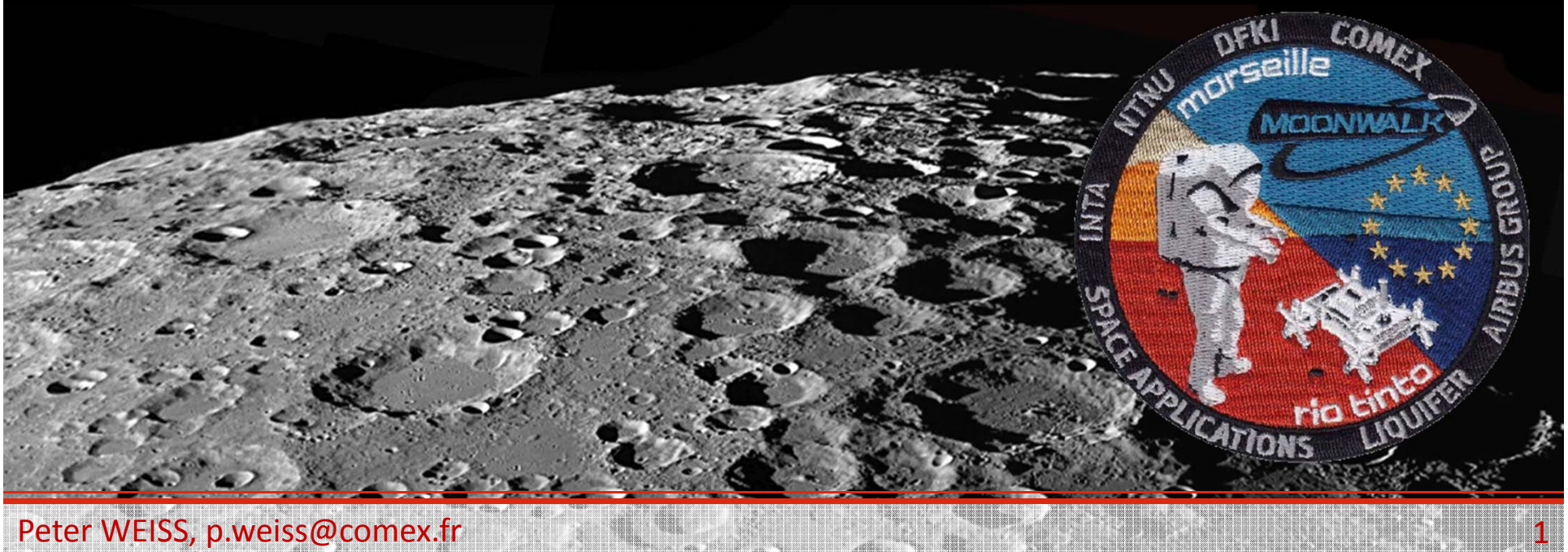


MOONWALK

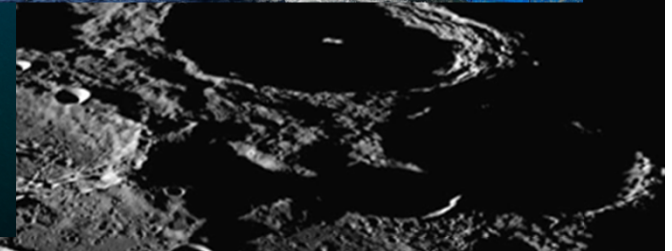
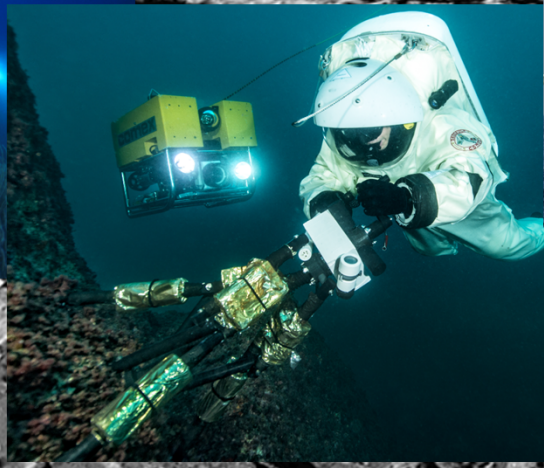
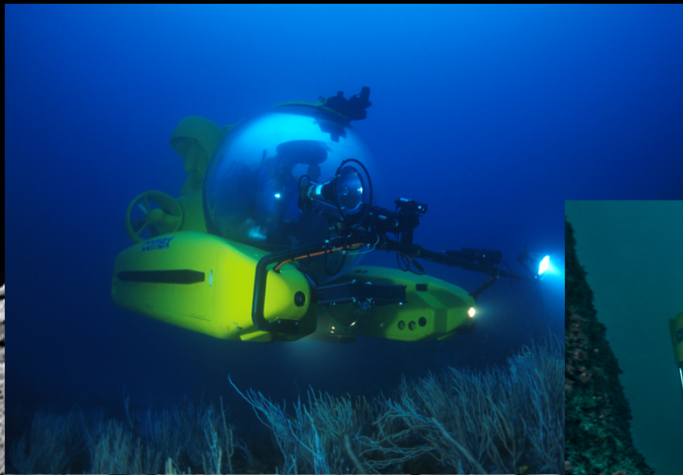
Simulation of future astronaut-robot cooperation

Peter WEISS, COMEX



COMEX

- Specialized in subsea intervention (human and robotics)
- Subsea mining, renewables and also EVA training for astronauts
- Based in Marseilles, South of France



The Philosophy behind the MOONWALK Project

MOONWALK is a European Commission project funded under FP7 to develop an EVA simulation infrastructure in Europe.

MOONWALK focusses on Astronaut-Robot cooperation during surface EVA (Moon / Mars) and will finish with two simulation campaigns (Marseilles / Rio Tinto)

Partners:



Deutsches Forschungszentrum für künstliche Intelligenz

COMEX SA

Airbus Group Innovations

Liquifer Systems Group GmbH,

Space Applications Services N.V. / S.A.,

NTNU Centre for Interdisciplinary Research in Space,

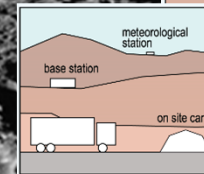
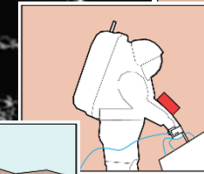
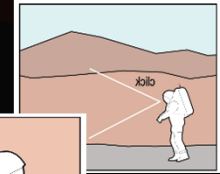
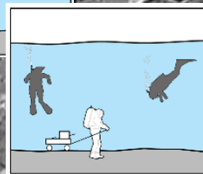
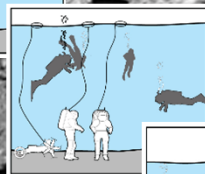
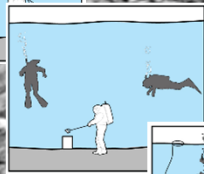
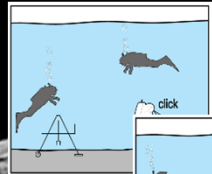
Instituto Nacional de Técnica Aeroespacial

The Philosophy behind the MOONWALK Project

Marseilles lunar subsea analogue



Rio Tinto Mars analogue



The Philosophy behind the MOONWALK Project

Marseilles lunar subsea analogue



Astronaut-Astronaut
Team

Analyze the impact
of using a robot

Astronaut-Robot
Team

Analyze the
influence of
different G-Levels
(1/6thG & 1G)

Analyze the
influence of
different G-Levels
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Rio Tinto Mars analogue



Astronaut-Astronaut
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Analyze the impact
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The Philosophy behind the MOONWALK Project

Marseilles lunar subsea analogue



Rio Tinto Mars analogue

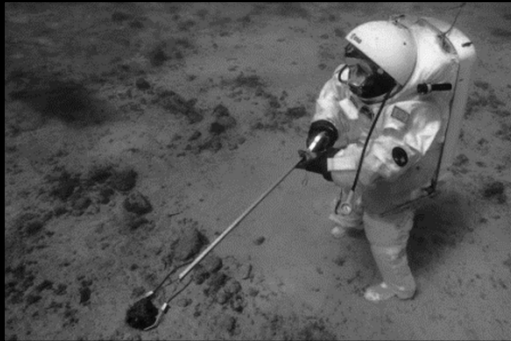


The underwater environment serves to recreate surface EVA in reduced gravity ($1/6^{\text{th}}$ – Moon) through neutral buoyancy simulations.



The Philosophy behind the MOONWALK Project

Marseilles lunar subsea analogue



Rio Tinto Mars analogue



The Rio Tinto test site offers conditions similar to some of those on Mars and allow to evaluate field exploration strategies for exobiology.





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MOONWALK
SIMULATION OF FUTURE ASTRONAUT-ROBOT COOPERATION



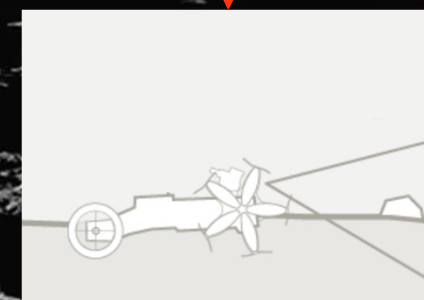
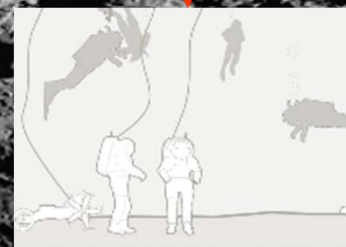
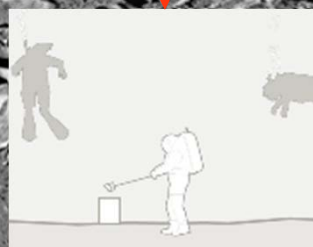
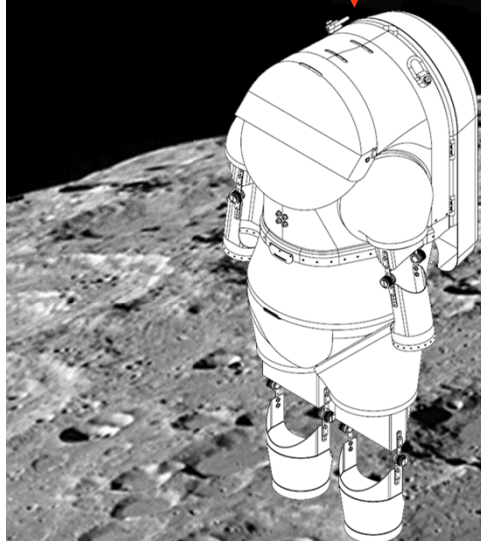
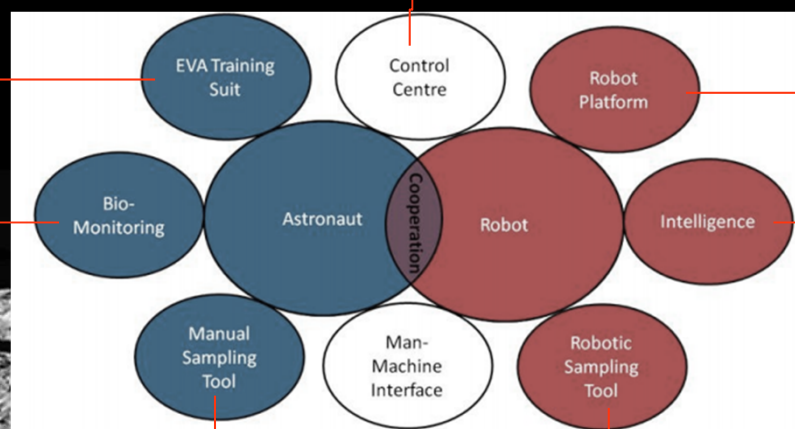
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A new era of human and robotic exploration

Astronaut-Robot Cooperation

The main research focus in MOONWALK is to evaluate different strategies and means of astronaut-robot cooperation.





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SIMULATION OF FUTURE ASTRONAUT-ROBOT COOPERATION



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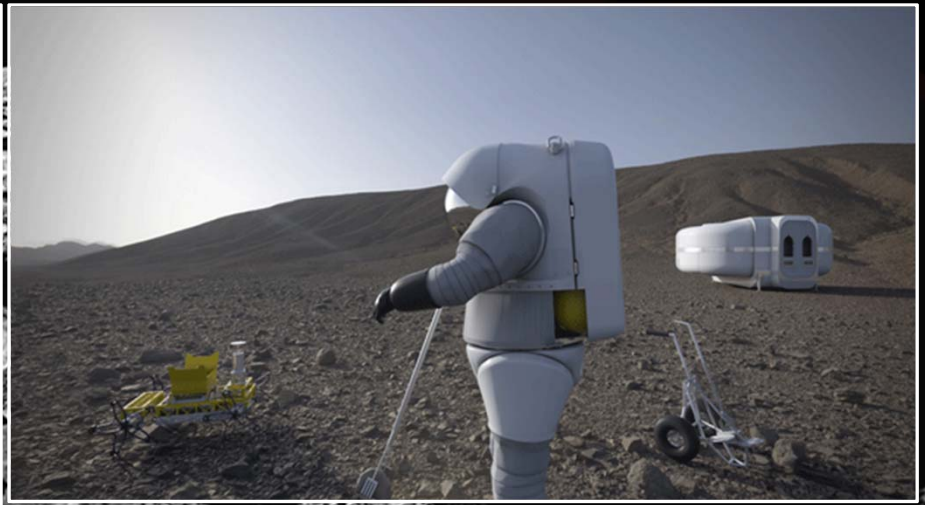
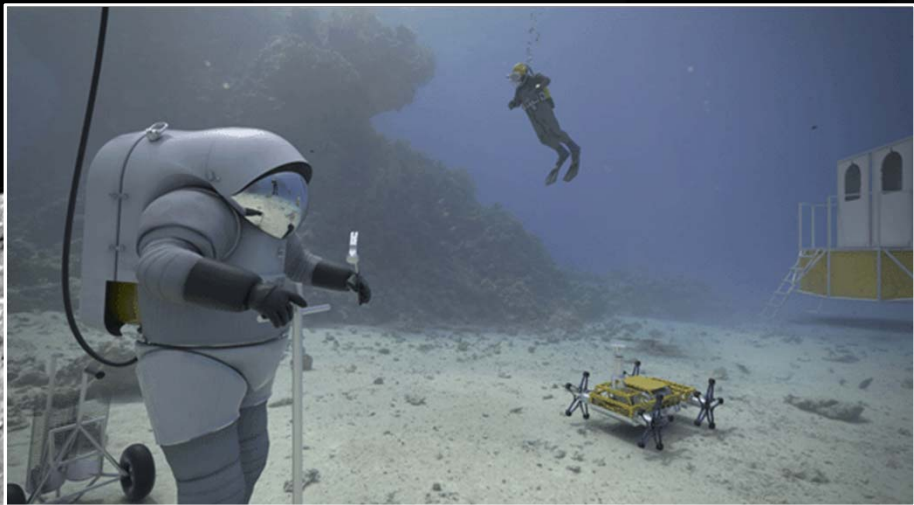
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A new era of human and robotic exploration

Astronaut-Robot Cooperation

Following tasks are foreseen to be implemented:

- *Field exploration (scouting)*
- *Hazardous locations exploration (cave, crater, ...)*
- *Assistance in sampling / documentation*
- *Transport tasks*
- *Assistance in problems*





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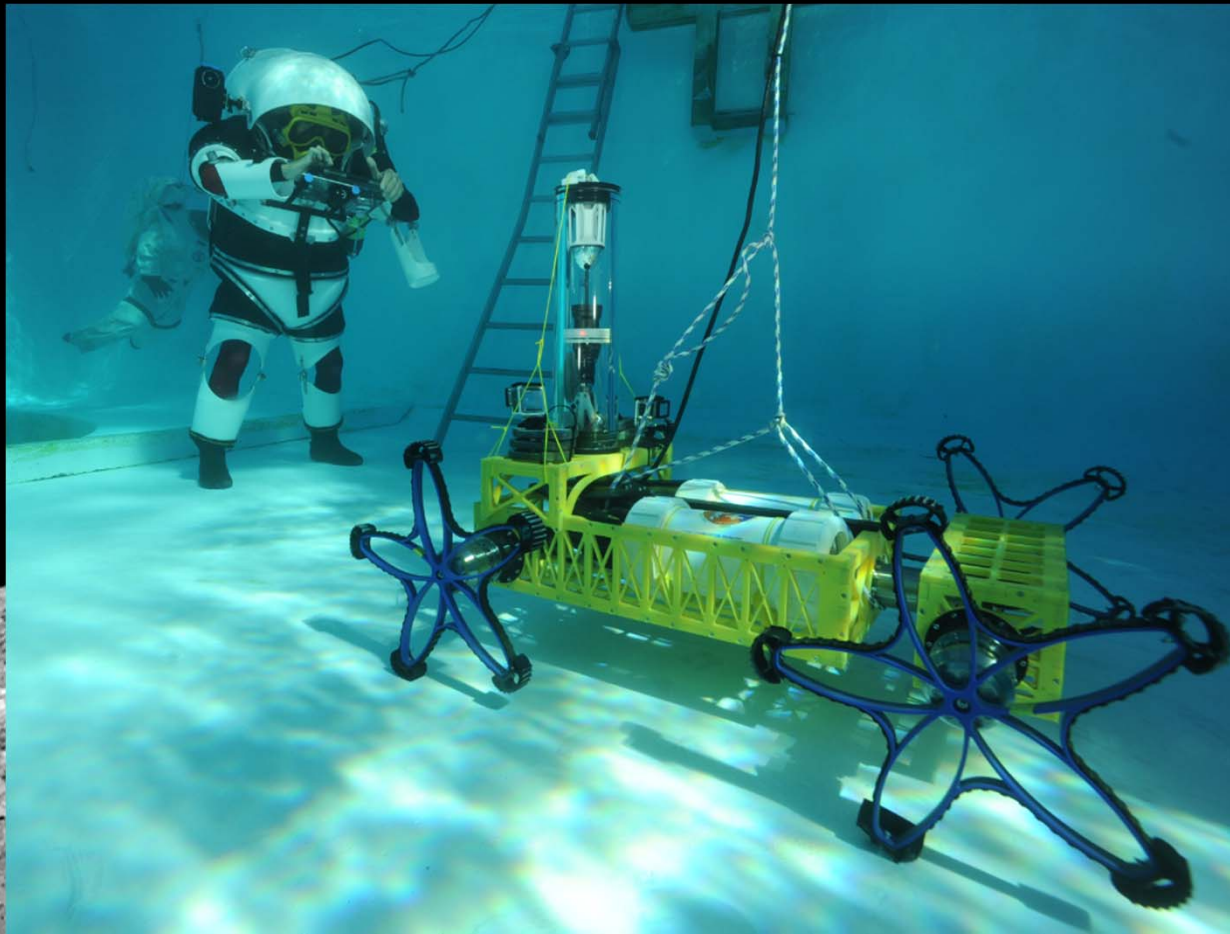
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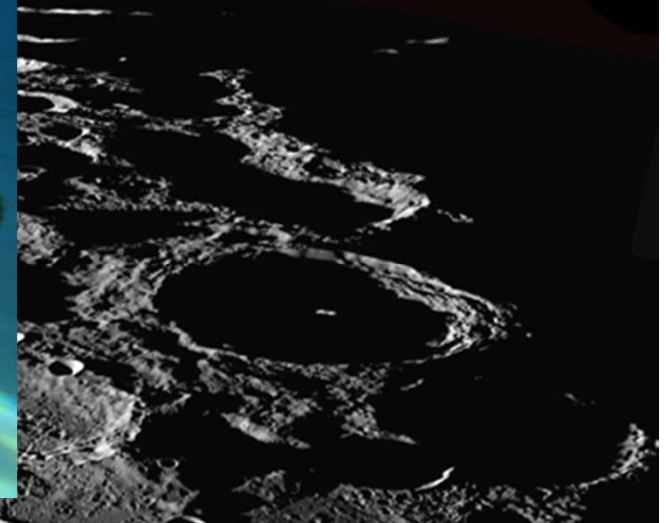
A new era of human and robotic exploration

Astronaut-Robot Cooperation

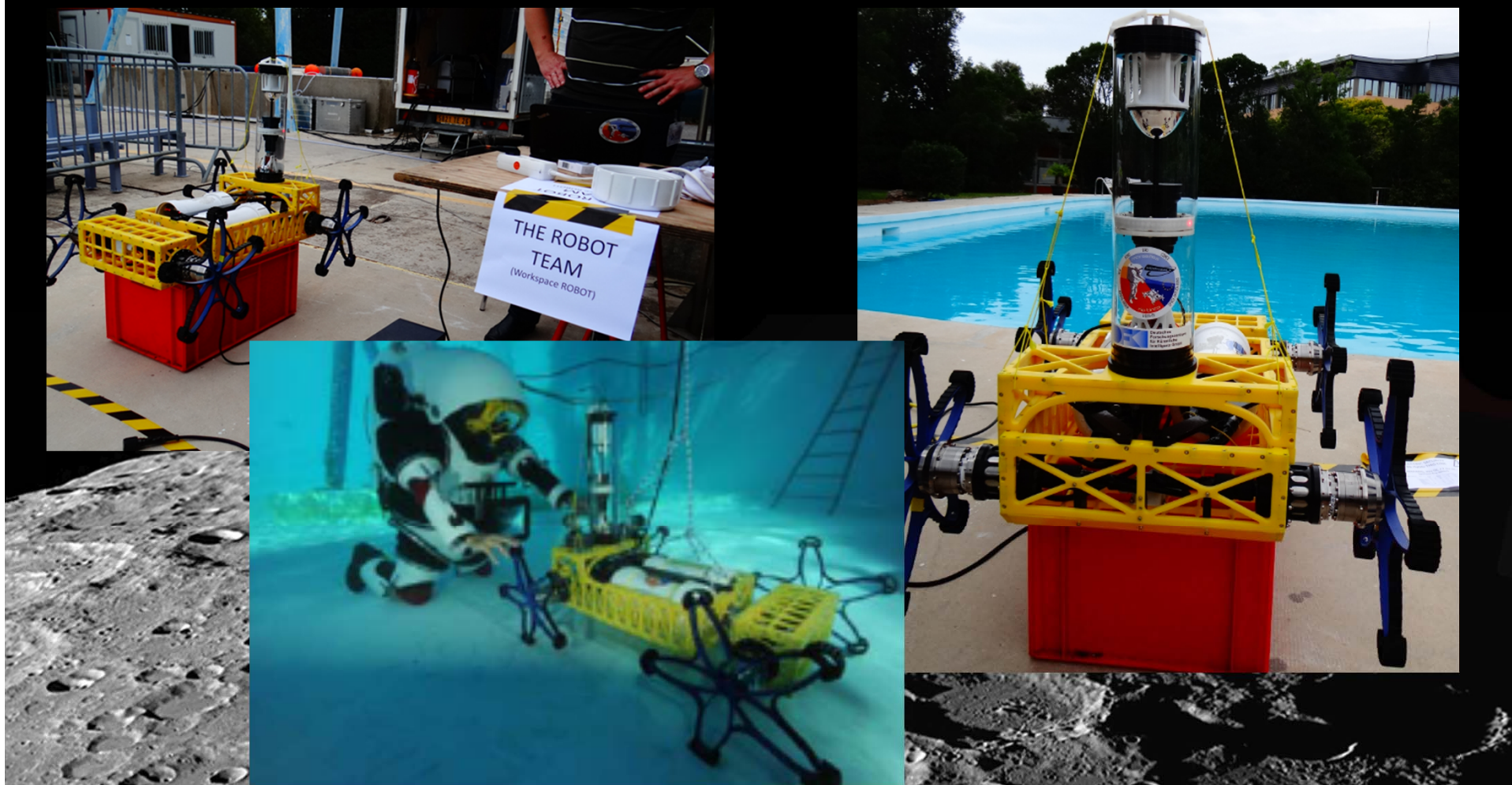
The DFKI robot scout



- Subsea rated version of a terrestrial system.
- Panoramic camera system
- Autonomous functions
- Gesture control



Astronaut-Robot Cooperation





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SIMULATION OF FUTURE ASTRONAUT-ROBOT COOPERATION



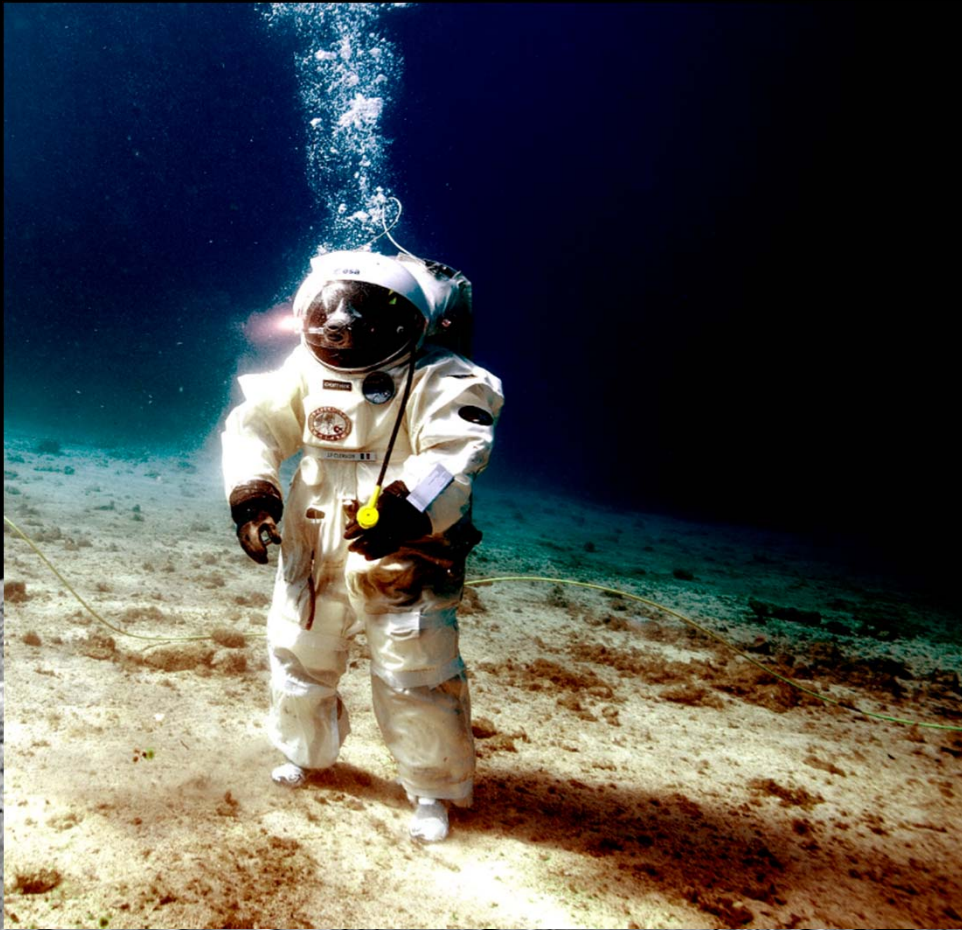
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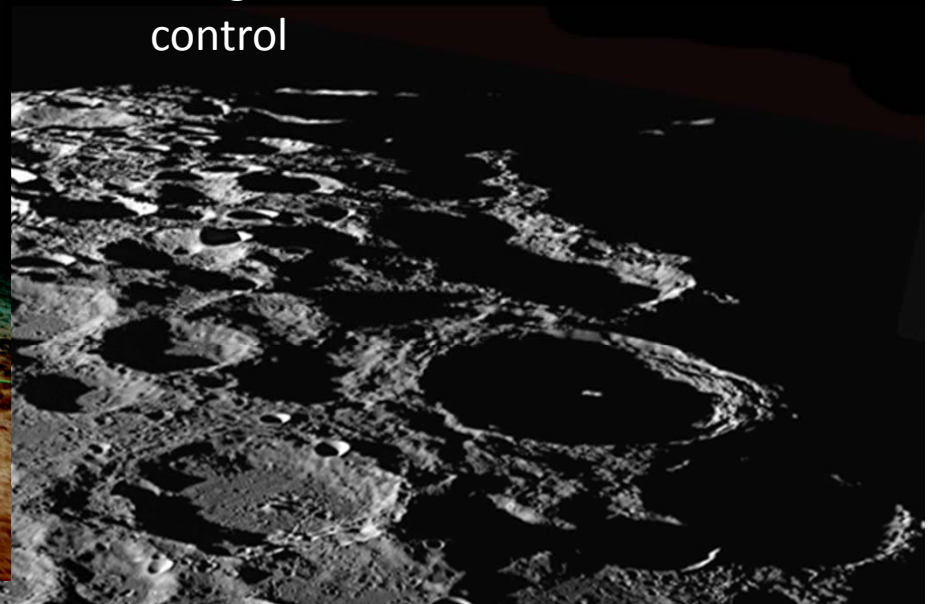
A new era of human and robotic exploration

Astronaut-Robot Cooperation

The EVA training suits



- Exoskeleton to simulate pressurized space suit
- Simulation of reduced gravity (underwater only)
- Integration of novel MMI; robot control





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Astronaut-Robot Cooperation

The EVA training suits





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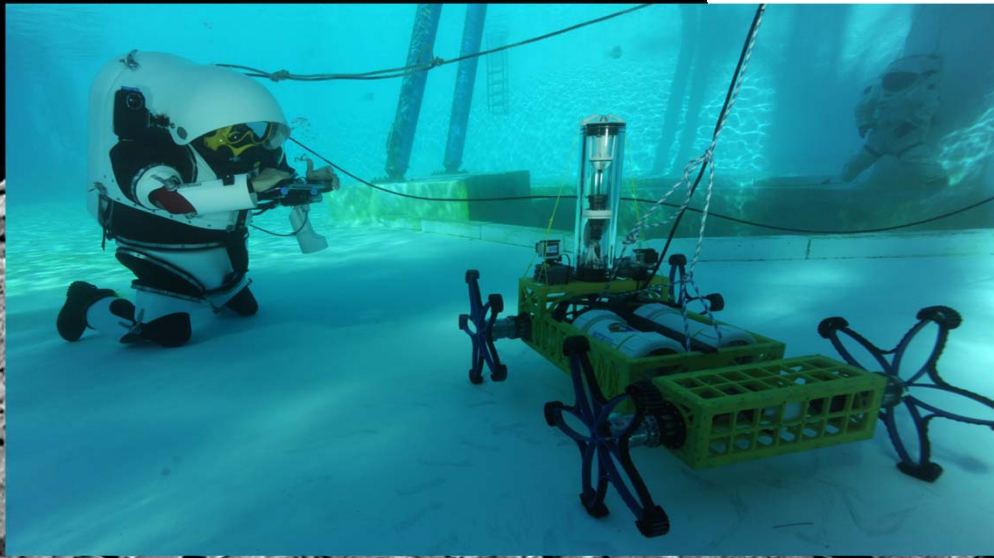
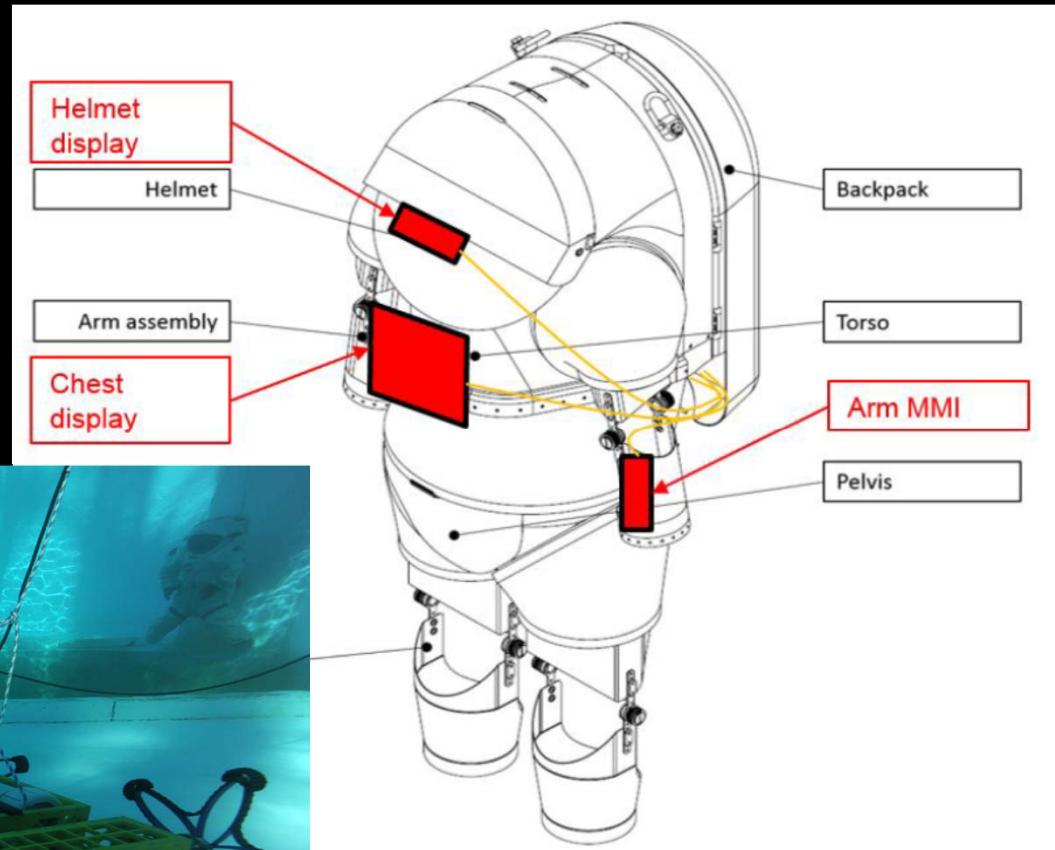
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Astronaut-Robot Cooperation

Testing of man-machine interfaces





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Astronaut-Robot Cooperation

The EVA training suits





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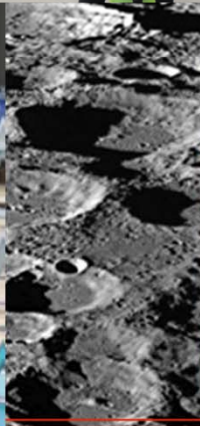


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Astronaut-Robot Cooperation

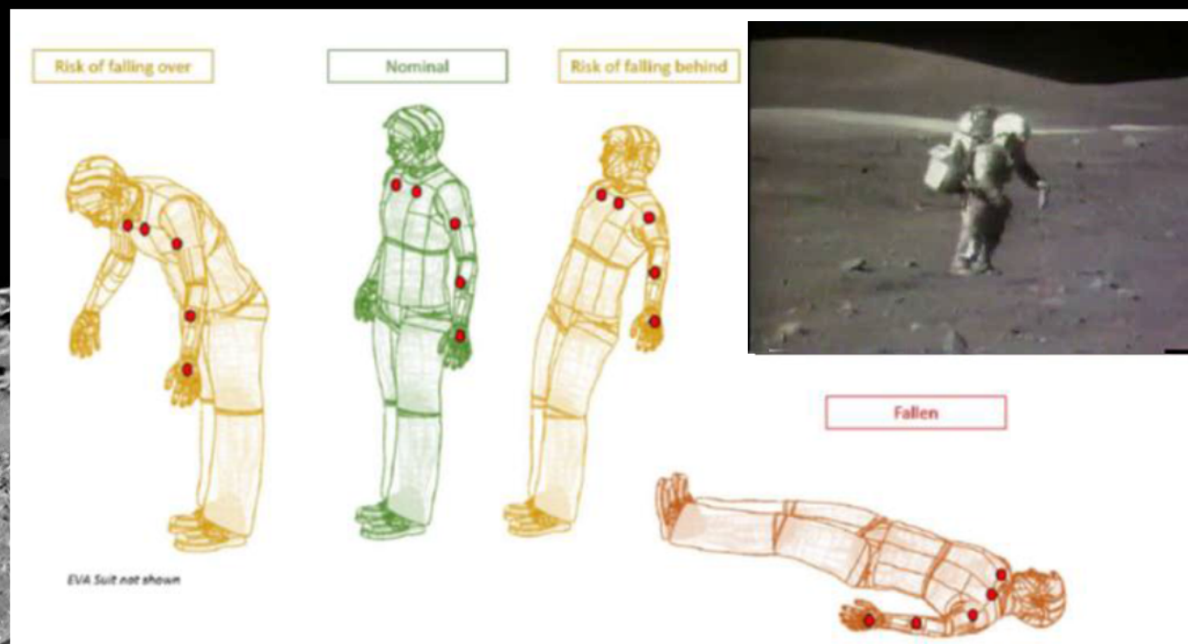


Peter WEISS, p.weiss@comex.fr

Astronaut-Robot Cooperation

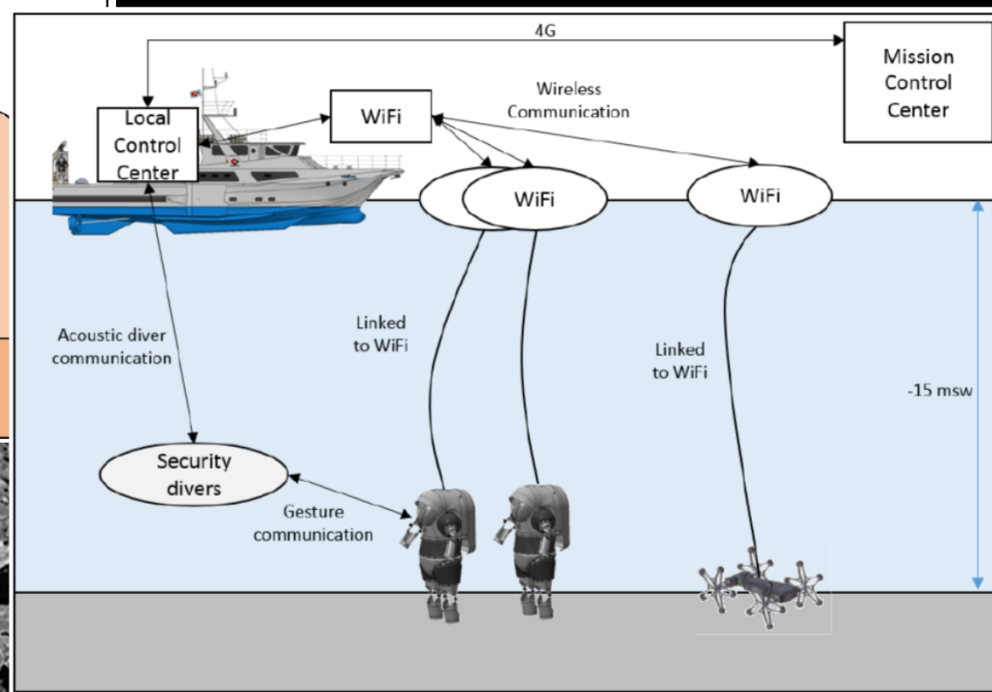
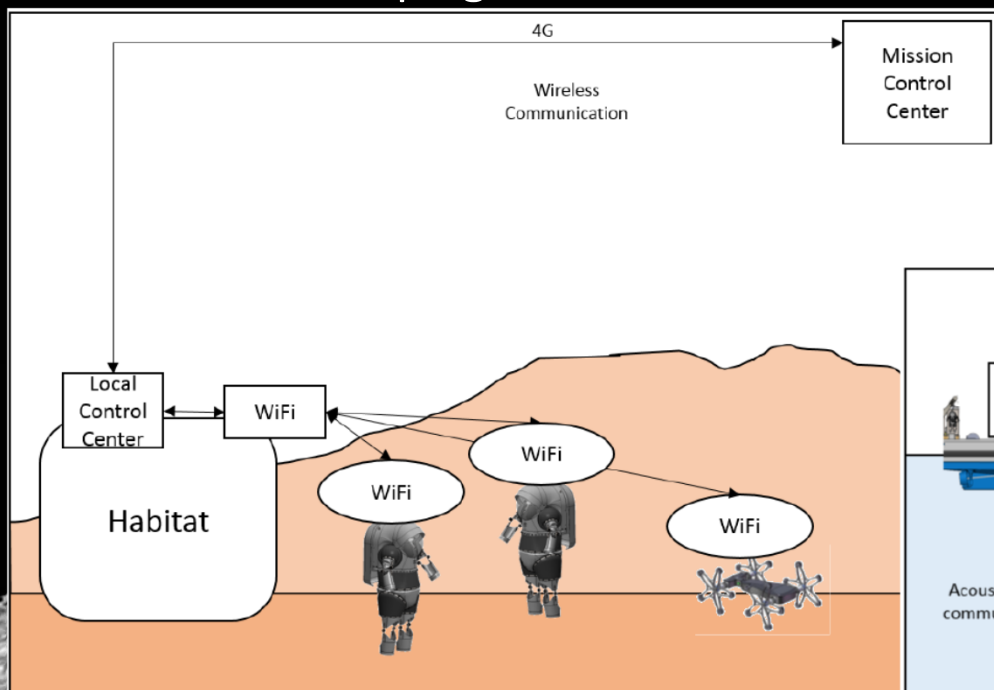
Gesture control (and position control)

The IMU that are used to perform the gesture control for the robot are also used to perform hazardous position detection (and alert !)



EVA Simulations

The final test campaigns are foreseen for the first half of 2016.





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SIMULATION OF FUTURE ASTRONAUT-ROBOT COOPERATION



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Opportunities

Lunar Simulation: Subsea Marseilles

30th May – 10th June
2016 (5 days)



Rio Tinto: Mars Simulation

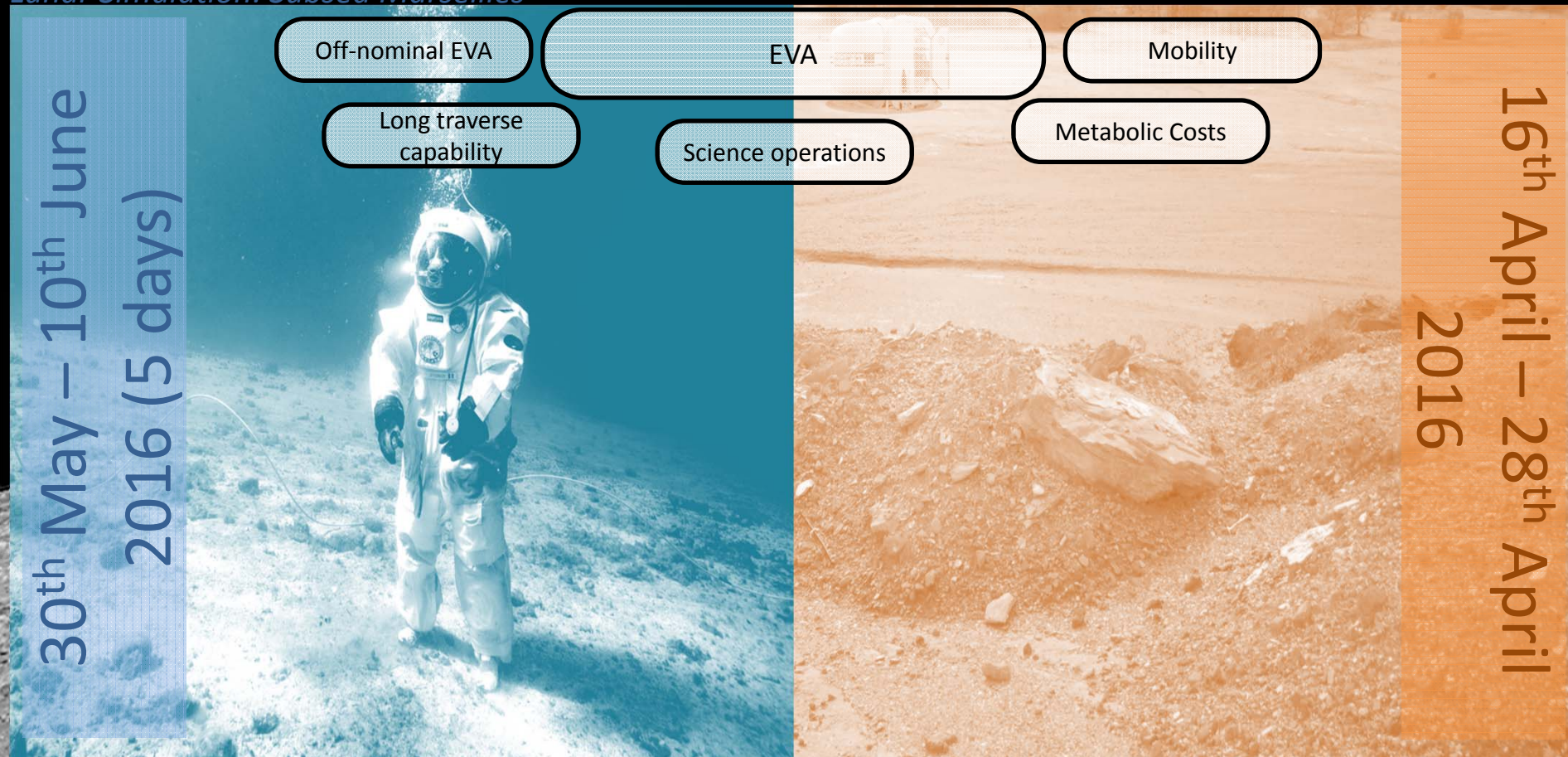
16th April – 28th April
2016



Opportunities

Lunar Simulation: Subsea Marseilles

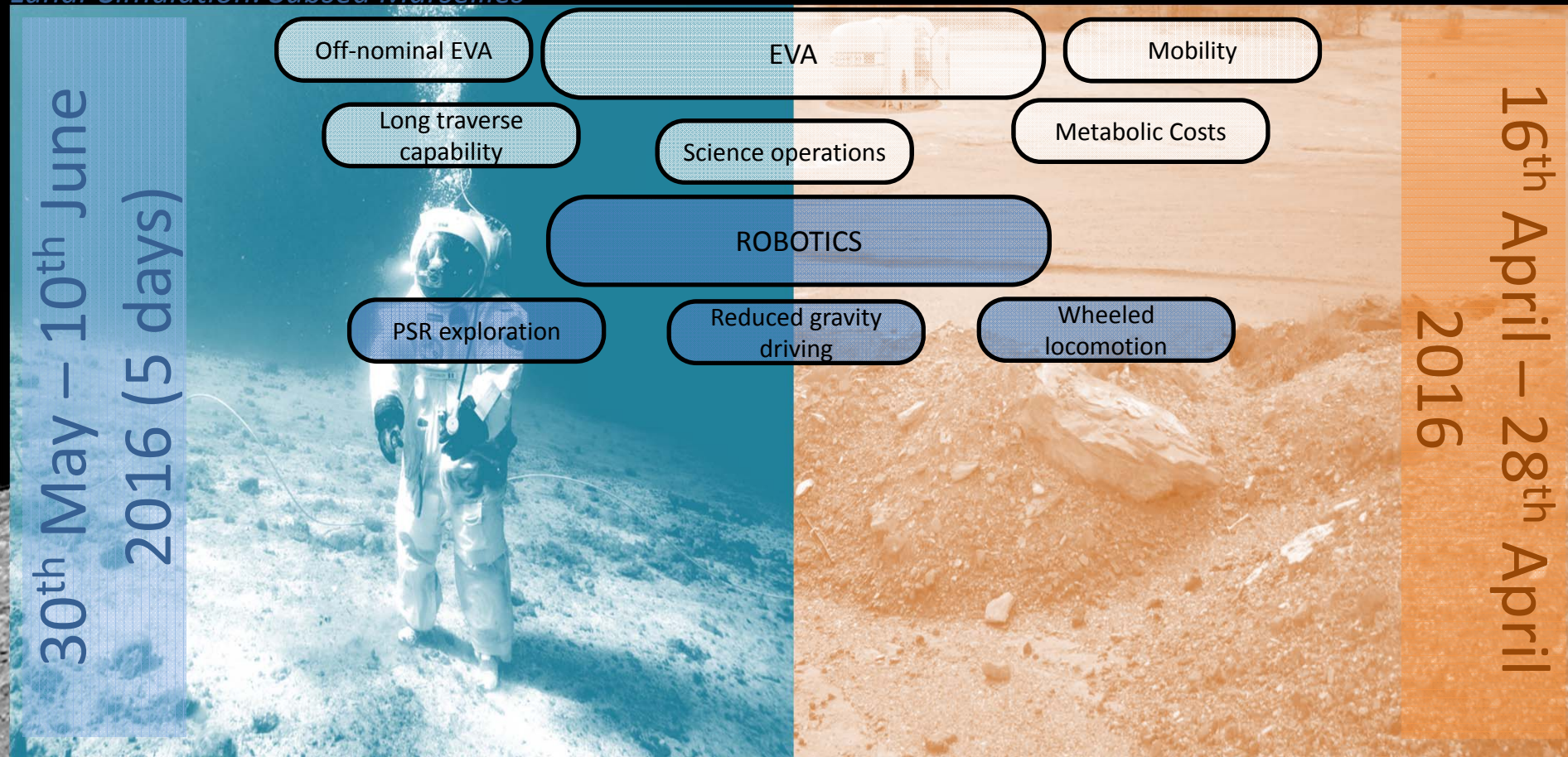
Rio Tinto: Mars Simulation



Opportunities

Lunar Simulation: Subsea Marseilles

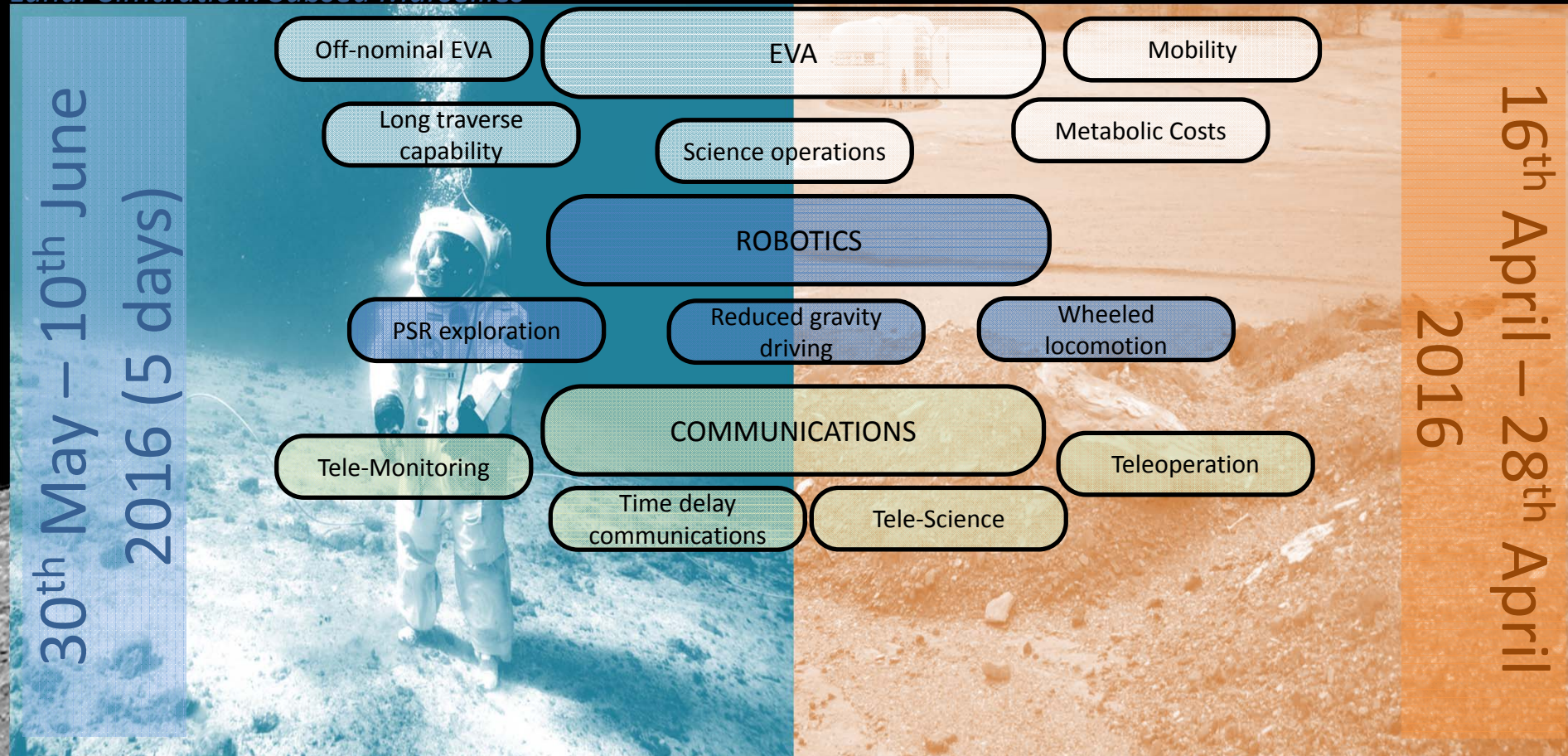
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Opportunities

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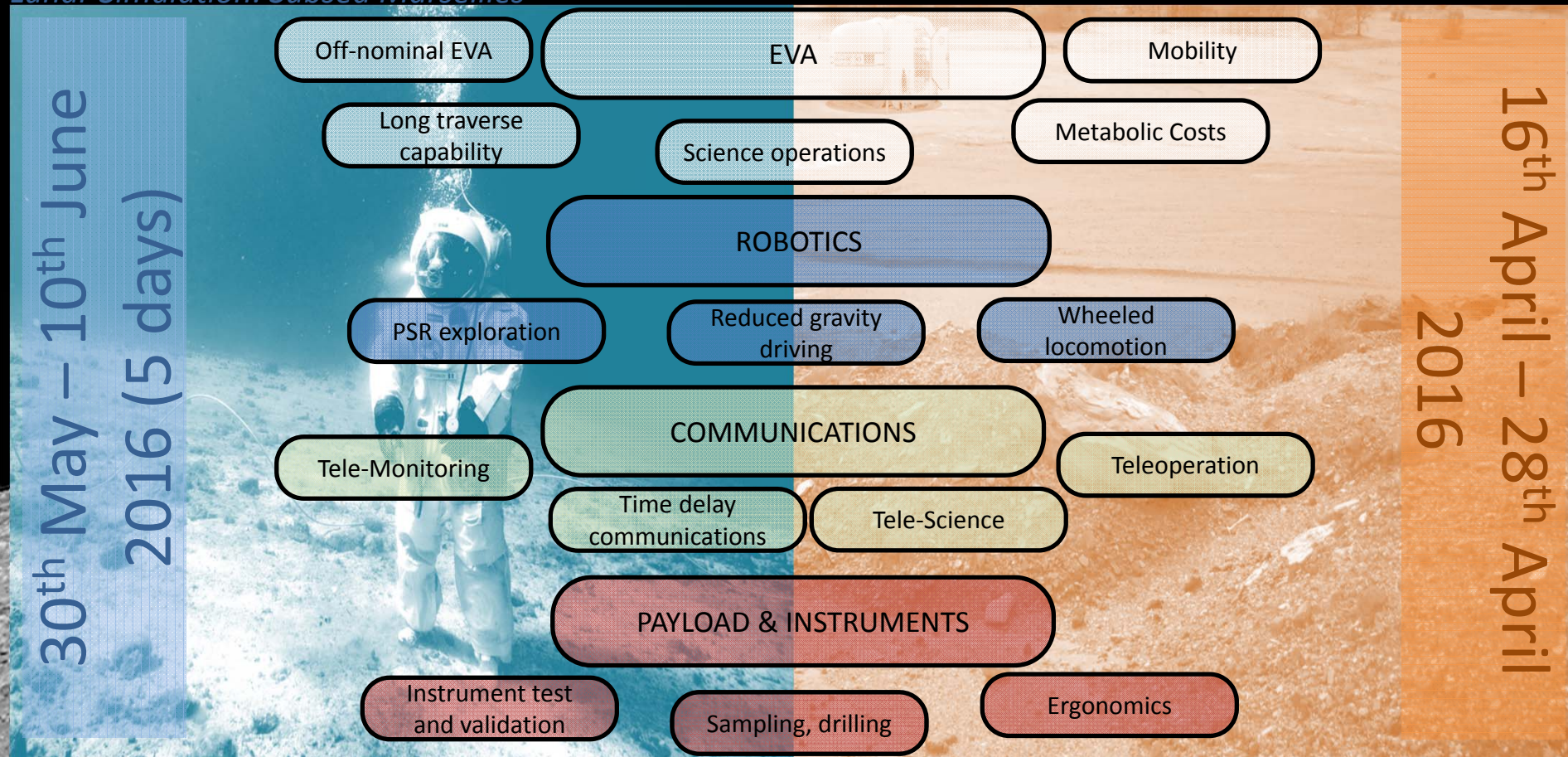
Rio Tinto: Mars Simulation



Opportunities

Lunar Simulation: Subsea Marseilles

Rio Tinto: Mars Simulation





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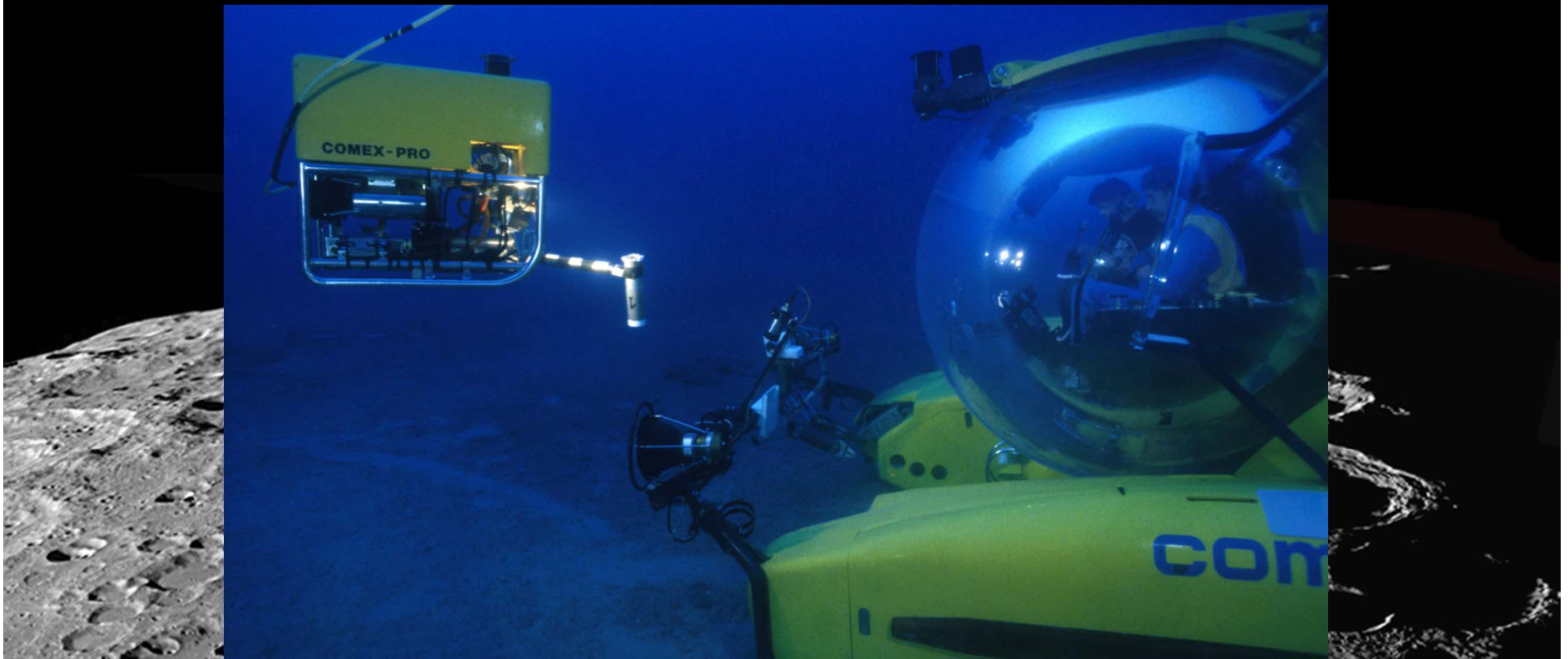
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Spin-Off Developments

- In subsea robotics in general (i.e. subsea mining)
- METERON-like robot control using subsea robots as “slave”





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Kid Competition





www.projectmoonwalk.net