MOON MISSION(s) AS RENAISSANCE AND OPPURTUNITY FOR LARGE SPACE INDUSTRY

Cristina Leone - Presidente

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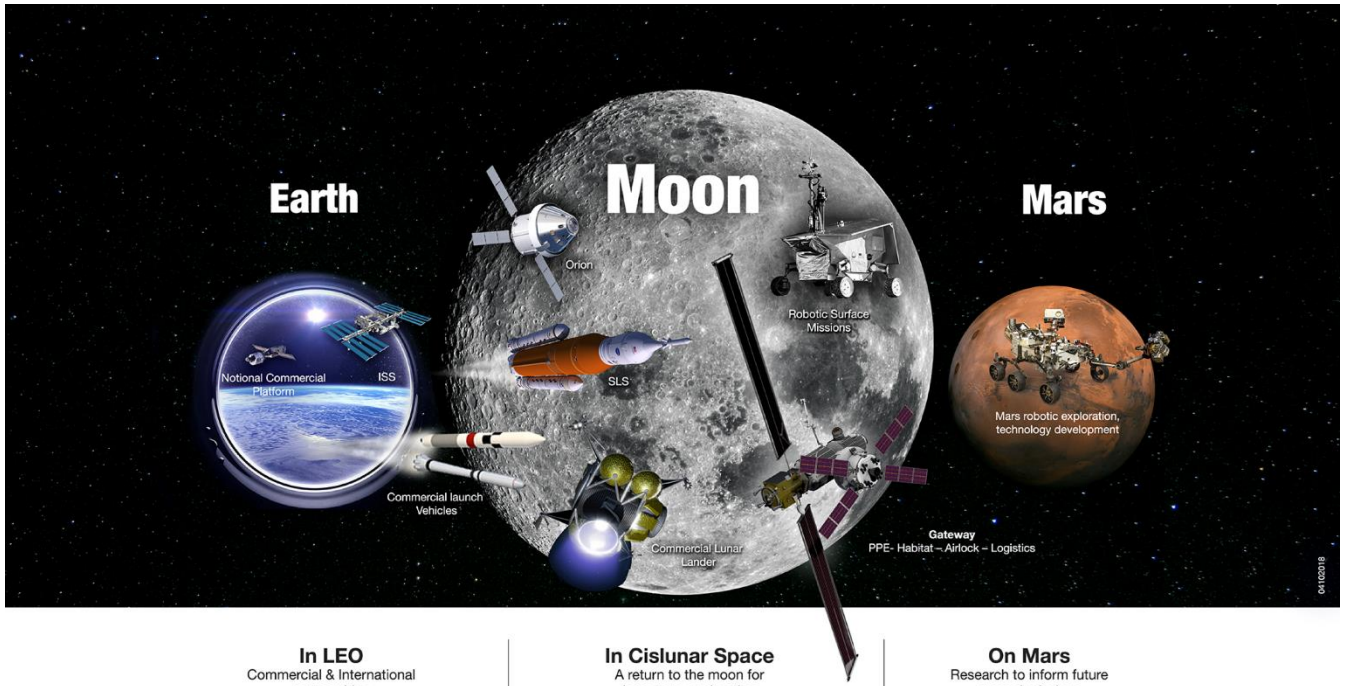
Introduction

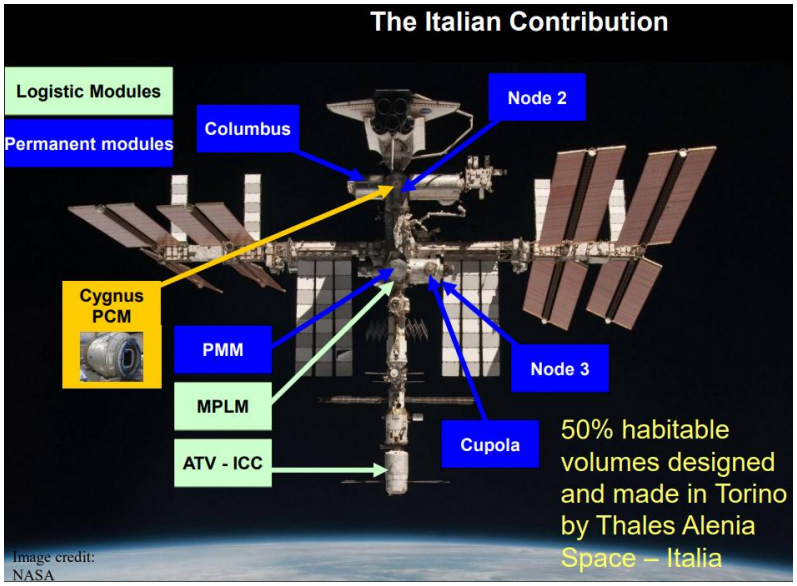
In December 2017, President Donald J. Trump gave NASA a new direction: to refocus exploration efforts on the moon, with an eye to eventually going on to Mars and even beyond.



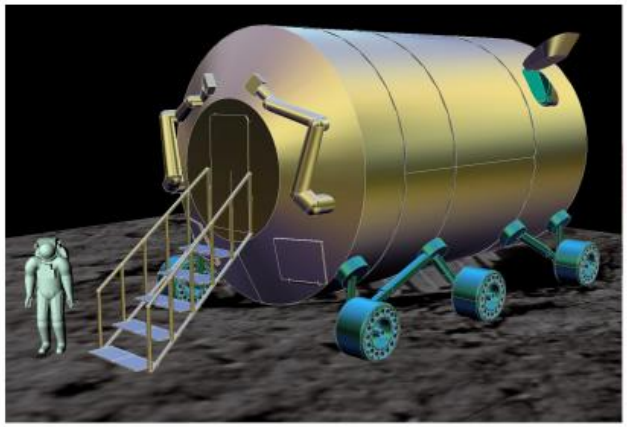
The Exploration Campaign is focused on three core domains: low Earth orbit; lunar orbit and surface; and Mars and other deep space objectives.

Italian assets

Thales Alenia Space provided half of the International Space Station's pressurized volume, which is equivalent to 40% of the entire ISS and it manufactures the Pressurized Cargo Modules for Cygnus vessels, that are dedicated to deliver supplies including food, water, equipment for experiments in space as well as other equipment for repairs and other purposes on the station.



Supported by Cluster & Regional District



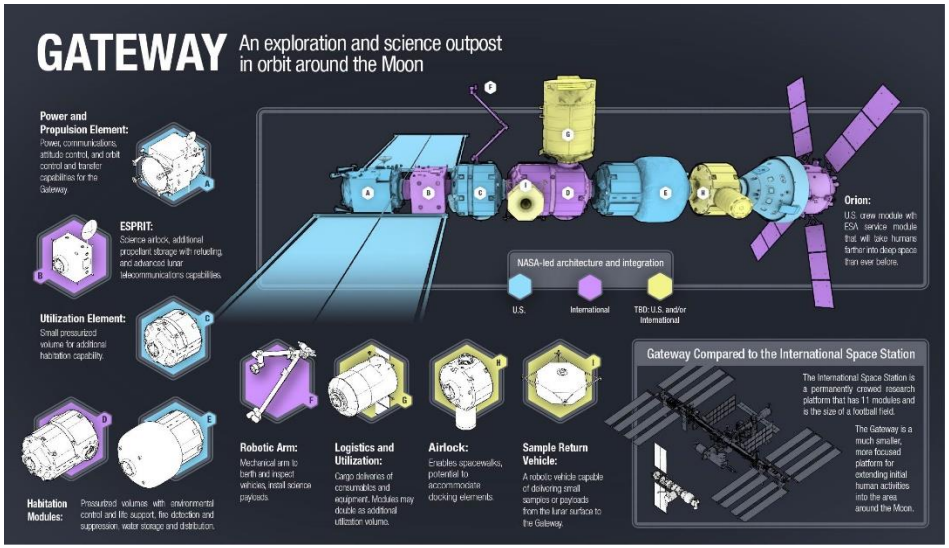
SAPERE project was promoted by **CTNA**, in response to the announcement of Ministry of Research. This project has due research liens. **SAPERE STRONG** aims to develop enabling technologies for rendezvous and docking mechanism, of the electric propulsion subsystem, and of the on-orbit automatic refueling system .

STEPS project was promoted by Piedmont Aerospace District, in response to the announcement of the Piedmont Region on Space Exploration. This project of which Thales Alenia Space is prime contractor, has the involvement of Politecnico di Torino, Universities, research centers e above all 24 small-medium companies.

First human station beyond the Earth's orbit

Thales Alenia Space has yet won contracts with the ESA in the frame of the **Lunar Orbital Platform – Gateway.**

Lunar Gateway is a small spaceship that will orbit the Moon and provide a temporary home for astronauts and laboratories to carry out research, easily reachable with a 5-day trip, that leads to 380,000 km from Earth.



The Gateway will host the astronauts headed for the exploration of the Moon, but above all it will be a "gym" where human beings can prepare themselves for the conquest of the Red Planet.

Human Exploration Roadmap

Starting from the ISS experience, TAS-I can contribute for preparing the Human Space Exploration towards Moon, asteroids, Mars including the capability to safely re-entry in the Earth atmosphere.

Main areas of expertise:

- ✓ Habitat (bid in progress)
- ✓ Logistic (bid in progress) because the moon cannot be permanently inhabited
- ✓ Robotics and AI

Supported by a Industrial and supply chain capacities (national/European sovereignty)

- ✓ **Human Exploration is one of Italian priorities and has a specific focus in the CTNA three-year technological plan**

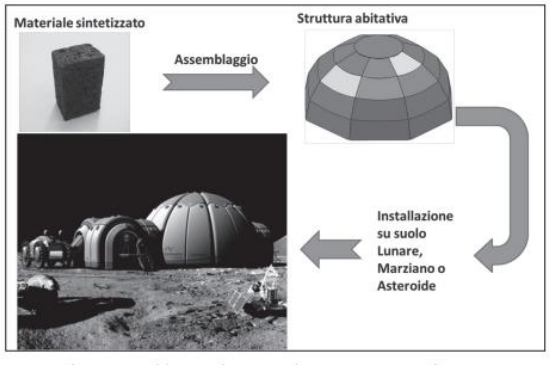
R&D Focus

- ✓ Inflatable Habitats
- ✓ Regenerative Life Support
- ✓ Advanced Thermomechanical materials and propulsion
- ✓ Crew Collaborative Robotics
- ✓ Re-entry demo missions and advanced transportation
- ✓ Landers and Pressurized Rovers

Can we live on the moon?

- ✓ Food Production
- ✓ Radiation protection (bunker/suites)
- ✓ Oxigen extraction

Food Production



DASS (Technological Aerospace District of Sardinia) studies on regolith allow the man, once landed on the Moon, to use the resources available directly on the spot, without the need to transport huge stocks from the Earth.

OHB Italy with Politecnico di Milano is studying technologies (In-Situ Resource Utilization) required for exploiting the lunar soil (regolith materials) in order to produce breathable oxygen and drinkable water. These technologies are key for the sustainable provision of the consumables needed for future human operations on lunar surface.

Space Economy

The ‘New Space’ entrepreneurs are behind the commercialisation of space activities:

- ✓ space tourism (Elon Musk, Jeff Bezos, and Sir Richard Branson, leading the charge for privately funded space excursions)
- ✓ resource extraction activities on the Moon or asteroids,
- ✓ large-scale in-space construction capabilities
- ✓ in-space manufacturing
- ✓ in-space assembly and servicing
- ✓ transportation of people and cargo to and from LEO.

Italian Strenghtness

+ Vision
+ Prime Contractor and supply chain
+ R&D investments
+ Knowledge of business and competitors

Cluster Tecnologico Nazionale Aerospazio

Sede Legale

c/o AIAD Via Nazionale, 54 - 00184 Roma

Email: Info@ctna.it

Website: www.ctna.it