelines for Safe and Sustainable Close-Proximity Operations (CPO)
- Since 2022: Coordinating a WG to derive a ECSS Handbook on Sustainable Close Proximity Operations

■ JAXA / Japanese Cabinet Office:

- Developed a set of technical standards in 2021 for commercial in-orbit servicing missions.

■ ISO published Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS) - Programmatic Principles and Practices (ISO 24330) in 07/2022



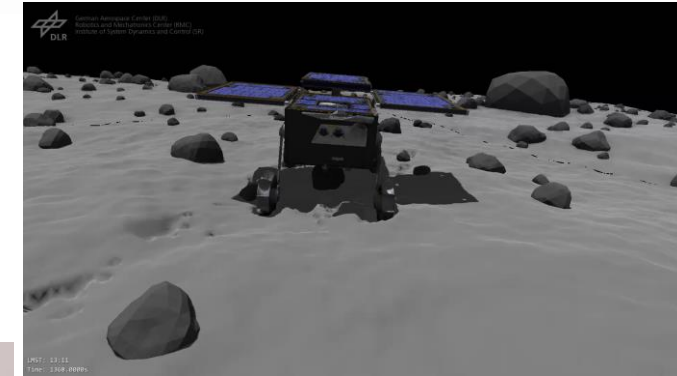
Unlock the potential of A&R for a future space eco-system

German contributions to Exploration Missions

Mission MMX: DLR Institute of Robotics & Mechatronics



- Mission MMX – Mars Moon Explorer – Phobos
- Launch 09/2024, Mars Arrival 08/2025, Phobos Proximity Phase incl. Landing & Sampling 2025-2028, Mars Departure 08/2028, Earth Return 07/2029
- MMX spacecraft will deliver IDEFIX Rover build by DLR&CNES
 - 30 kg Rover, 4 non directional Wheels, 4 moving legs
 - Cameras, radiometer, Raman spectrometer
- IDEFIX build without agency funding, scientific funding only



In-situ surface exploration of the Martian moon Phobos

→ Session 8a, 9a

Imprint

Topic: Automation And Robotics in the German Space Program
Date: 2023-10-17
Author: Thomas Wolf
Institute: German Space Agency at DLR
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Thank you for your patience!

How AI-Tool DALL-E sees a
robotic servicing satellite:

