HORIZON 2020

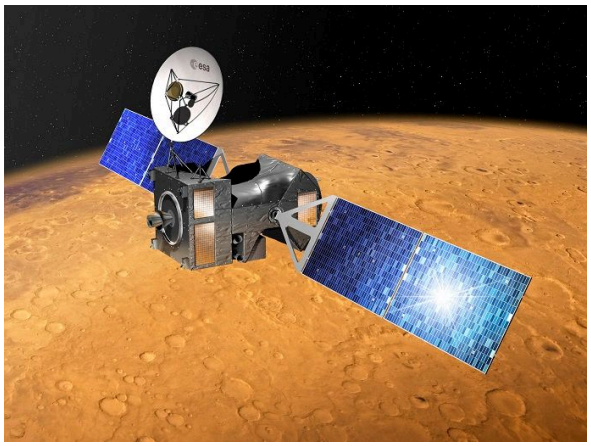
Standard Interface for Robotic Manipulation of Payloads in Future Space Missions

Results in Brief

Modular multifunctional interfaces connect space robot building blocks

In the 50 years since man landed on the moon, hundreds of unmanned missions mostly within our solar system have tremendously enhanced our knowledge of what lies beyond our home. EU-funded space robotics technology is supporting that effort and enhancing Europe's capacity for space exploration.

SPACE



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Although the pioneering manned moon missions were among the first and last in which human beings travelled beyond low Earth orbit, they were not the end of space exploration but perhaps the beginning. In 2018 alone, there were 112 successful space launches worldwide from 8 different countries, the most since 1990.

The diversity in space exploration can be seen in just a few of the recent missions. Within the last two years, Mars Insight arrived at its destination, BepiColombo headed to Mercury, NASA launched a mission to hunt for exoplanets, and China's Chang'e 4 lander and Yutu-2 rover landed on the far side of the moon.

The EU-funded SIROM project is enhancing the operational capacity and mission flexibility of European space exploration with advanced robotic technologies. Via optimised interfaces for modular robotic systems, researchers will ensure reliable

and robust mechanical, thermal, electrical and data connectivity between modules in a streamlined ‘plug-and-connect’ design.

Reducing the complexity

Space robotics and advanced technologies are integral to the continued exploration of our cosmos. They are a large and diverse group of systems carrying out a myriad of tasks.

Planetary robotics include orbiters, landers and rovers that explore other planets and asteroids. They collect and analyse samples and prepare them for return to Earth.

Orbital robotics support orbital servicing and maintenance activities. Since most satellites (orbiting bodies) are currently built as disposable products, they rely on economical solutions and enhanced service life including modifications and upgrades tailored to changing needs and wear.

To accomplish their multitude of tasks, space robots interact with other systems or components. Reliable and robust interfaces between robot and payload or payload and payload are paramount to mission success. According to project coordinator Javier Vinals, as part of the Horizon 2020 Space Strategic Research Clusters (SRCs) on Space Robotics Technologies, “SIROM’s main objective was to develop key technologies for a common building-block connector for autonomous robotic systems conducting in-orbit satellite servicing and planetary exploration – in other words, to define a standard and modular ‘USB’ for space robotic operations.”

‘Plug-and-connect’ standardised interfaces for modular building blocks

As Vinals explains: “The multifunctional interface was designed to include mechanical interfaces connecting the blocks to one other, electrical interfaces for power transmission, thermal interfaces for heat regulation and interfaces to transmit data throughout the satellite.” It required development of power and data transmission standards, methods for thermal transfer and management, as well as mechanical load transfer and interface latching.

Space applications have much stricter criteria than Earth-based interfaces. SIROM ensured their systems take into account the long duration of missions, the lack of logistics support, and missions composed of multiple payloads and architectures. Modelling and simulations enabled multi-criteria design optimisation to meet varied requirements.

SIROM’s interfaces improve operational capacity, simplify logistics and enhance

mission flexibility in a cost-efficient and customer-oriented design. The technology has been validated in lab demonstrations and the consortium is now moving toward in-orbit validation. Overall, SIROM technologies are poised to enhance European capability for space exploration while reducing costs, increasing safety and improving sustainability.

Keywords

SIROM | space | interface | mission | robotic | orbit | space robot | modular | space exploration | payload | satellite | planetary | servicing | mechanical | data | thermal | electrical | modules

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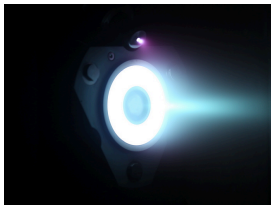

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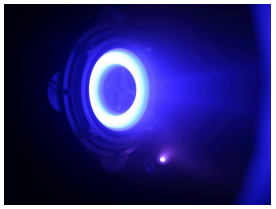

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Project Information

SIROM

Grant agreement ID: 730035

Project website

DOI
10.3030/730035

Project closed

EC signature date
21 October 2016

Start date
1 November 2016

End date
28 February 2019

Funded under
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies – Space

Total cost
€ 3 487 442,50

EU contribution
€ 3 487 442,50

Coordinated by
SENER INGENIERIA Y SISTEMAS SA
Spain

Last update: 14 April 2020