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The MOONWALK Project

ASTRONAUT-ROBOT COOPERATION DURING SURFACE EVA

ASTRA Conference
Leiden 22/06/2017

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The MOONWALK Project

I. COMEX
– From sea to space

II. The MOONWALK Project
– simulation of future robotic and manned missions to the Moon and Mars

III. Outlook

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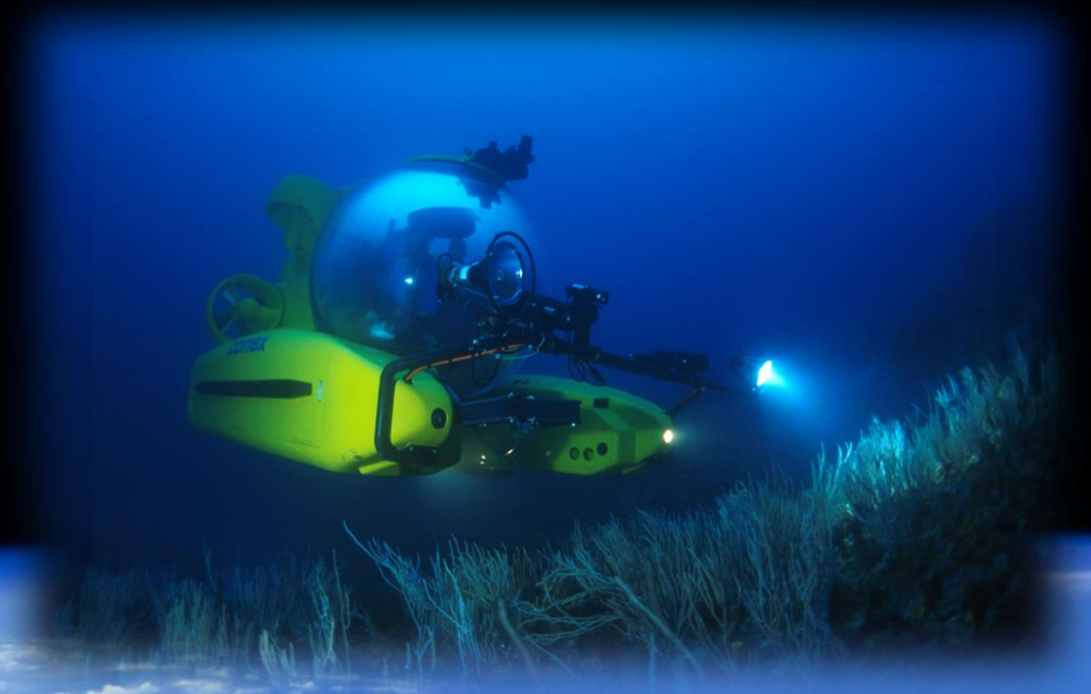
COMEX
From the sea to space



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COMEX and its expertise

The *Compagnie Maritime d'Expertise* (COMEX) was founded in 1961 by Henri Germain Delauze (1929-2012).

It became a worldwide pioneer in the development of technologies for human and robotic intervention in extreme environments.

Saturation dive 180m under ice (1969)

AQUABULLE habitat (1980)

HYDRA-10 deep-diving record (1992)

REMORA2000 submarine (1995)

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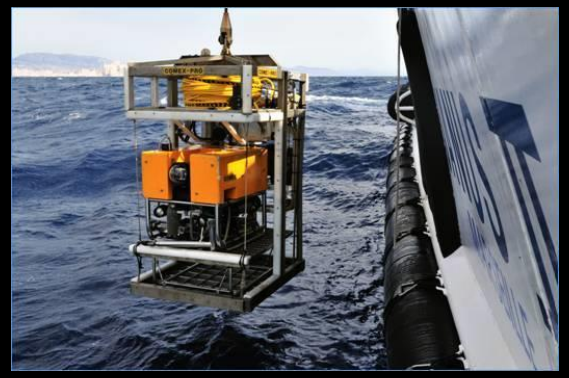
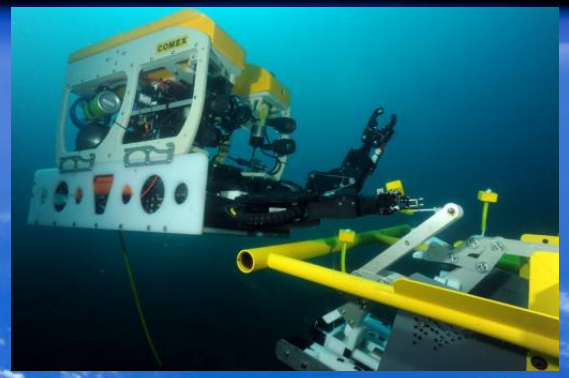
Marine Operations





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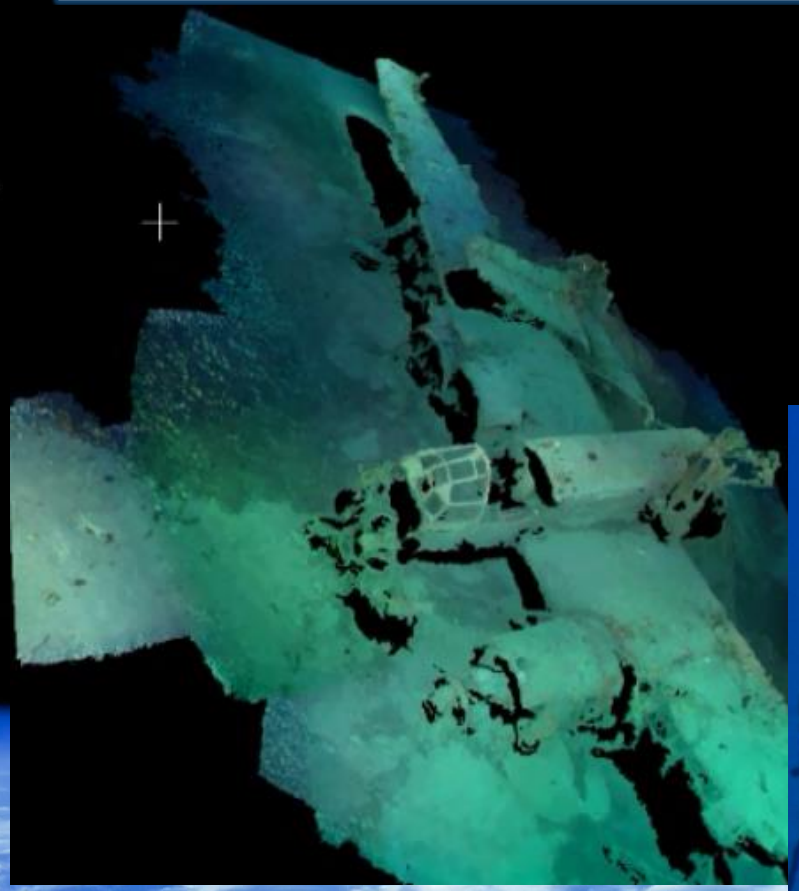
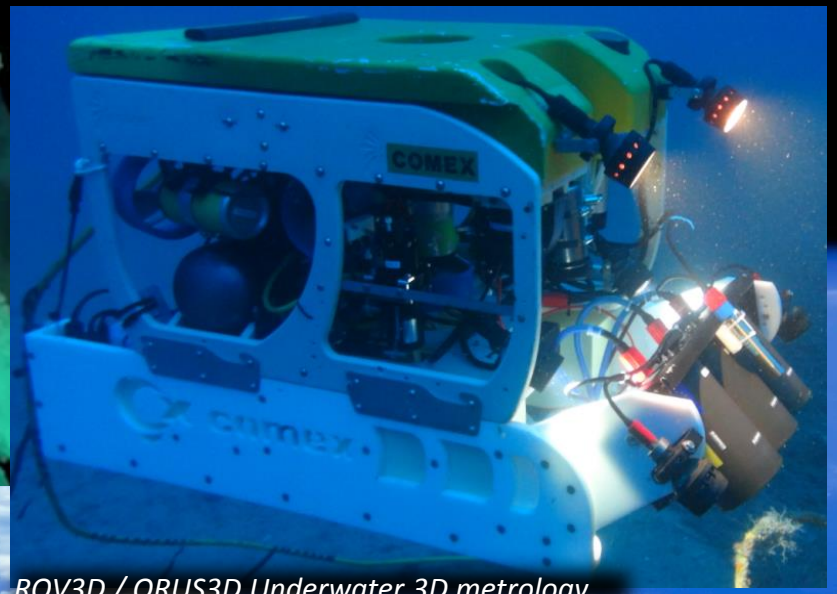
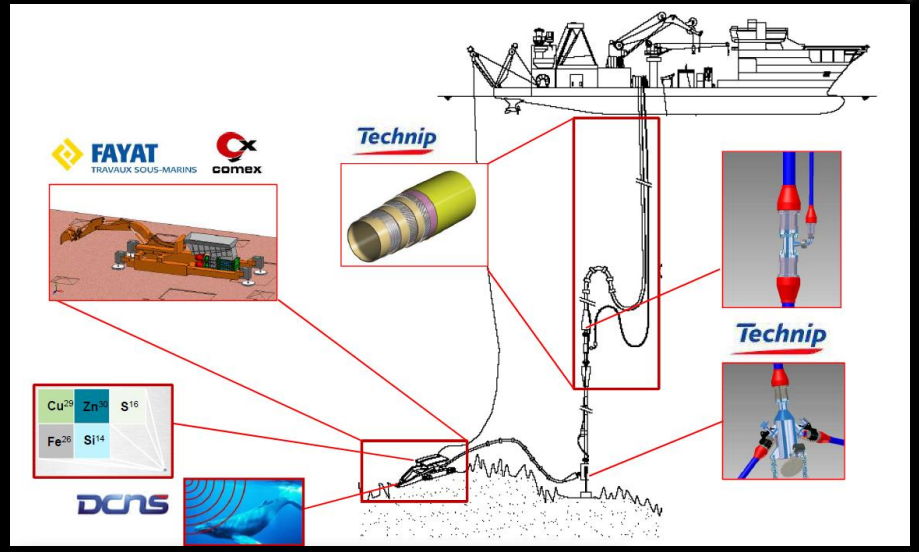
Robotics and Vision – 3D metrology





ROV3D / ORUS3D Underwater 3D metrology



FONASURF: Subsea mining robotic system

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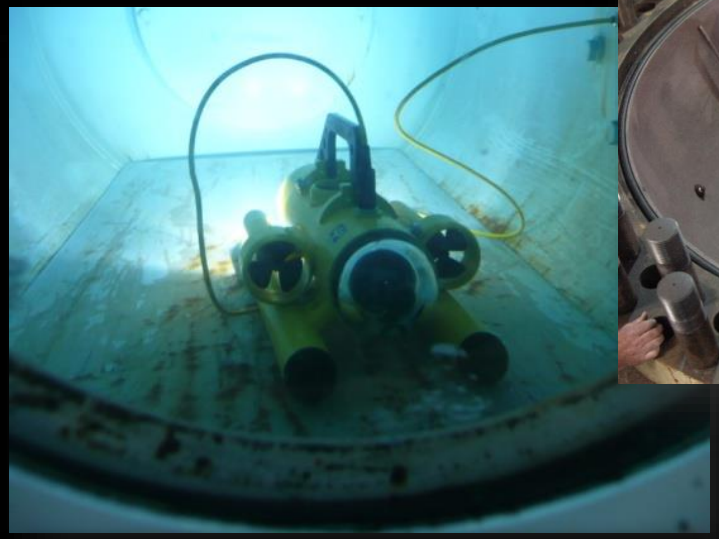
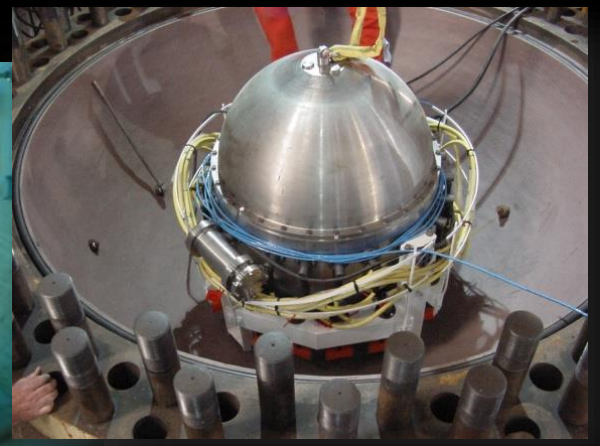
Extreme environment engineering

Space and stratospheric suits testing and development





Pressure chamber testing (from vacuum to 400bar)

Space mission simulation

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The MOONWALK Project (FP7)

Simulation of astronaut-robot cooperation during lunar and Martian EVA

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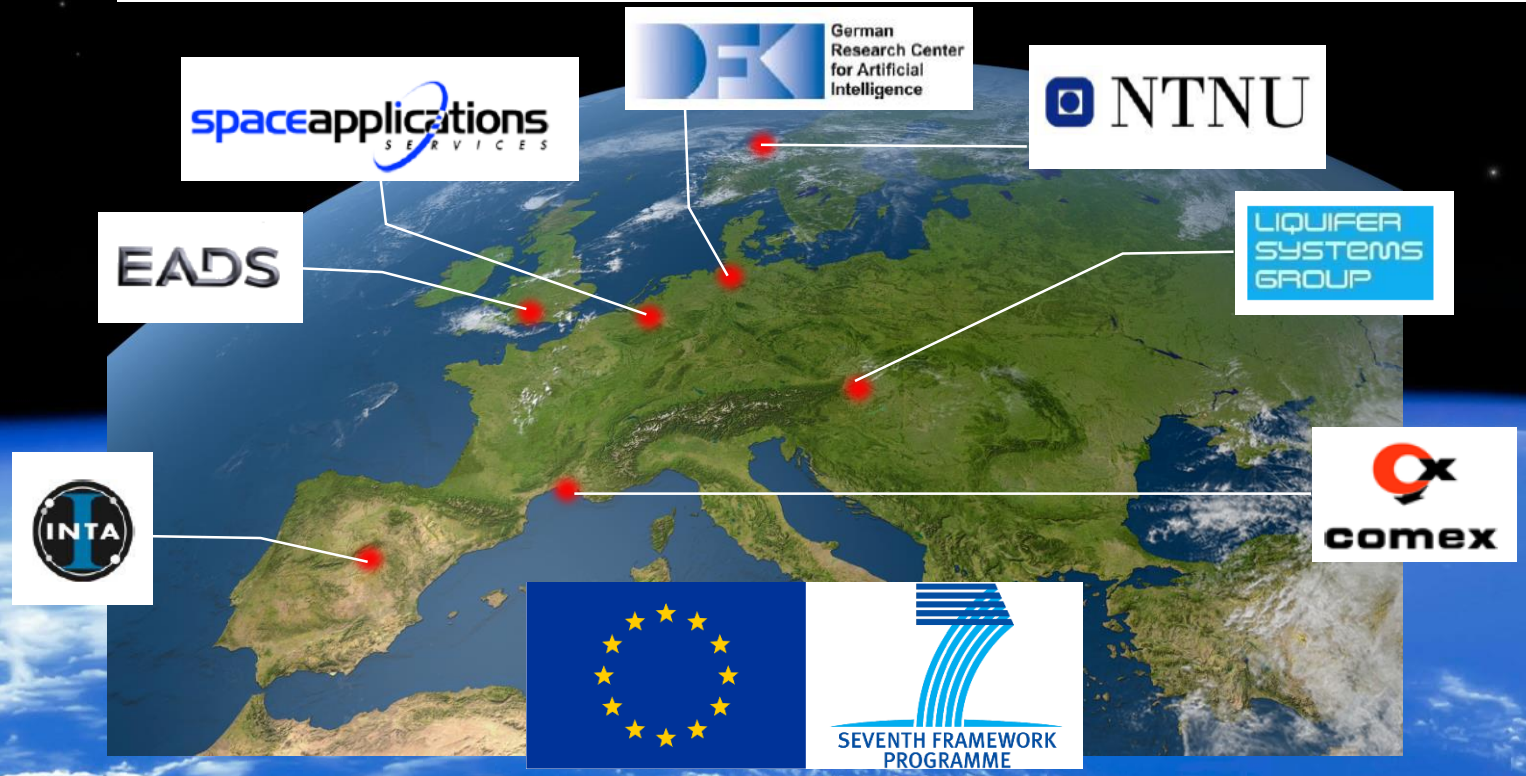
The MOONWALK project (European Commission - FP7)

GOAL

The goal of project **MOONWALK** is to develop and test technologies and training procedures for future human missions to Moon and Mars. MOONWALK will focus on astronaut-robot cooperation applied to Extra-Vehicular Activities (EVA) on planetary surfaces.



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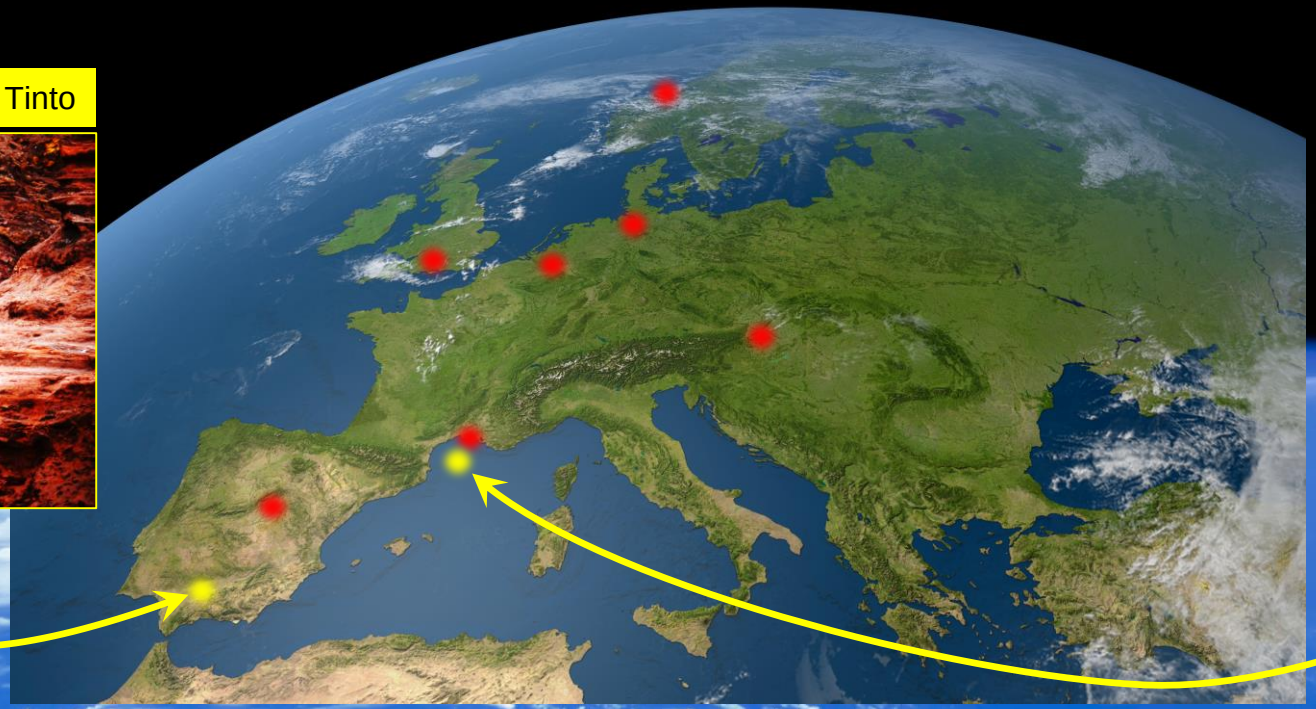
Mars Simulation – Rio Tinto



Moon Simulation – Marseille

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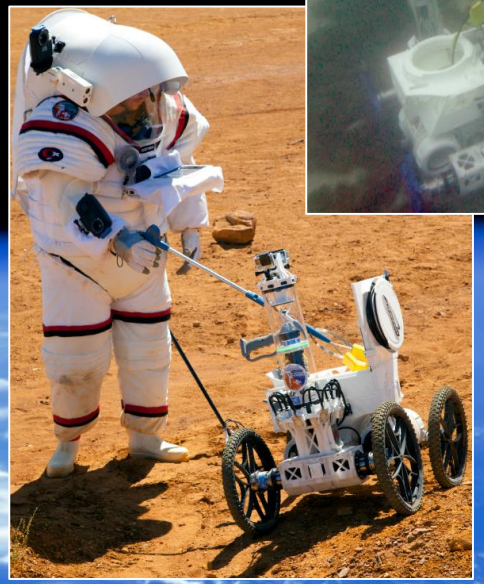
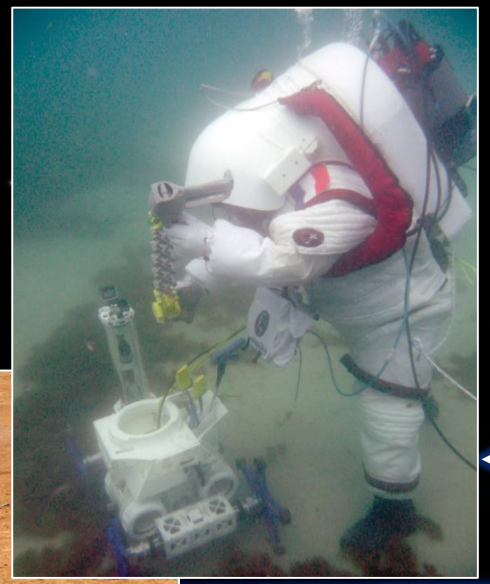
The Simulation Architecture

On site elements





Mission Control Centre at SPACE APPLICATIONS

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Comparative cases

	Reduced Gravity (1/6e G)	Normal Gravity (1 G)
Astronaut = Astronaut		
Astronaut = Robot		

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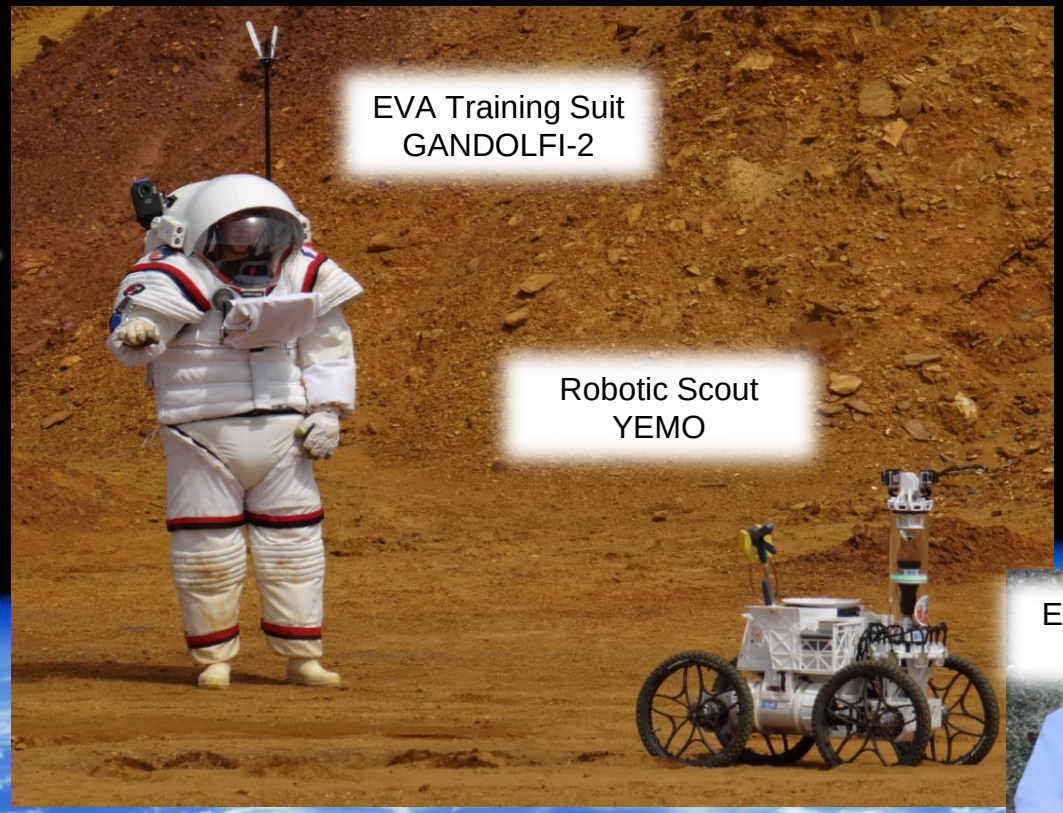
Infrastructure during the Rio Tinto tests



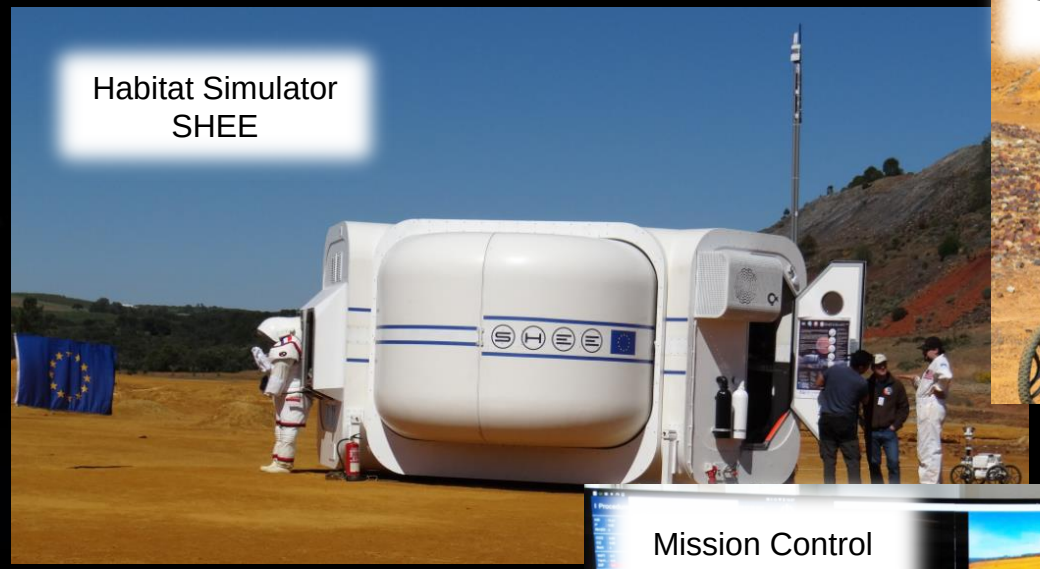


Photo: Space Application Services

Photo: Space Application Services

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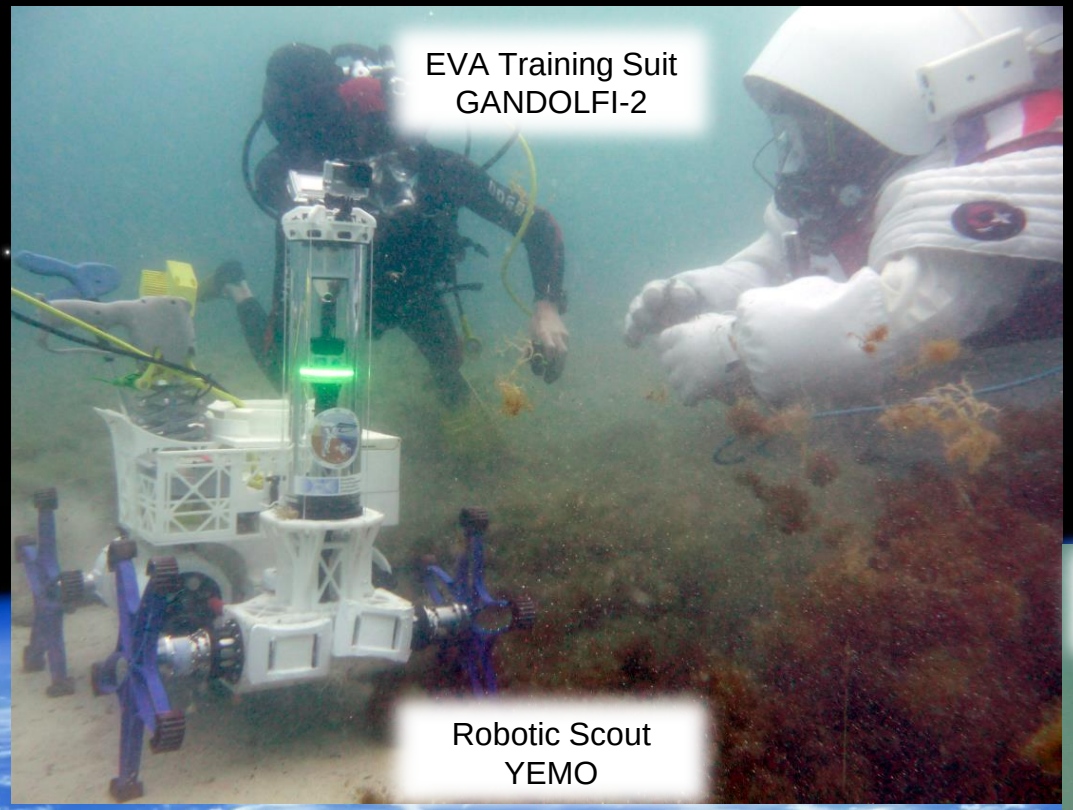
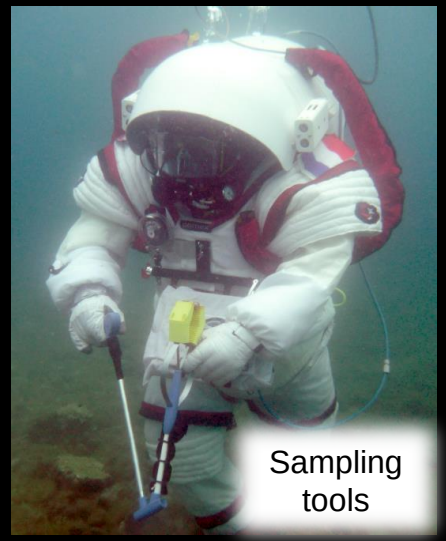
Infrastructure during the Marseilles tests





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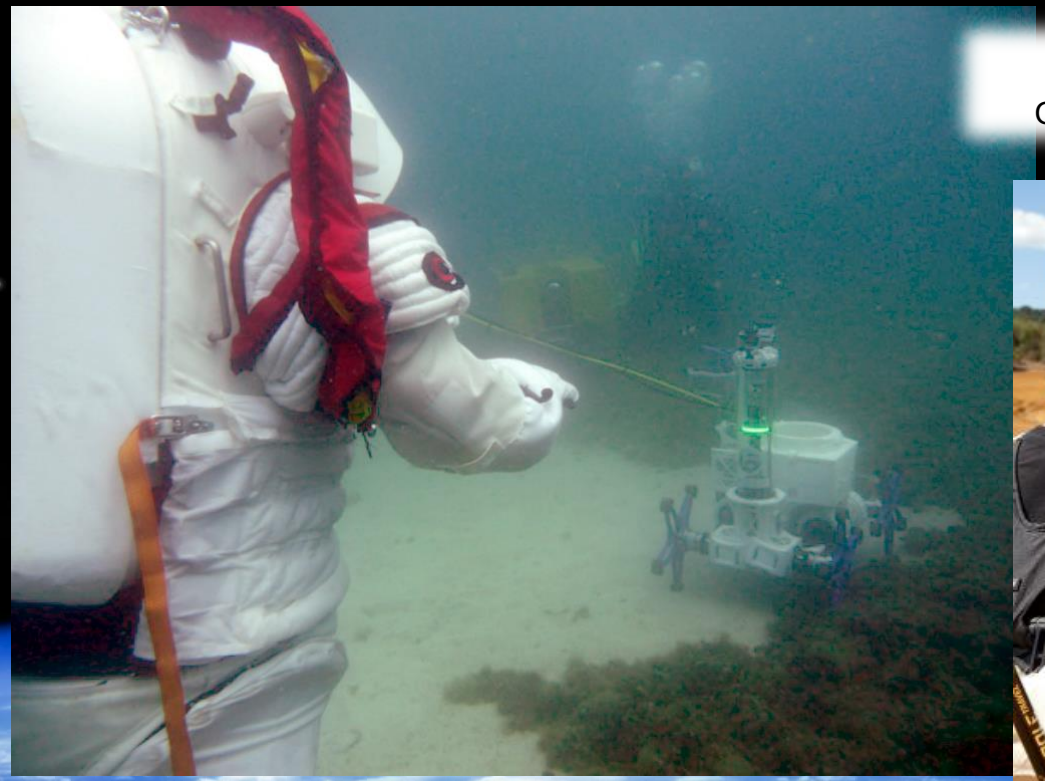
The MOONWALK project



Control of the robot

Gestures, tablet, « follow-me »

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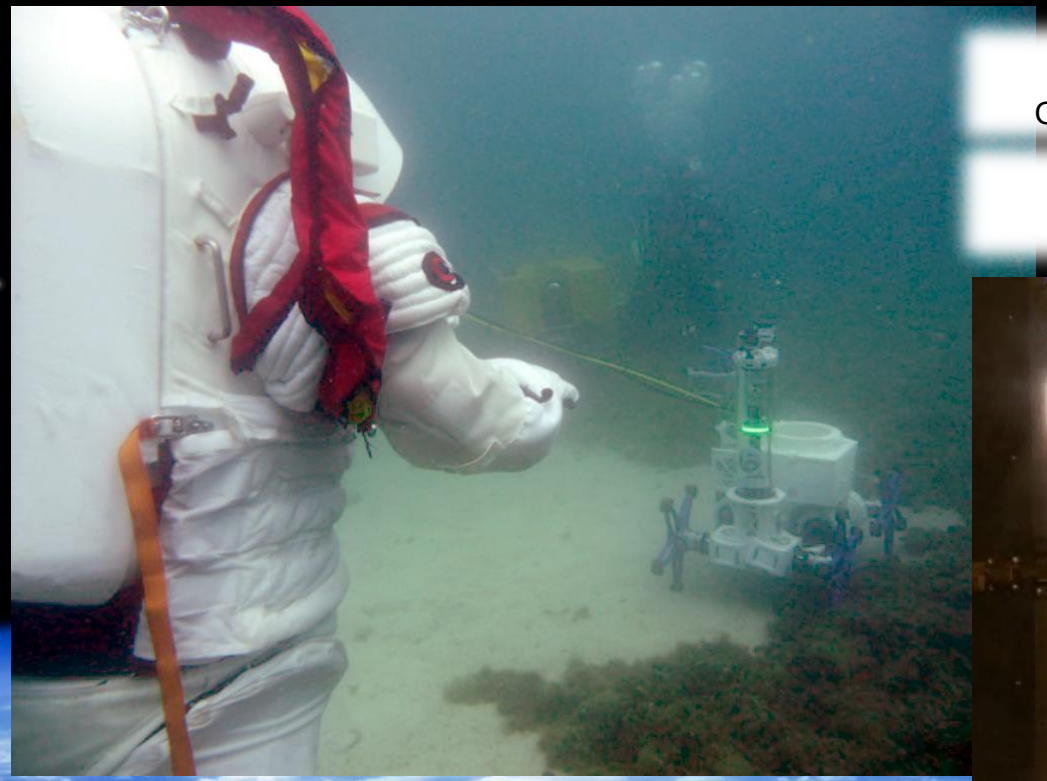
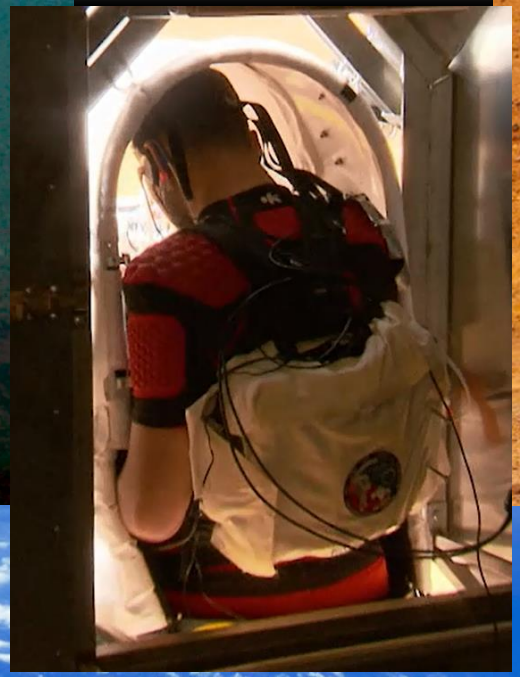
The MOONWALK project



Control of the robot

Gestures, tablet, « follow-me »

Biomonitoring
(evaluation of the stress)



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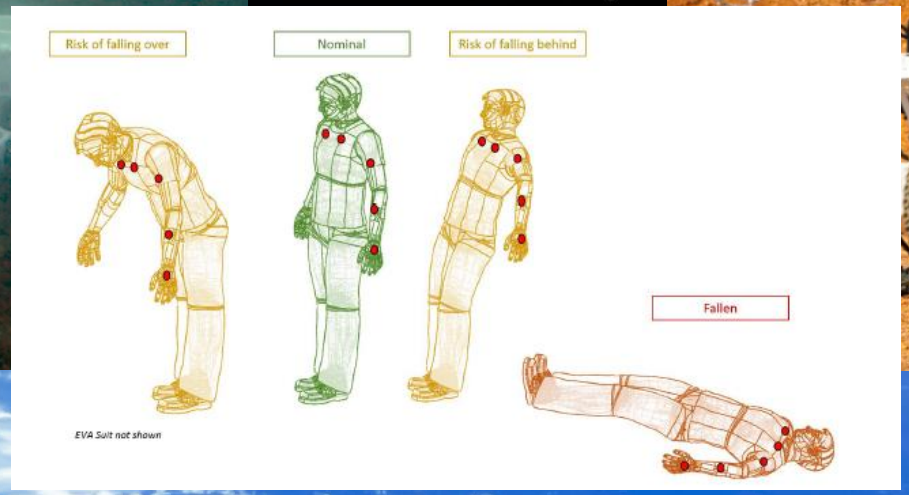
The MOONWALK project

Control of the robot

Gestures, tablet, « follow-me »

Biomonitoring
(evaluation of the stress)

Hazardous Position Alert



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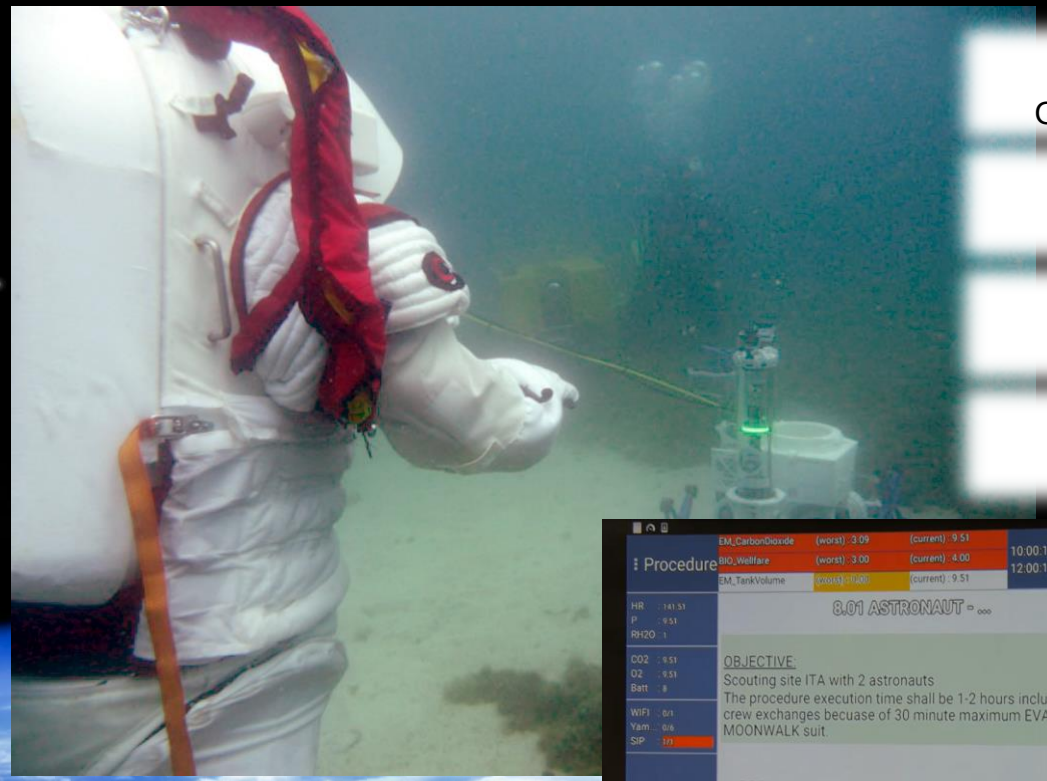
The MOONWALK project



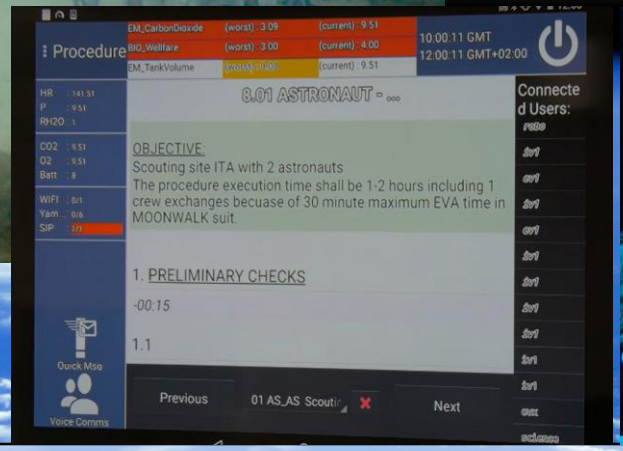
Control of the robot

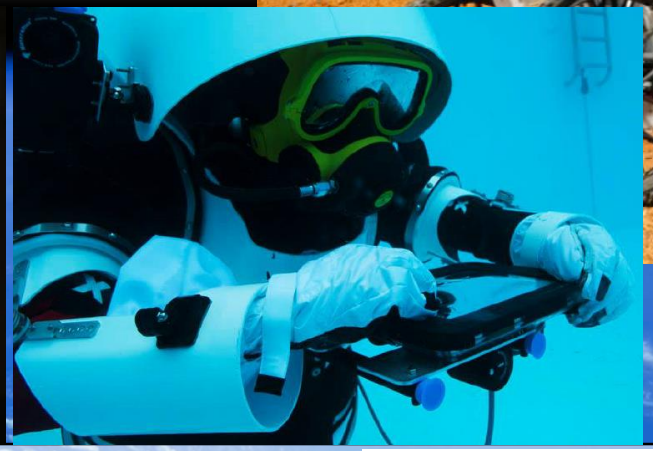
Gestures, tablet, « follow-me »

Biomonitoring
(evaluation of the stress)

Hazardous Position Alert

Communication strategies
(Earth-Mars)





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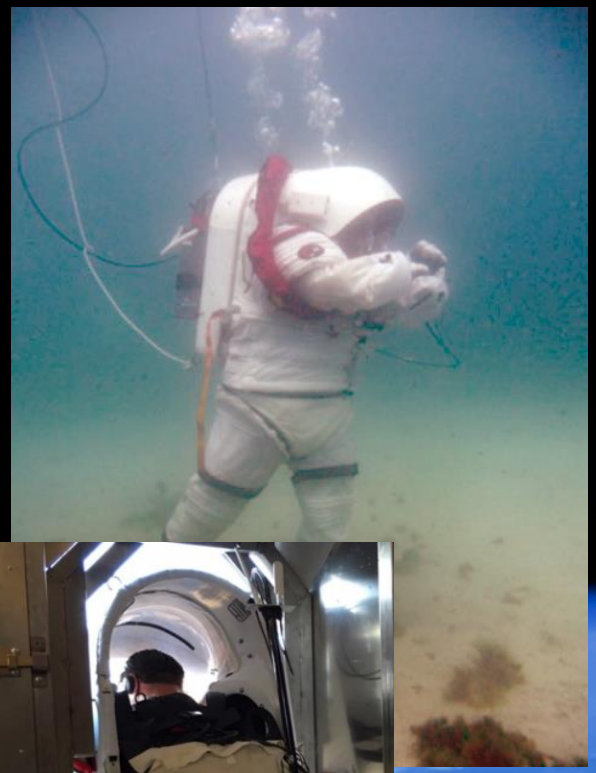
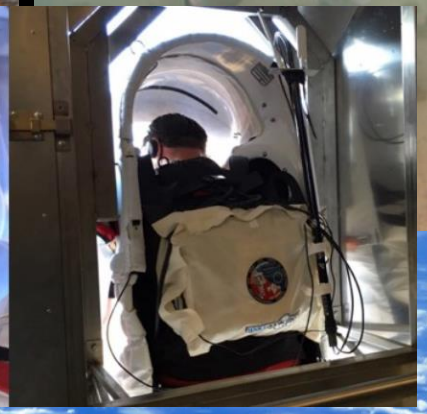
EVA Information system EVIAS and Sampling Tools





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Results:

	In 1 EVA	Accumulated/peak
Distance	*780m* *Max distance for 1 EVA*	*2200m* *Max cumulative distance for 1 subject*
Time	*00:52:00* *Max time for 1 EVA*	*04:01:49* *Max cumulative time for 1 subject*
Speed	*3,05 km/h* *Max average speed*	*5,1 km/h* *Max speed peak*

Current space suit designs might be too heavy for EVA on Mars.

Subsea (or underwater) simulations are a good method for astronaut training while terrestrial simulations serve enormously to test and engineer.

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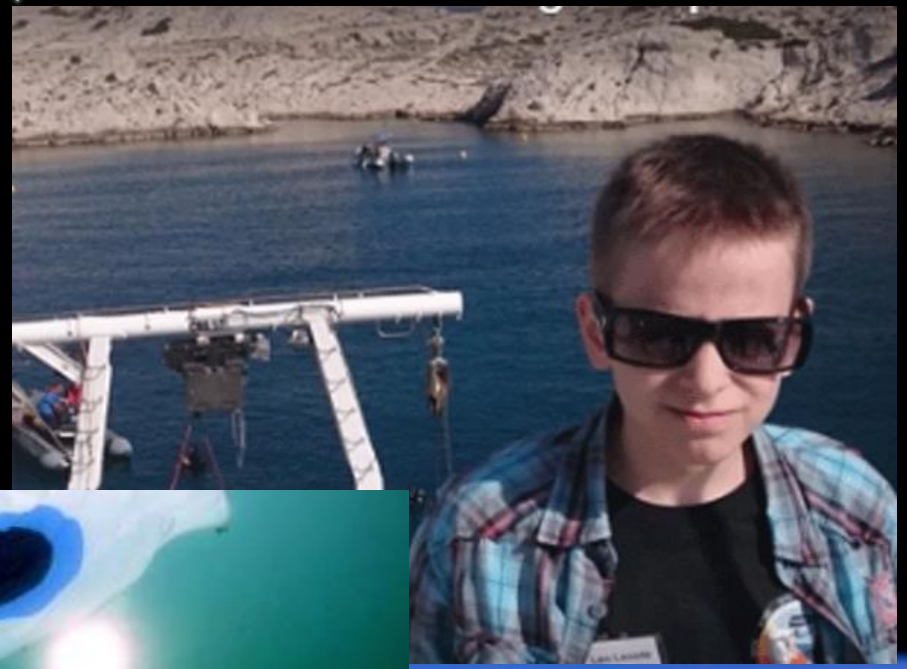
« Today Mars – Tomorrow the Stars! »



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Outlook

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MOONDIVE: Development of underwater simulations for human missions to the Moon or asteroids (ESA)

Development of methods to train astronauts at the EAC NBF for future missions to the Moon and asteroids.

Peter WEISS, PhD , p.weiss@comex.fr – ASTRA 2017, Leiden

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Thank you !

p.weiss@comex.fr