Human Spaceflight & Operations (HSO)

Programmi di esplorazione spaziale promossi da ESA

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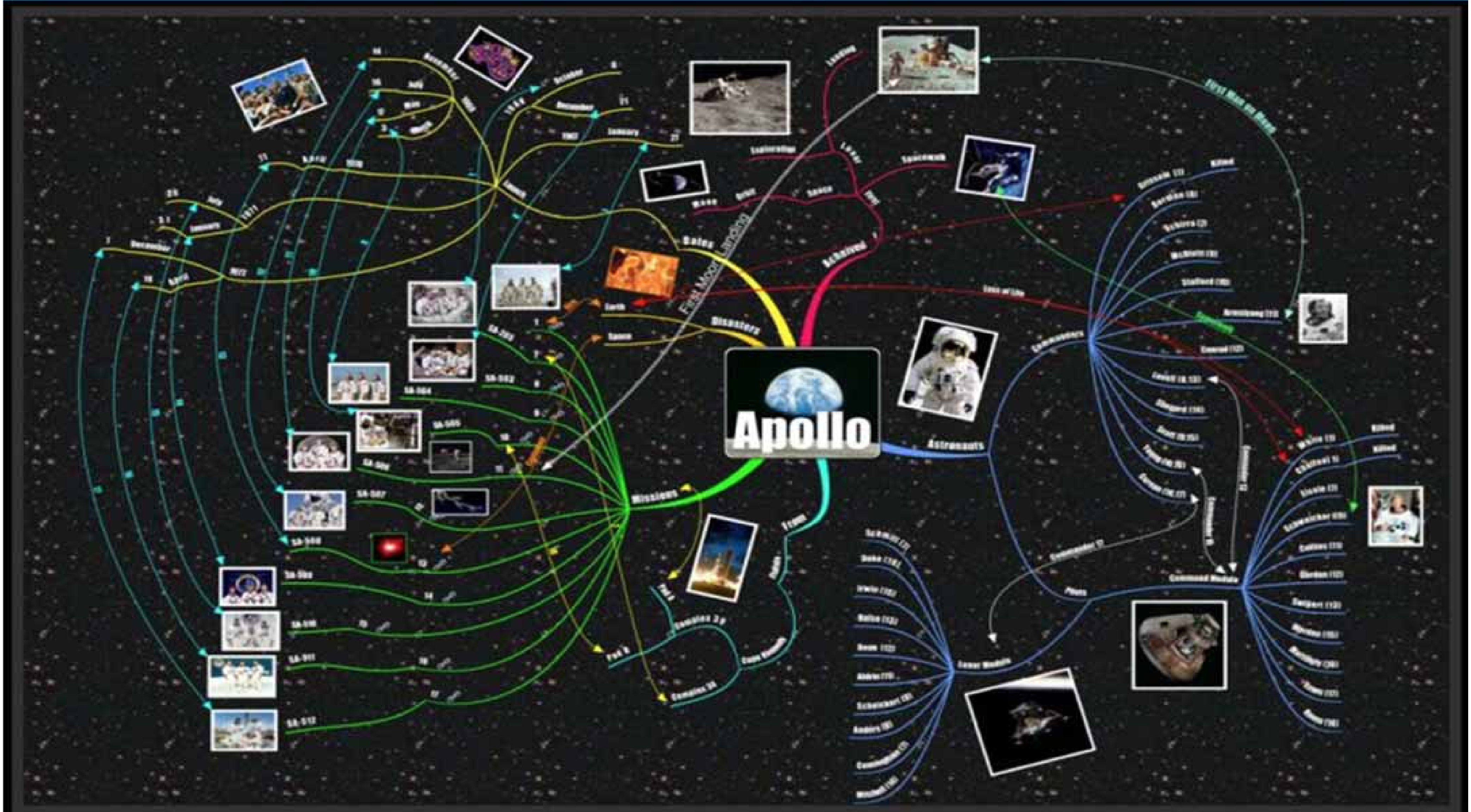
Simposio 'Space Farming'
Firenze, 27.01.2012

I CONTENUTI

- Il **PASSATO** dell'esplorazione spaziale
- Il **PRESENTE** dell'esplorazione spaziale
- **ELIPS**
- Il **FUTURO** dell'esplorazione spaziale
- **CONSIDERAZIONI** FINALI

IL PASSATO



12 aprile 1961

Human Spaceflight and Operations (HSO)

20 luglio 1969

Human Spaceflight and Operations (HSO)

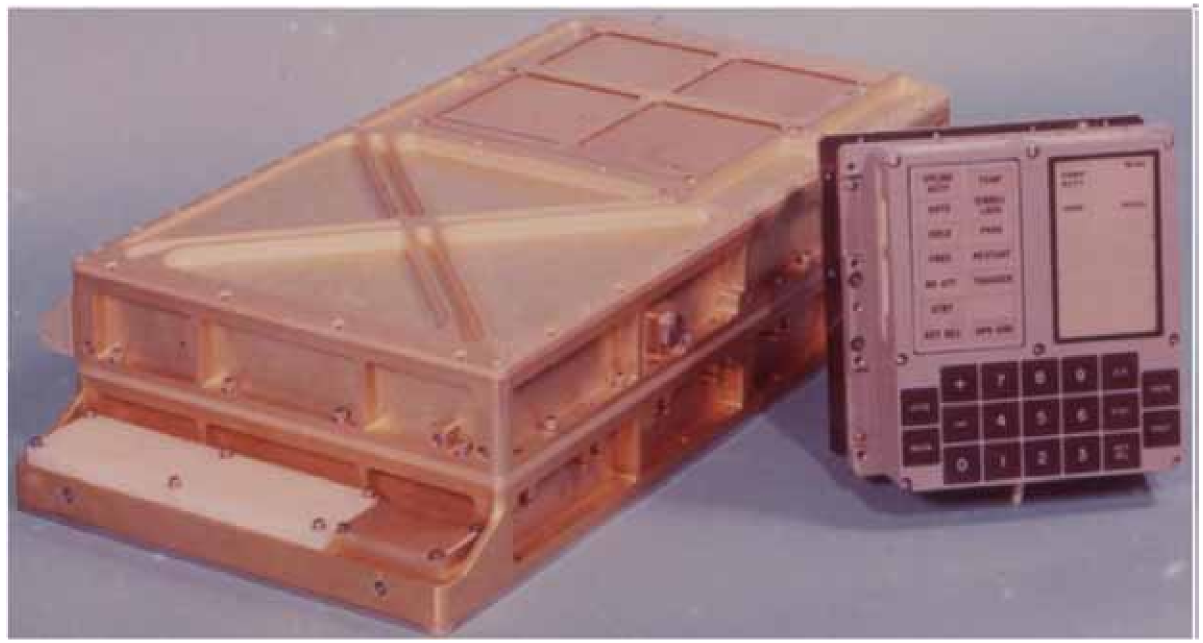
12 Pionieri

- Neil Armstrong (Apollo 11, 1969)
- Buzz Aldrin (Apollo 11, 1969)
- Pete Conrad (Apollo 12, 1969)
- Alan Bean (Apollo 12, 1969)
- Alan Shepard (Apollo 14, 1971)
- Edgar Mitchell (Apollo 14, 1971)
- David Scott (Apollo 15, 1971)
- James Irwin (Apollo 15, 1971)
- John W. Young (Apollo 16, 1972)
- Charles Duke (Apollo 16, 1972)
- Harrison Schmitt (Apollo 17, 1972)
- Eugene Cernan (Apollo 17, 1972)

APOLLO 11's guidance computer

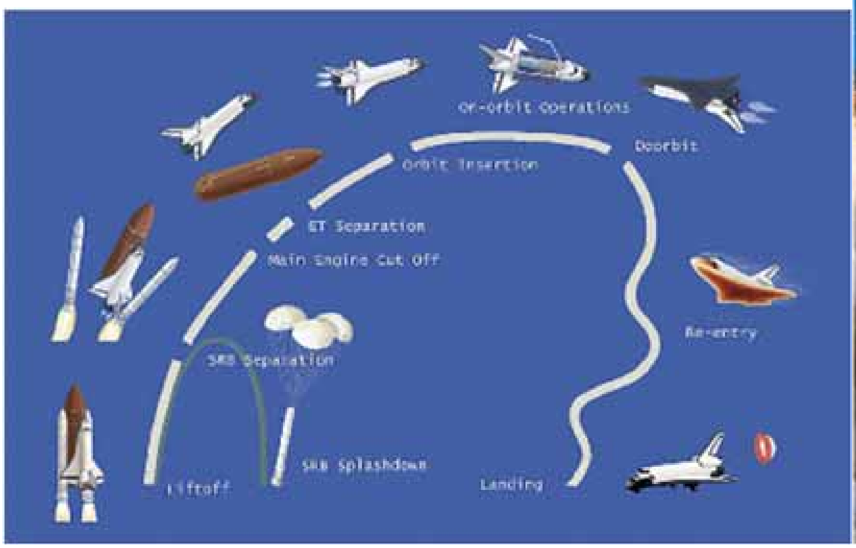
HARDWARE (prestazioni dimezzate rispetto al IBM PC XT del 1979)

- 2k of memory
- 32k of read-only memory
- Clock speed: 1,024 MHz
- 4 registri 16-bit



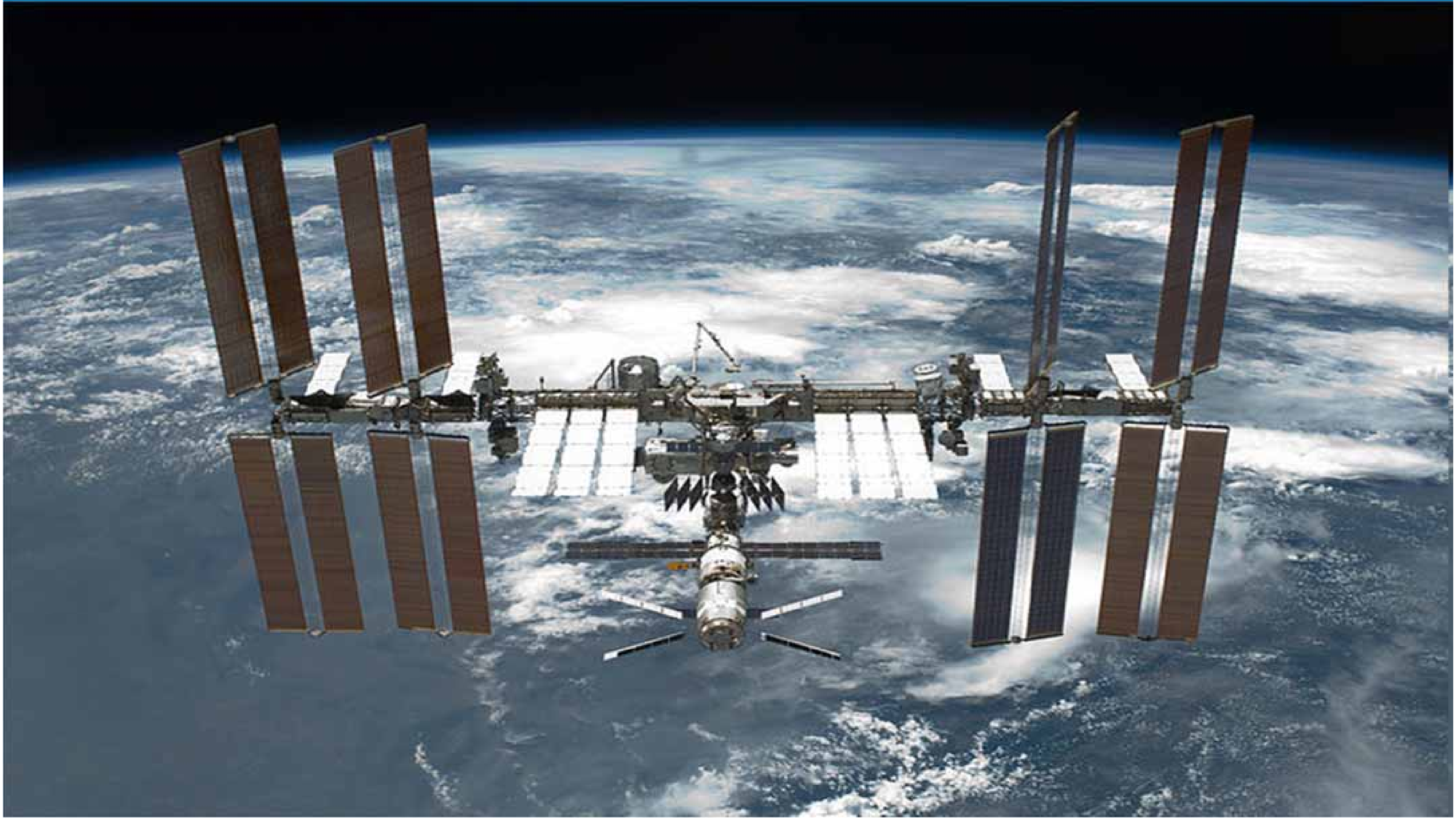
L'era SPACE SHUTTLE

- **135** missioni dal 1981 al 2011
- Sistema combinato di razzi di lancio, navetta spaziale orbitante e ' spaceplane' per il rientro
- Utilizzato per le missioni in LEO (Low-Earth Orbit)
- Utilizzato per la rotazione dell' equipaggio sulla ISS
- 5 Space Shuttle: Columbia (2003), Challenger (1986), Discovery, Atlantis e Endeavour (STS-134)



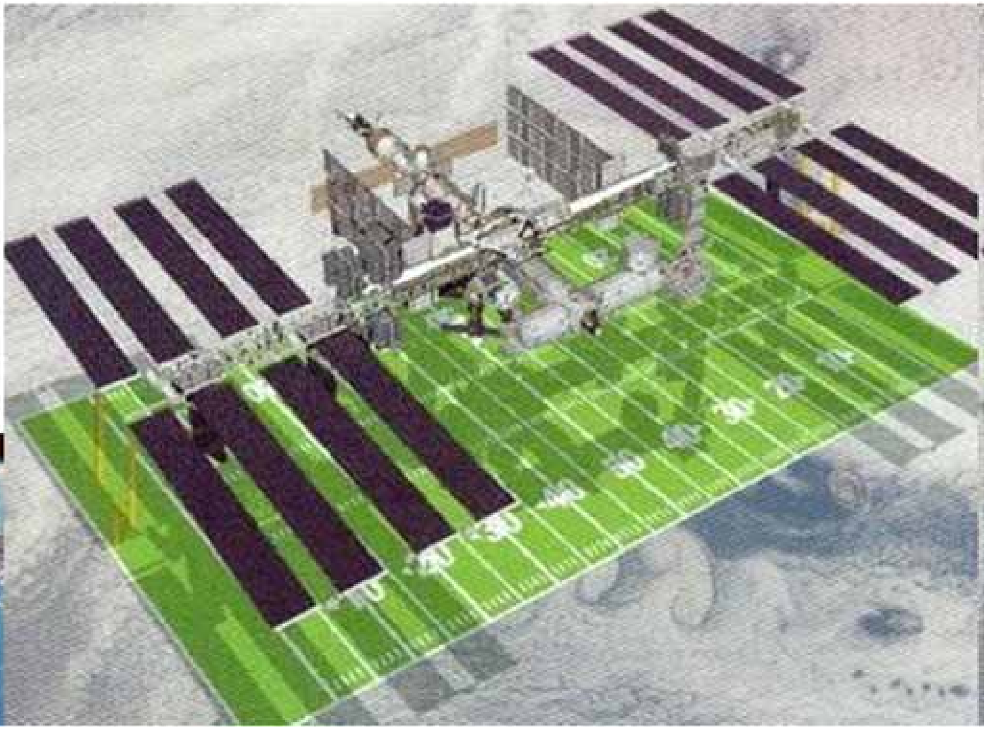
Human Spaceflight and Operations (HSO)

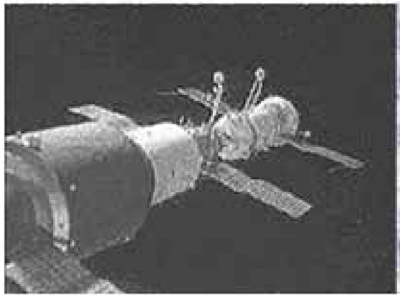
IL PRESENTE: La Stazione Spaziale Internazionale

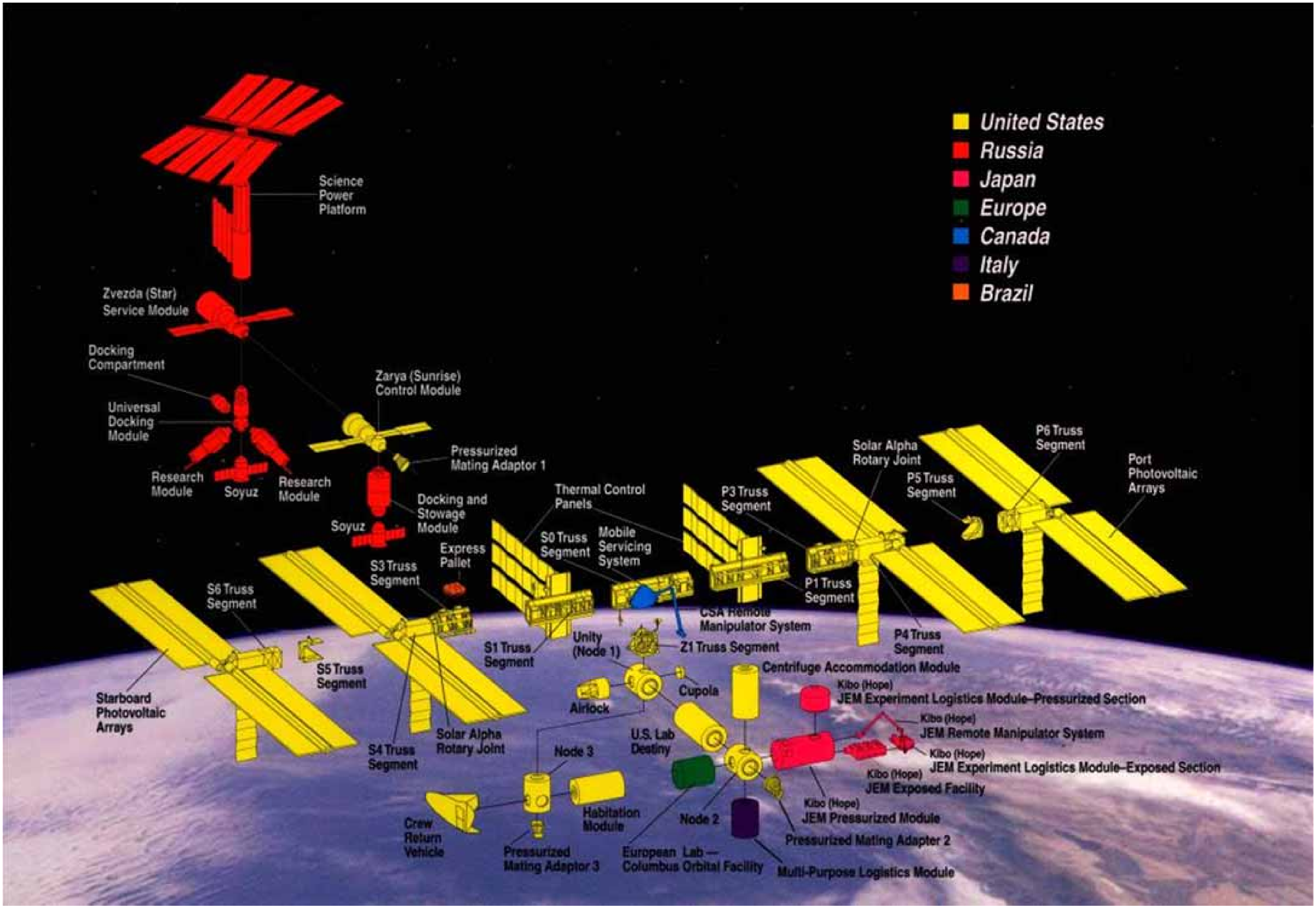


ISS

- E' il risultato di uno sforzo congiunto Europa (ESA), US (NASA), Russia, Giappone (JAXA), Canada (CSA)
- Non 'e il primo esempio di satellite artificale abitabile: in realtá é il NONO
- Salyut-1, Almaz, Skylab, MIR
- Pesa 450 tonnellate
- 330-410 km di altezza
- Lunghezza 72.8 m, Larghezza 108.5 m
- Operativa fino al 2020 (->2028)



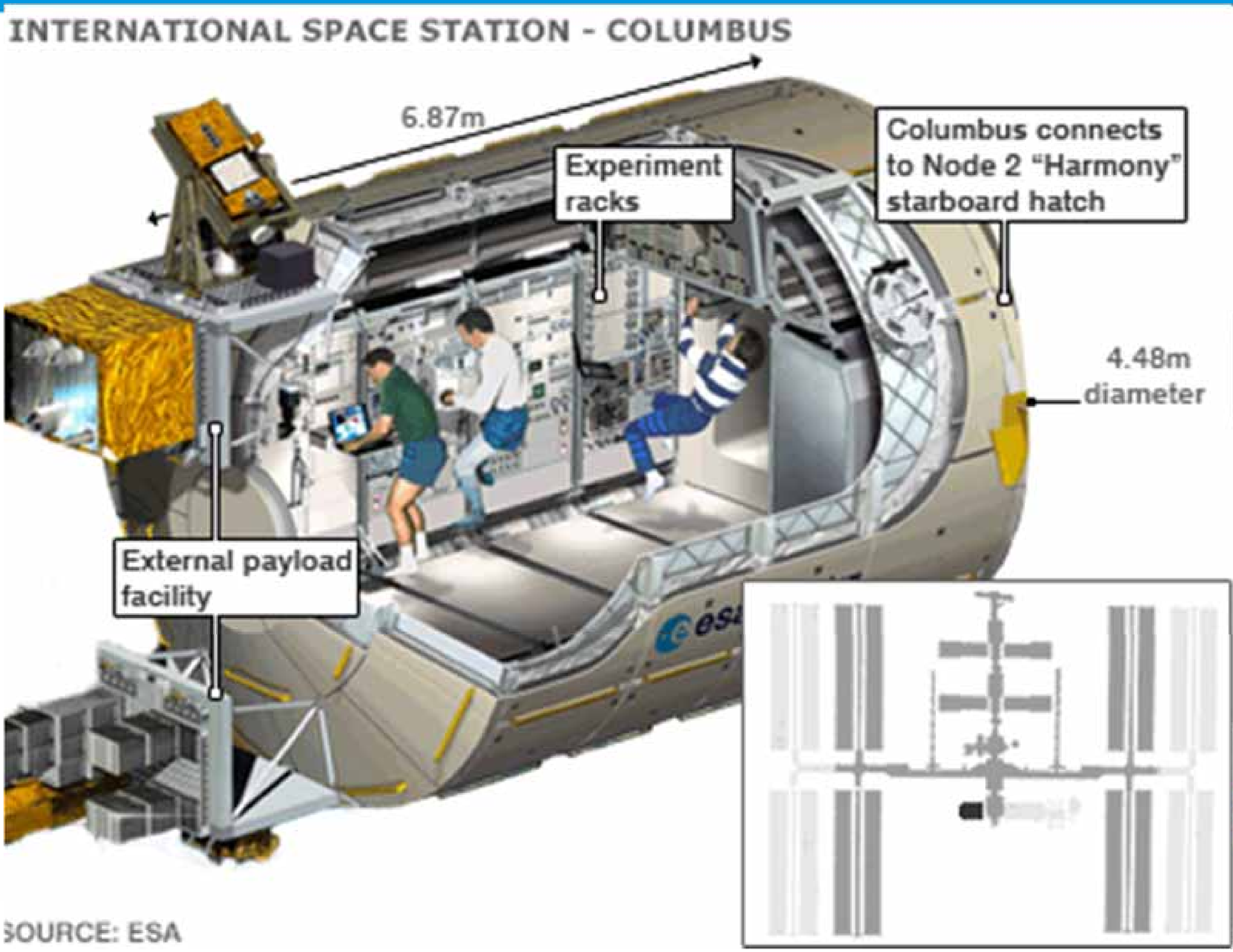




United States
Russia
Japan
Europe
Canada
Italy
Brazil
Science Power Platform
Zvezda (Star) Service Module
Docking Compartment
Universal Docking Module
Research Module
Soyuz
Research Module
Zarya (Sunrise) Control Module
Pressurized Mating Adaptor 1
Docking and Stowage Module
Soyuz
Express Pallet
S3 Truss Segment
S6 Truss Segment
Thermal Control Panels
S0 Truss Segment
Mobile Servicing System
P3 Truss Segment
Solar Alpha Rotary Joint
P6 Truss Segment
P5 Truss Segment
Port Photovoltaic Arrays
P1 Truss Segment
CSA Remote Manipulator System
P4 Truss Segment
S1 Truss Segment
Unity (Node 1)
Z1 Truss Segment
Centrifuge Accommodation Module
S5 Truss Segment
Cupola
Airlock
Starboard Photovoltaic Arrays
Kibo (Hope)
JEM Experiment Logistics Module–Pressurized Section
Kibo (Hope)
JEM Remote Manipulator System
Solar Alpha Rotary Joint
S4 Truss Segment
U.S. Lab Destiny
Node 3
Kibo (Hope)
JEM Experiment Logistics Module–Exposed Section
Kibo (Hope)
JEM Exposed Facility
Habitation Module
Node 2
Kibo (Hope)
JEM Pressurized Module
Crew Return Vehicle
Pressurized Mating Adapter 2
Pressurized Mating Adaptor 3
European Lab — Columbus Orbital Facility
Multi-Purpose Logistics Module

Human Spaceflight and Operations (HSO)

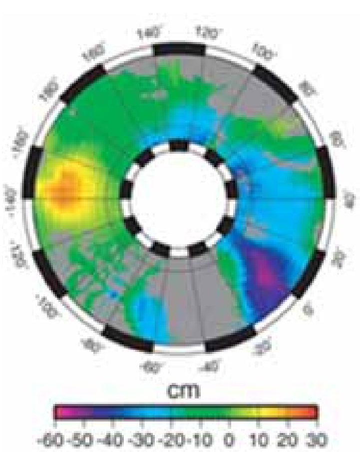
COLUMBUS

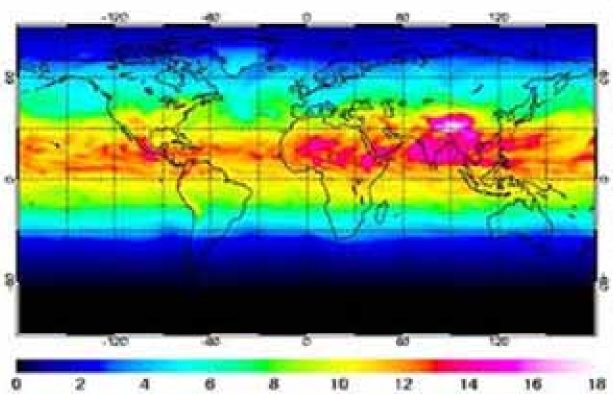


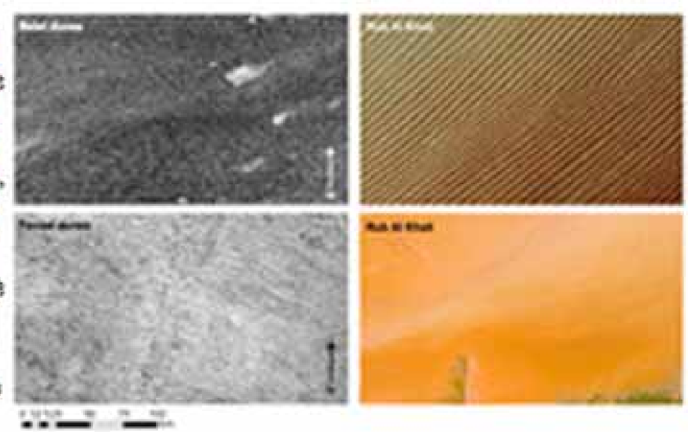
Human Spaceflight and Operations (HSO)

LA RICERCA SULL’ISS

- SPACE OBSERVATION & SPACE SCIENCE
- EARTH OBSERVATION
- ELIPS (European Life and Physical science in Space)







EARTH OBSERVATION

'Living Planet' Programme

- **GOCE** (2009–) per studiare il campo gravitazionale terrestre
- **SMOS** (2009–) per studiare il ciclo dell'acqua sulla Terra
- **CryoSat-2** (2010–) per studiare la copertura glaciale dei poli

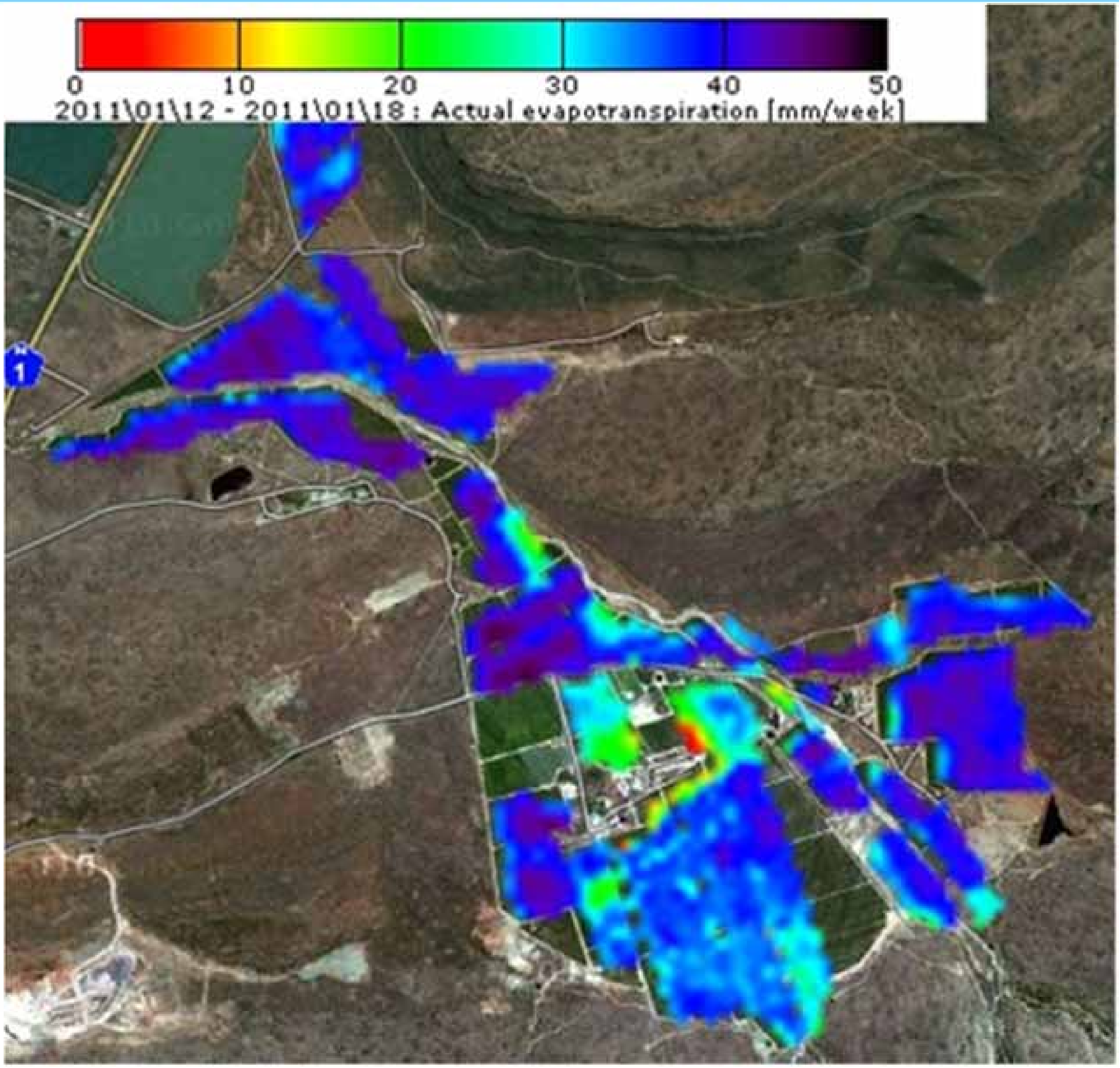
- **Swarm** (2012) per studiare il campo magnetico terrestre
- **ADM-Aeolus** (2013) per lo studio dell'atmosfera
- **EarthCARE** (2015) per lo studio delle nuvole, delle radiazioni e dell'aerosol

EARTH OBSERVATION

– **GRAPELOOK**: Space Based Services to Improve Water Use Efficiency of Vineyards in South Africa

http://www.fruitlook.co.za/

http://www.esa.int/esaCP/SEM373BX9WG_index_0.html



ICARUS initiative

International Cooperation for Animal Research Using Space

HOME | ABOUT ICARUS | TECHNICAL SOLUTION | SCIENCE & PROJECTS | MEDIA COVERAGE | PUBLICATIONS

You are here: Home

About ICARUS

Published by admin on Wed, 11/16/2011 - 09:14

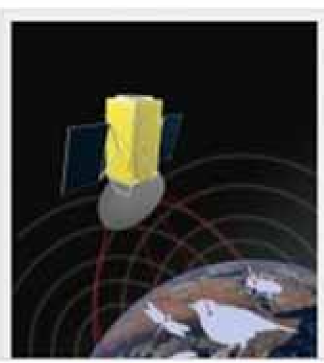
International Cooperation for Animal Research Using Space

ICARUS' mission is to work towards establishing a remote sensing platform for scientists world-wide that track small organisms globally, enabling observations and experiments over large spatial scales.

> Read more

Science & Projects

Published by admin on Tue, 11/15/2011 - 20:38



Many billion songbirds migrate every year between continents. Similarly, many bat species and countless large insects migrate long distances, potentially also between continents. Scientists are so far unable to follow individual small animal during their long-distance migrations. Knowledge about individual decisions is essential for an ecological and evolutionary understanding of dispersal and migration.

Movebank

Movebank is a free, online resource created to help researchers manage, share, analyze, and archive animal movement data.

Why use Movebank?

LA RICERCA SULLA ISS: ELIPS

→ EUROPEAN PROGRAMME FOR LIFE AND PHYSICAL SCIENCES AND APPLICATIONS (ELIPS)

E’ il programma di finanziamento promosso da ESA per la ricerca e l’applicazione in microgravitá finalizzata alla presenza a lungo termine dell’uomo nello spazio

La maggior parte degli esperimenti vengono svolti sulla ISS

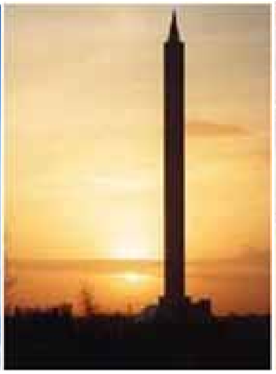
Human Spaceflight and Operations (HSO)

LA RICERCA SULLA ISS: ELIPS

Il resto degli esperimenti nelle Ground Based Facilities

I campi di ricerca sono fisica dei fluidi, scienza dei materiali, fisica, fisiologia umana, biologia, exobiology, esplorazione planetaria

ELIPS-4 partirá a fine 2012-inizio 2013 con i nuovi AO (Announcement of Opportunity)



BIOLOGIA

- Solitamente il finanziamento prevede lo sviluppo di un hardware dedicato

- Gli esperimenti in biologia vegetale vengono effettuati in uno dei seguenti moduli

- KUBIK
- EMCS
- Biolab

E IL FUTURO?

GLOBAL EXPLORATION ROADMAP

ESPLORAZIONE

~~COLONIZZAZIONE~~ X

... the goal isn't just scientific exploration ... it's also about extending the range of human habitat out from Earth into the solar system as we go forward in time ... In the long run a single-planet species will not survive ... **If we humans want to survive for hundreds of thousands or millions of years, we must ultimately populate other planets.**

Now, today the technology is such that this is **barely conceivable**.

We're in the infancy of it. ...

I'm talking about that one day, I don't know when that day is, but there will be more human beings who live off the Earth than on it. We may well have people living on the moon. We may have people living on the moons of Jupiter and other planets. We may have people making habitats on asteroids ... I know that humans will colonize the solar system and one day go beyond.

~ Michael Griffin

Human Spaceflight and Operations (HSO)

GLOBAL EXPLORATION ROADMAP

esa

– Alla ricerca della vita

– Estendere e sostenere la presenza umana

– Sviluppare tecnologie

– La scienza per supportare l’esplorazione

– Stimolare l’espansione economica

– Scienza dello spazio, della terra ed applicata

– Stimolare la sicurezza ed il benessere del pianeta Terra

Key Supporting Objectives

Goal	Objective
Search for Life	Find evidence of past or present life.
	Explore the past or present potential of solar system destinations to sustain life.
Extend Human Presence	Explore new destinations.
	Increase opportunities for astronauts from all partner countries to engage in exploration.
	Increase the self-sufficiency of humans in space.
Develop Exploration Technologies and Capabilities	Test countermeasures and techniques to maintain crew health and performance, and radiation mitigation technologies and strategies.
	Demonstrate and test power generation and storage systems.
	Develop and test high-performance mobility, extravehicular activity, life support, and habitation capabilities.
	Demonstrate the use of robots to explore autonomously and to supplement astronauts' exploration activities.
	Develop and validate tools, technologies, and systems that extract, process, and utilize resources to enable exploration missions.
	Demonstrate launch and advanced in-space propulsion capabilities.
	Develop thermal management systems, including cryogenic fluid management capabilities.
	Learn how to best perform basic working tasks and develop protocols for operations.
	Test and demonstrate advanced entry-decent-landing technologies.
	Test automated rendezvous and docking, on-orbit assembly, and satellite servicing capabilities.
	Develop and demonstrate technologies to support scientific investigation.
	Develop space communications and navigation capabilities.

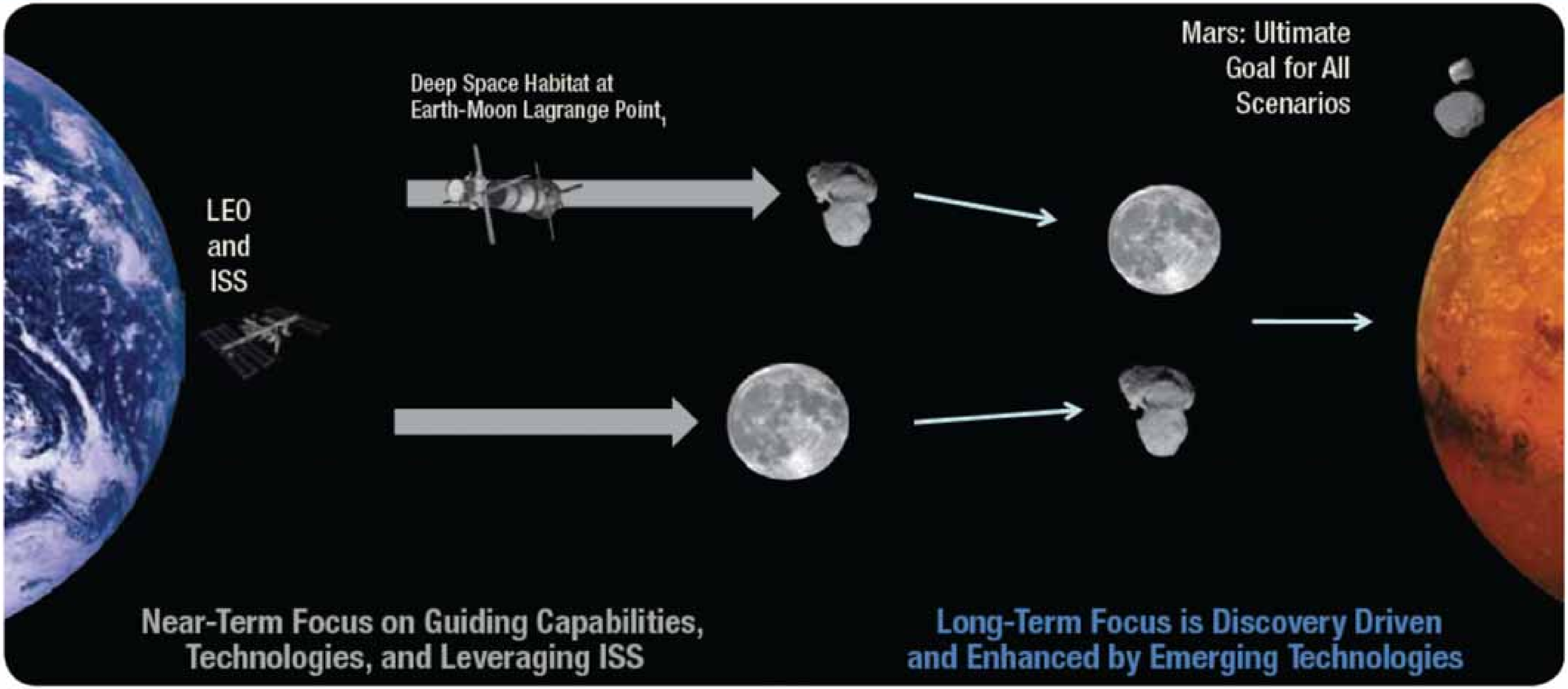
Key Supporting Objectives *(continued)*

Goal	Objective
Perform Science to Support Human Exploration	Evaluate human health in the space environment.
	Monitor and predict radiation in the space environment.
	Characterize the geology, topography, and conditions at destinations.
	Characterize available resources at destinations.
	Evaluate the impacts of the surface, near-surface, and atmospheric environment on exploration systems.
Stimulate Economic Expansion	Provide opportunities for the integration of commercial transportation elements into the exploration architecture.
	Provide opportunities for the integration of commercial surface and orbital elements into the exploration architecture.
	Evaluate potential for commercial goods and services at destinations, including markets for discovered resources.
Perform Space, Earth, and Applied Science	Perform Earth observation, heliophysics, and astrophysics from space.
	Gather scientific knowledge of destinations.
	Gather scientific knowledge of solar system evolution.
	Perform applied research.
Engage the Public in Exploration	Use interactive hands-on communications tools to provide virtual experiences using real and live exploration data.
	Enlist amateur/citizen scientists to contribute to exploration-related knowledge collection.
Enhance Earth Safety	Characterize potential near-Earth asteroid collision threats.
	Test techniques to mitigate the risk of asteroid collisions with Earth.
	Manage orbital debris around the Earth.

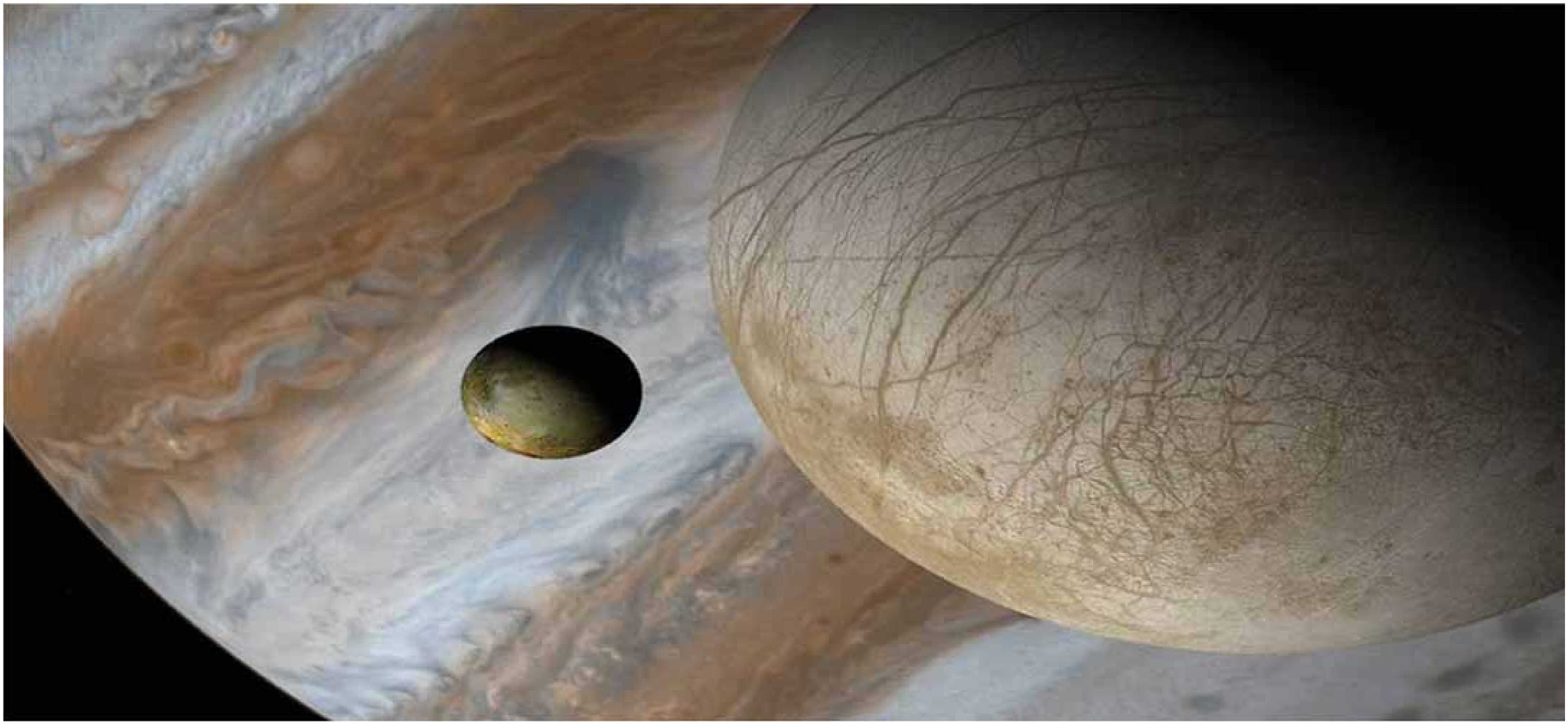
IL FUTURO E IL RUOLO DI ESA

- Uso della ISS per l’ esplorazione spaziale
- ‘Robotic missions’
- Sviluppo di tecnologia avanzata
- Sviluppo di nuovi sistemi spaziali ed infrastrutture

Human Spaceflight and Operations (HSO)



COSMIC VISION



MISSIONI SCIENTIFICHE ESA ATTUALI

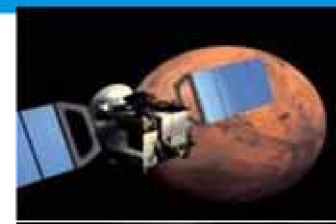
– **Mars Express** (2003–) per lo studio di Marte, le sue lune e la sua atmosfera

– **Rosetta** (2004–), la prima missione a lungo termine per studiare ed atterrare su una cometa

– **Venus Express** (2005–) per lo studio di Venere e della sua atmosfera

– **Herschel** (2009–) per l'osservazione dei pianeti e del cosmo nello spettro dell'infrarosso

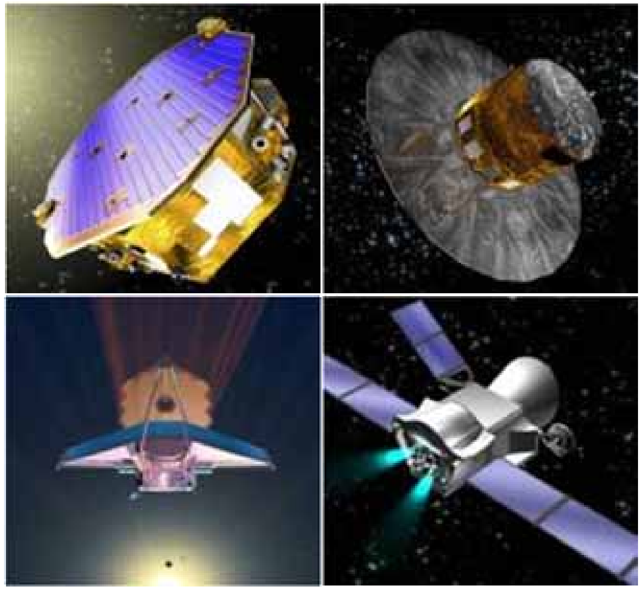
– **Planck** (2009–) per lo studio delle radiazioni 'fossili' dal Big Bang





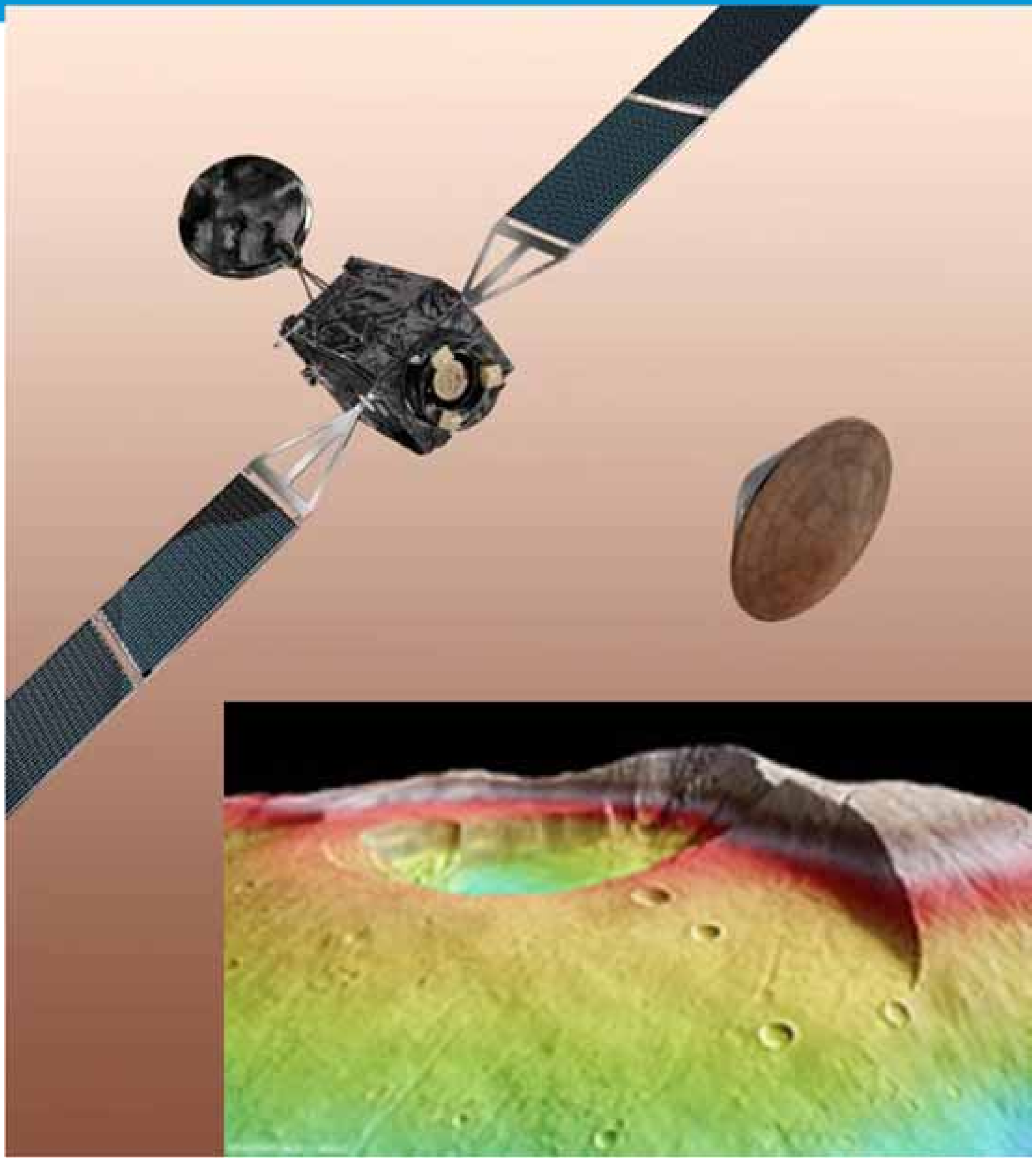
PROSSIME MISSIONI

- **LISA Pathfinder** (2013) – test di tecnologie per lo studio delle onde gravitazionali
- **Gaia** (2013) – per la mappatura di miliardi di stelle nella nostra galassia
- **James Webb Space Telescope** (2018) – per lo studio delle zone remote dell'universo (con NASA/CSA)
- **BepiColombo** (2014) – un doppio satellite per l'esplorazione di Mercurio (con JAXA)



EXOMARS

ExoMars studierá l’ambiente marziano, soprattutto dal punto di vista dell’astrobiologia, e svilupperá nuove tecnologie per l’esplorazione planetaria con una visione a lungo termine per una futura missione su Marte con rientro di materiale a partire dal 2016.



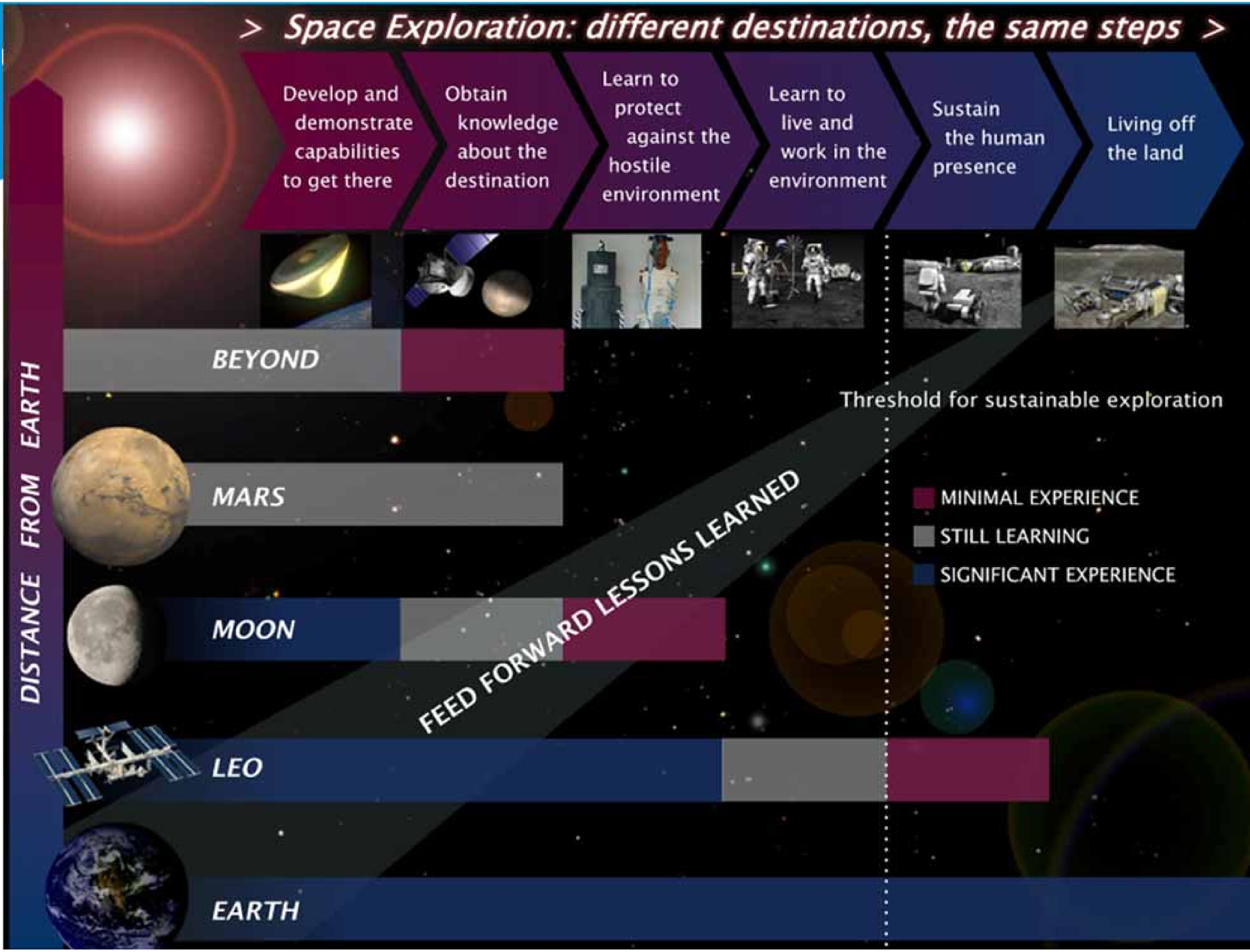
Summary of the Destination Assessment Activity

	Mars	Moon	Near-Earth Asteroid	LaGrange Points/Cis-Lunar Space
Key Objectives	Search for life. Advance understanding of planetary evolution. Learn to live on other planetary surfaces.	Characterize availability of water and other resources. Test technologies and capabilities for human space exploration. Advance understanding of solar system evolution. Utilize the Moon's unique importance to engage the public.	Demonstrate innovative deep space exploration technologies and capabilities. Advance understanding of these primitive bodies in solar system evolution and origin of life. Test methods to defend the Earth from risk of collisions with near-Earth asteroids.	Expand capability of humans to operate in this strategic region beyond low-Earth orbit. Demonstrate innovative deep space exploration technologies and capabilities.
Challenges	Significant technology advancements are essential for safe and affordable missions. Radiation risk and mitigation techniques must be better understood. Highly reliable space systems and infrastructure are needed. Demonstrated ability to use local resources is essential.	Expenses associated with extended surface activities.	Need to better understand and characterize the asteroid population. Technology advancements are needed before missions to asteroids.	Understanding the benefit of human presence vs. robots.

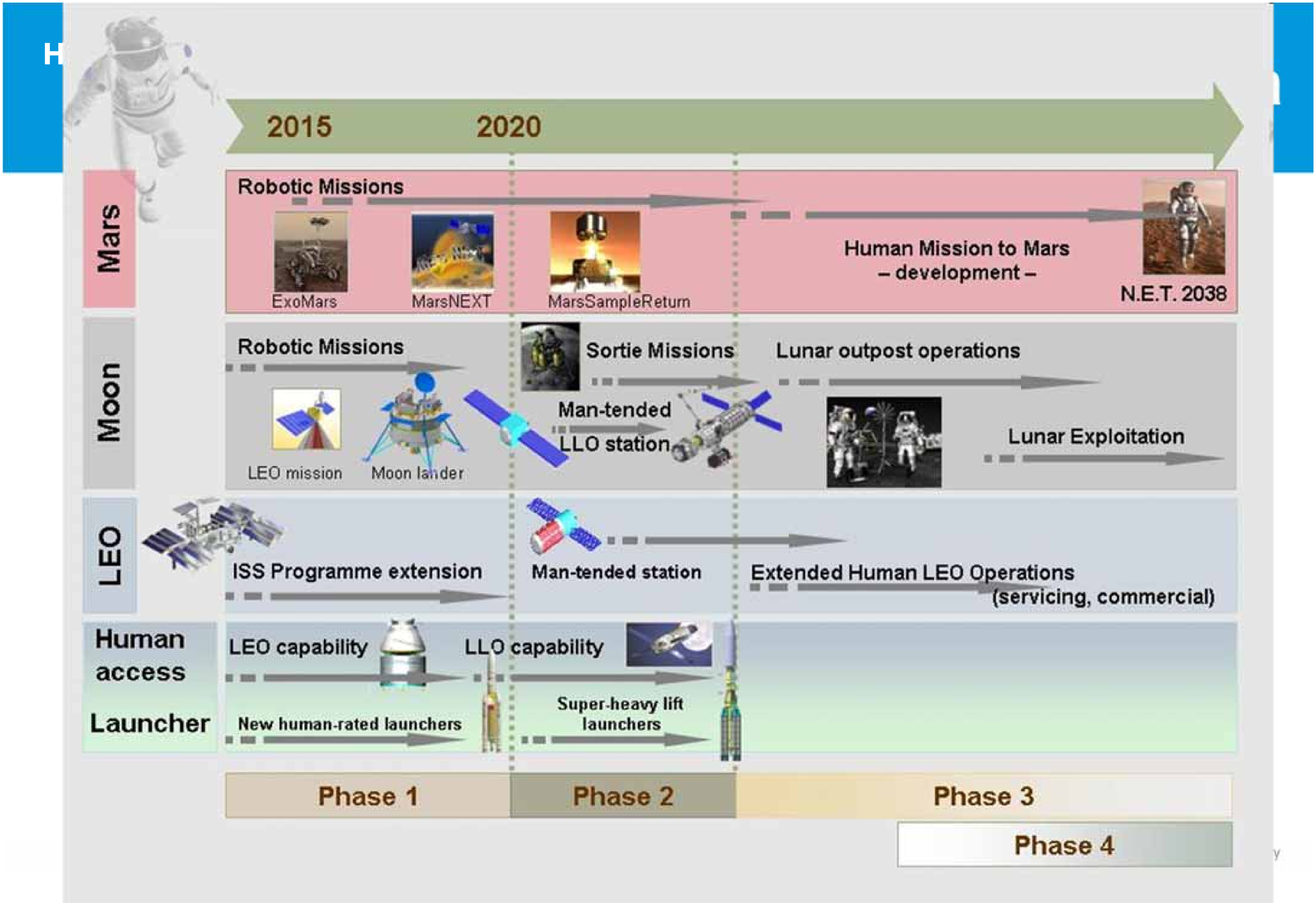
Hu

Categorization of Proposed Technology Developments

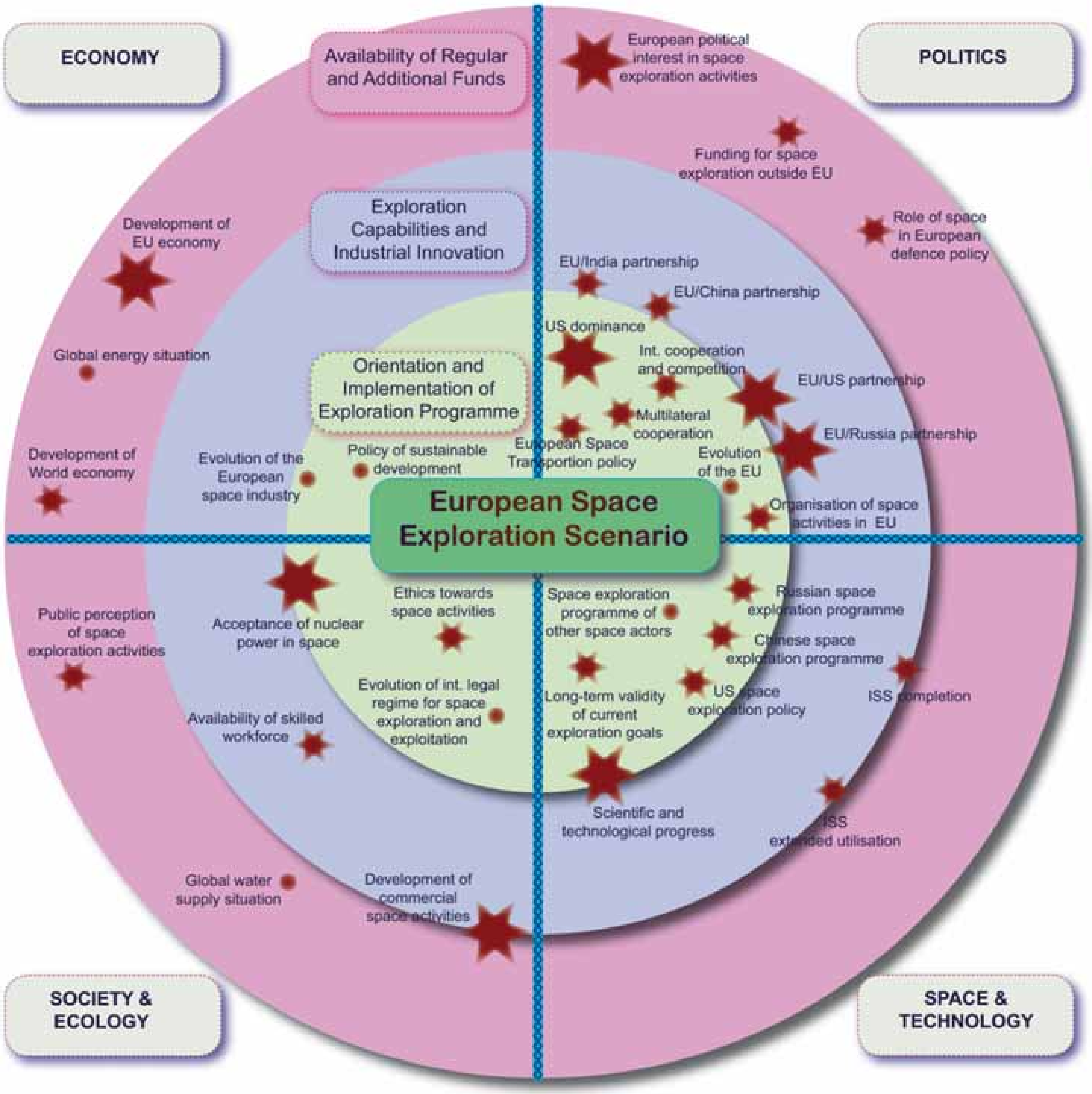
Technology Area	ASI	CNES	CSA	DLR	ESA	JAXA	KARI	NASA	NSAU	Roscosmos	UKSA
Launch Propulsion Systems (TA01) Enhance existing solid or liquid propulsion technologies by lower development and operations costs, improved performance, availability, and increased capability.					●	●	●	●	●	●	●
In-Space Propulsion Technologies (TA02) Advancements in conventional and exotic propulsion systems, improving thrust performance levels, increased payload mass, increased reliability, and lowering mass, volume, operational costs, and system complexity.	●	●			●	●		●		●	●
Space Power and Energy Storage (TA03) Improvements to lower mass and volume, improve efficiency, enable wide temperature operational range and extreme radiation environment over current state-of-the-art space photovoltaic systems, fuel cells, and other electrical energy generation, distribution, and storage technologies.	●			●	●	●		●		●	●
Robotics, Telerobotics and Autonomous Systems (TA04) Improvements in mobility, sensing and perception, manipulation, human-system interfaces, system autonomy are needed. Advancing and standardizing interfaces for autonomous rendezvous and docking capabilities will also be necessary to facilitate complex in-space assembly tasks.		●	●	●	●	●	●	●		●	●
Communication and Navigation (TA05) Technology advancements to enable higher forward & return link communication data rates, improved navigation precision, minimizing latency, reduced mass, power, volume and life-cycle costs.	●	●	●	●	●	●	●	●	●	●	
Human Health, Life Support and Habitation Systems (TA06) Improvements in reliability, maintainability, reduced mass and volume, advancements in biomedical countermeasures, and self-sufficiency with minimal logistics needs are essential for long-duration spaceflight missions. In addition, advancements in space radiation research is required, including advanced detection and shielding technologies.	●	●	●	●	●	●	●	●		●	●



> Space Exploration: different destinations, the same steps >
Develop and demonstrate capabilities to get there
Obtain knowledge about the destination
Learn to protect against the hostile environment
Learn to live and work in the environment
Sustain the human presence
Living off the land
BEYOND
MARS
MOON
LEO
EARTH
DISTANCE FROM EARTH
Threshold for sustainable exploration
FEED FORWARD LESSONS LEARNED
MINIMAL EXPERIENCE
STILL LEARNING
SIGNIFICANT EXPERIENCE



2015
2020
Mars
Robotic Missions
ExoMars
MarsNEXT
MarsSampleReturn
Human Mission to Mars
– development –
N.E.T. 2038
Moon
Robotic Missions
LEO mission
Moon lander
Sortie Missions
Lunar outpost operations
Man-tended
LLO station
Lunar Exploitation
LEO
ISS Programme extension
Man-tended station
Extended Human LEO Operations
(servicing, commercial)
Human access
Launcher
LEO capability
LLO capability
New human-rated launchers
Super-heavy lift launchers
Phase 1
Phase 2
Phase 3
Phase 4


ECONOMY
POLITICS
SOCIETY & ECOLOGY
SPACE & TECHNOLOGY
Availability of Regular and Additional Funds
Exploration Capabilities and Industrial Innovation
Orientation and Implementation of Exploration Programme
European Space Exploration Scenario
European political interest in space exploration activities
Funding for space exploration outside EU
Role of space in European defence policy
EU/India partnership
EU/China partnership
US dominance
Int. cooperation and competition
EU/US partnership
Multilateral cooperation
EU/Russia partnership
European Space Transportion policy
Evolution of the EU
Organisation of space activities in EU
Development of EU economy
Global energy situation
Development of World economy
Evolution of the European space industry
Policy of sustainable development
Public perception of space exploration activities
Acceptance of nuclear power in space
Ethics towards space activities
Evolution of int. legal regime for space exploration and exploitation
Availability of skilled workforce
Global water supply situation
Development of commercial space activities
Space exploration programme of other space actors
Russian space exploration programme
Chinese space exploration programme
US space exploration policy
ISS completion
Long-term validity of current exploration goals
Scientific and technological progress
ISS extended utilisation


Lo Spazio é indifferente a ció che facciamo; non ha sentimenti, né progetti; non ha nessun interesse se noi lottiamo per lui. Ma noi non possiamo rimanere indifferenti allo spazio, perché la magnifica lenta marcia della nostra intelligenza ha condotto la nostra generazione ad un punto dal quale noi siamo in grado di esplorarlo, capirlo, utilizzarlo. Tornare indietro adesso significa negare la nostra storia e le nostre capacitá.
~ James A. Michener