



# 3<sup>RD</sup> SPACE EXPLORATION CONFERENCE & EXHIBIT

## Int.l collaboration and Global Space Exploration: an Italian/European view

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Italian Space Agency – Observation of the Universe Dpt

February 27, 2008 - Denver

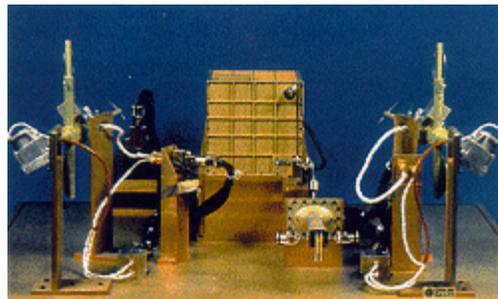


# Bilateral Collaboration



## Cassini-Huygens (launched in 1997)

- Italy is participating to 3 out of 12 experiments on-board Cassini:
  - **VIMS-V, Radio Science, Radar**
- Italy realized the **High Gain Antenna (HGA)** for the TLC system and the **Ka Transponder**
- and provided the experiment **HASI** to the Huygens probe



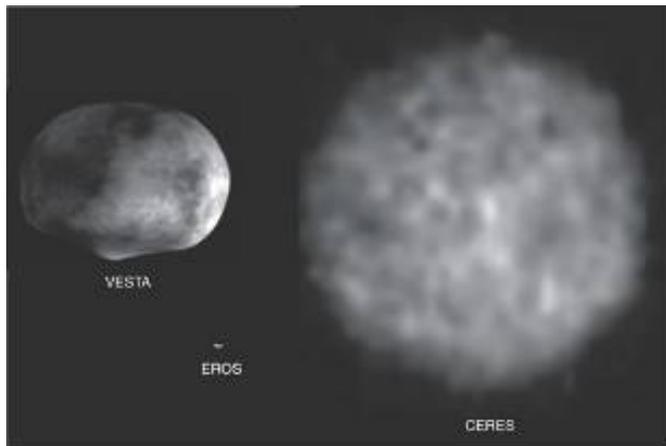
# Bilateral Collaboration



Dawn (Discovery), launched in 2007 to Vesta and Ceres

- Italian contribution:
- VIR Spectrometer (Visual and Infrared Spectrometer)
- Mission support

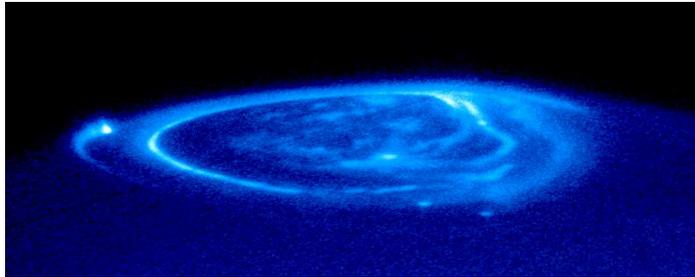
Credit NASA/UCCLA



# Bilateral Collaboration

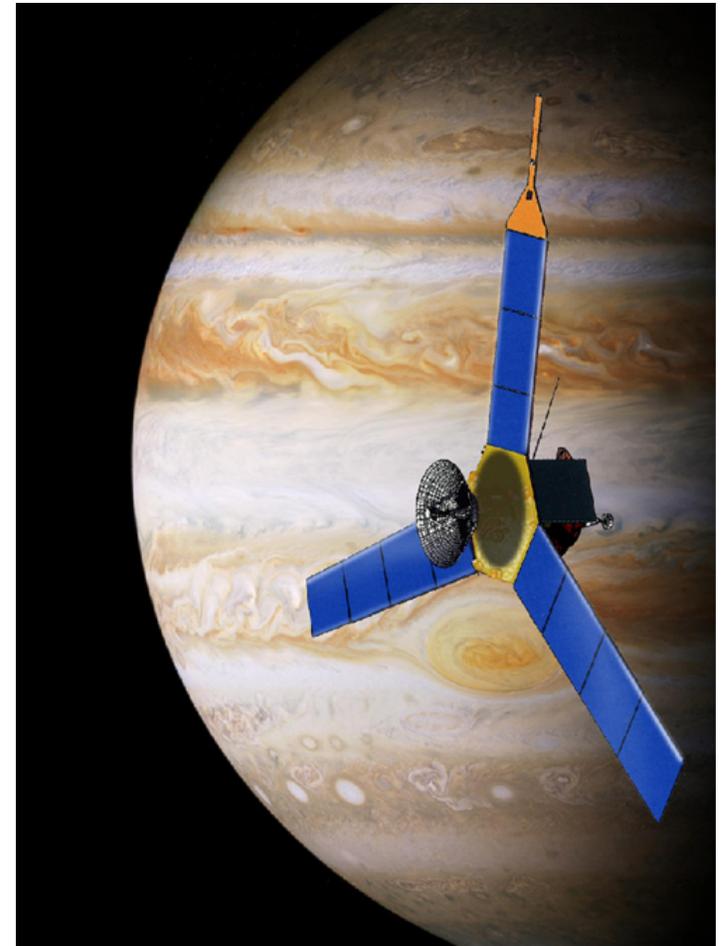


**Juno (New Frontiers), to be launched in 2011 to Jupiter**



Aurora (Hubble Space Telescope)

- **Italian contribution:**
  - **JIRAM (InfraRed Imaging Spectrometer)**
  - **KaT (Radio science)**



Credit: NASA/JPL

# ESA Scientific Programme



- **ESA Scientific Programme Horizon 2000**

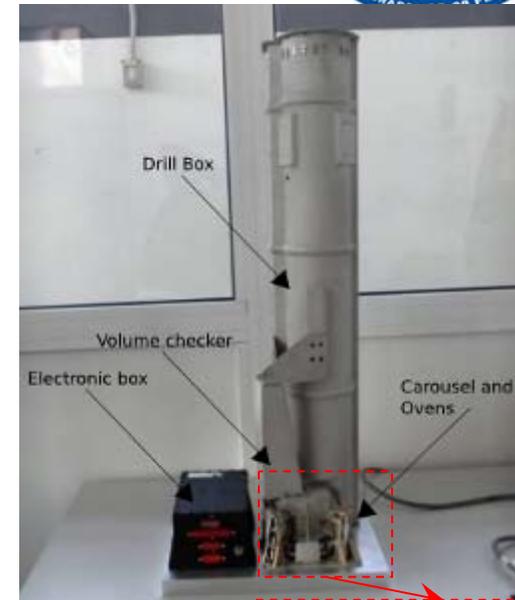


- **The missions are developed by European industries under ESA management and the scientific payloads are selected through AOs and provided to ESA under the responsibility of the National Agencies of the PIs.**
- **In this context Italy is participating to all the ESA Science missions such as [Mars Express](#) (launched in 2003), [Rosetta](#) (launched in 2004 to comet P/Churyumov-Gerasimenko), [Venus Express](#) (launched in 2005).**

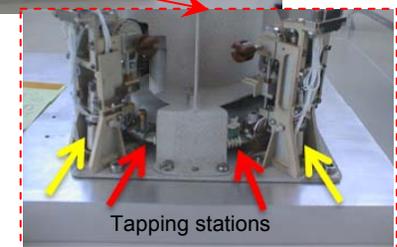
# Rosetta Lander



- Rosetta Lander Philae, developed by a Consortium of 11 agencies and institutes led by DLR, CNES and ASI and provided to ESA
- Italy contributing with
  - SD2 Sample acquisition and distribution system
  - Solar Arrays
  - Manpower to the lander project Team



SD2



FM



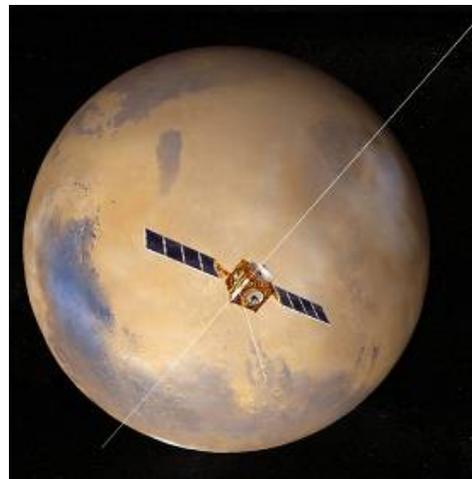
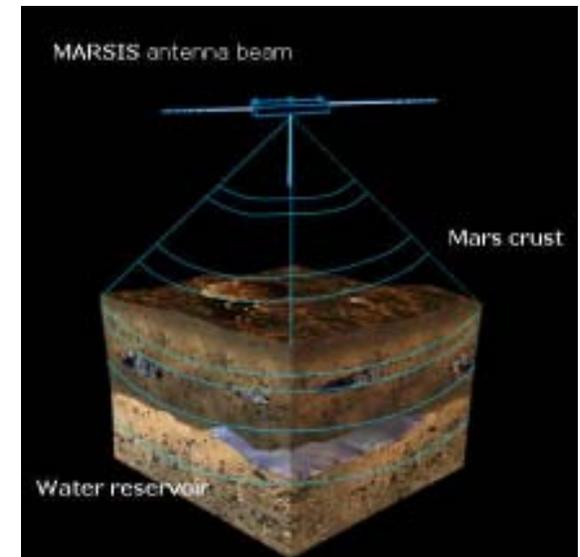
PPARC



# Mars Exploration



- Through different types of collaboration, Italy implements its own national exploration strategy, in particular for what concerns **Mars**:
  - **Mars 96 (Russia)**
  - **Mars Express (ESA)**:
    - **PFS Planetary Fourier Spectrometer PI**
    - **MARSIS Radar sounder PI**
    - **OMEGA Imaging spectrometer co-I**
    - **ASPERA Neutral atoms co-I**

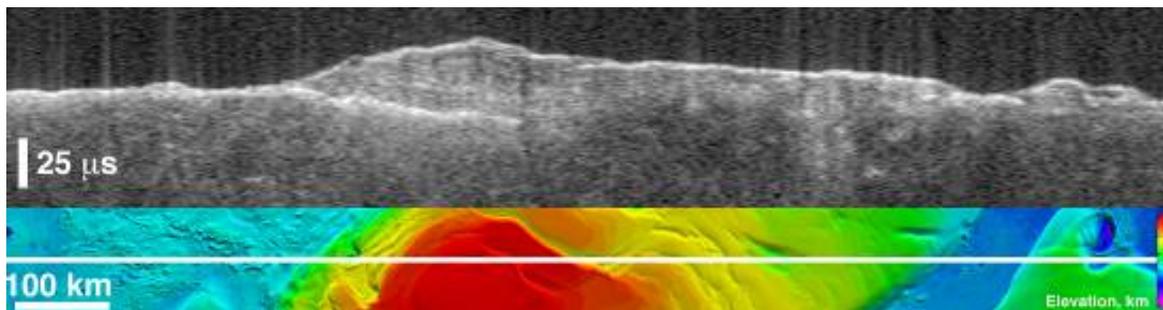




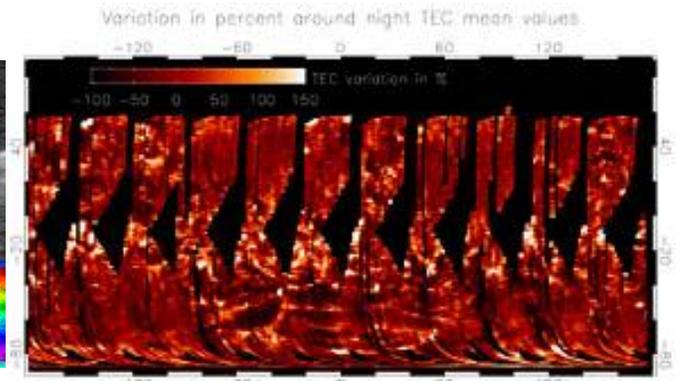
# Mars Exploration (MEX – MARSIS)

Some relevant facts:

- First global map of Mars ionosphere (November 16<sup>th</sup>, 2007) - MARSIS echoes allow to measure the Total Electron Content in the ionosphere
- Evidences of water ice on Mars (March 15<sup>th</sup>, 2007) - MARSIS gauges water ice quantity around south pole: the amount of frozen water trapped in layers over south polar region is equivalent to a layer of ~ 11m depth covering the planet



Credits: NASA/JPL/ASI/ESA/Univ. of Rome/MOLA Science Team



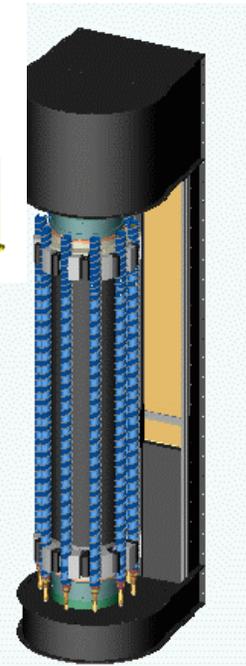
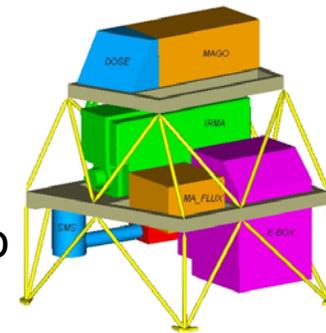
Credits: ASI/NASA/ESA/Univ. of Rome/Univ. of Iowa/JPL

# Mars Exploration (MSR2003-2005; MRO)



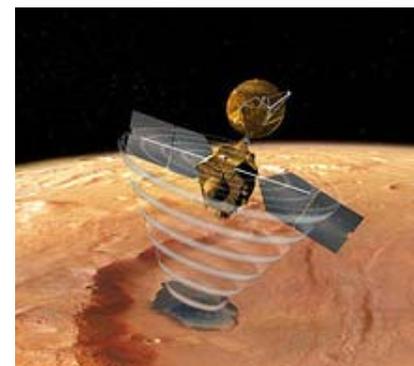
## – Mars Sample Return 2003-2005 (NASA)

- Agreement between NASA and ASI.
- Based on the expertise acquired with development of the *Rosetta's* SD2 drilling system, Italy was committed to provide a drill for subsurface samples acquisition and a mini-laboratory to perform in-situ analysis equipped with a robotic arm for sample distribution.



## – Mars Reconnaissance Orbiter (NASA)

- Italy providing SHARAD (SHAllow RADar) as a facility instrument.



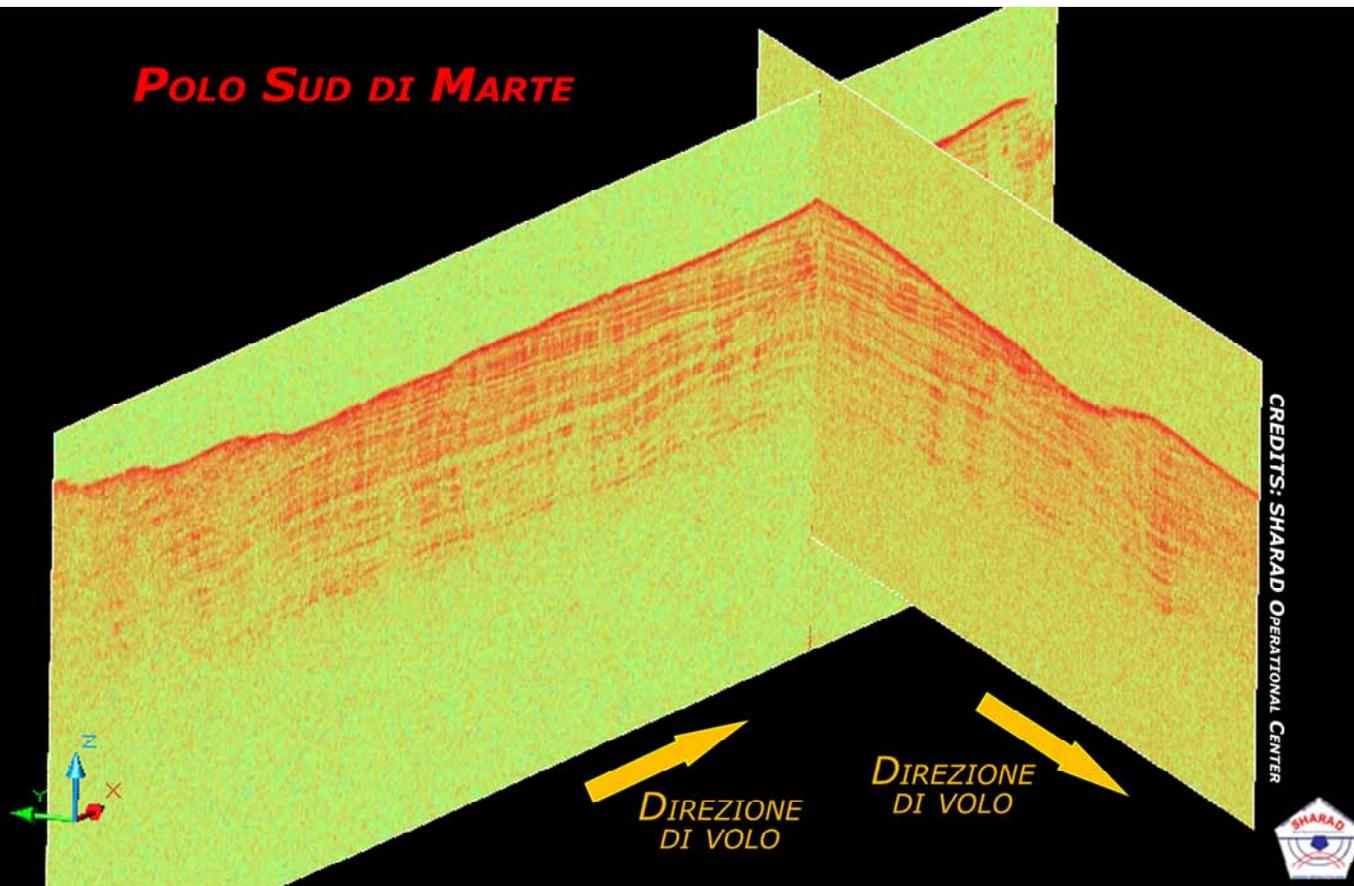
Credit NASA/JPL

# Mars Exploration (MRO – SHARAD)



## POLO SUD DI MARTE

RICOSTRUZIONE 3D DI DUE OSSERVAZIONI ACQUISITE NELLA ZONA CHIAMATA PROMETHEI LINGULA AL POLO SUD DI MARTE DAL RADAR ITALIANO SHARAD, A BORDO DELLA MISSIONE NASA MRO. SONO VISIBILI STRUTTURE FINO A CIRCA 1 KM DI PROFONDITÀ. LE DUE IMMAGINI SONO STATE ACQUISITE DURANTE DUE DIVERSE ORBITE AVENTI UN'ANGOLAZIONE DI CIRCA 50° TRA DI LORO. IL PERFETTO FUNZIONAMENTO DEL RADAR CONSENTE DI AFFIANCARE LE DUE IMMAGINI CHE QUINDI MOSTRANO LA SOTTOSUPERFICIE IN TRE DIMENSIONI.



# Mars Exploration (Aurora - ExoMars)



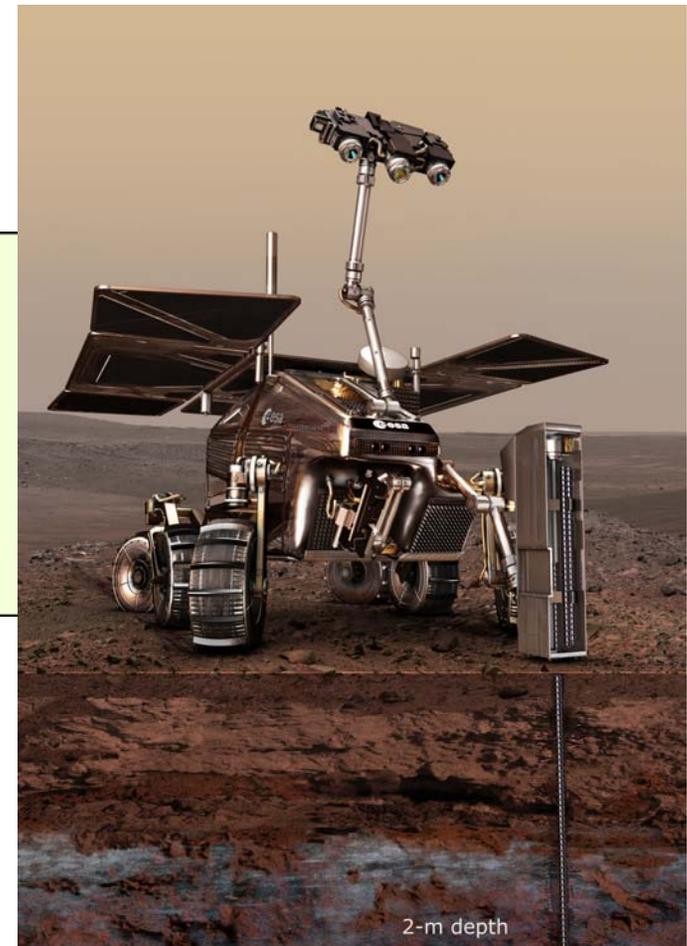
## – ExoMars (ESA)

- ExoMars is the 1° robotic exploration mission of the ESA Exploration Programme Aurora approved at the Ministerial Council in Berlin in December 2005.

The ExoMars mission's scientific objectives, in order of priority, are:

- To search for signs of past and present life on Mars;
- To characterise the water/geochemical environment as a function of depth in the shallow subsurface;
- To study the surface environment and identify hazards to future human missions;
- To investigate the planet's subsurface and deep interior to better understand the evolution and habitability of Mars.

- Technological Objectives – validation of some key technologies for planetary exploration:
  - EDLS – *Entry, Descent, and Landing System*
  - Horizontal mobility: *rover*
  - Vertical mobility: *drill*



Credit ESA

# Mars Exploration (Aurora - ExoMars)



- Mission overview:
  - ExoMars will be launched on December 2013 with Ariane 5 ECA (back-up Proton-M)
  - Martian orbit insertion on September 2014 and parking orbit until 2015 to avoid dust storms
  - The Rover+Lander will be released in 2015 and the science phase will start on July 2015
- Italy is leading the programme (40% of the subscription):
  - Prime Contractor is Thales Alenia Space - Italy (Turin)
  - **Rover Operations Center** (ALTEC – Turin)
  - **Drill + SPDS**
  - **4 experiments** with Italian Team coordinator + contribution to 5 experiments
  - Phase B2 to start early 2008



# Primitive Bodies Exploration (...beyond!)



- As for Mars, through different types of collaboration, Italy is implementing its strategy of exploration of **comets** and **asteroids**:
  - **Rosetta** and **Philae** (**ESA**)
  - **Dawn** (**NASA**)
  - **Stardust** (**NASA**)
  - Recently **ASI** and **JAXA** agreed to perform jointly a mission study to assess the possibility to utilize the VEGA launcher vehicle for the **Hayabusa-2** mission, paving the way for a future collaboration.



Credit JAXA

# Moon Exploration



- In 2006, ASI has awarded 16 studies related to the robotic exploration of the Moon.
  - The main goal of these studies was to assess which scientific objectives among those rated of high priority by the Italian community were achievable through robotic missions with Italian capabilities.
- >>> based on the outcomes of these studies, a draft roadmap for a “science driven” exploration programme of the Moon has been prepared.

>>> this roadmap is currently under revision and will be completed with technologies development for human exploration that could be tested on the Moon.



- In parallel to this activity, a PI mission to the Moon has just been selected for a Phase A study: **MAGIA: Missione Altimetrica Gravimetrica Geochimica Italiana lunAre**

# Human Exploration



## International Space Station

- **ASI-NASA MoU:**  
3 MPLM modules <<>> 6 astronauts flights + ISS utilization
- Node 2, Node 3 and the Cupola were provided by ESA to NASA and developed in Italy under ASI Management. The technology used is derived from that of the MPLM (idem for Columbus)
- ESPERIA: P. Nespoli flying on STS-120 in October 2007 (MPLM Flight) with Node 2 (Harmony)



# Human Exploration



- Italy acquired a solid expertise on pressurized modules through the realization of 3 MPLM, Cupola, Node 2 (Harmony) and Node 3, and the flight primary structure of the Columbus laboratory.



**Columbus transport to KSC**



**Node 2**

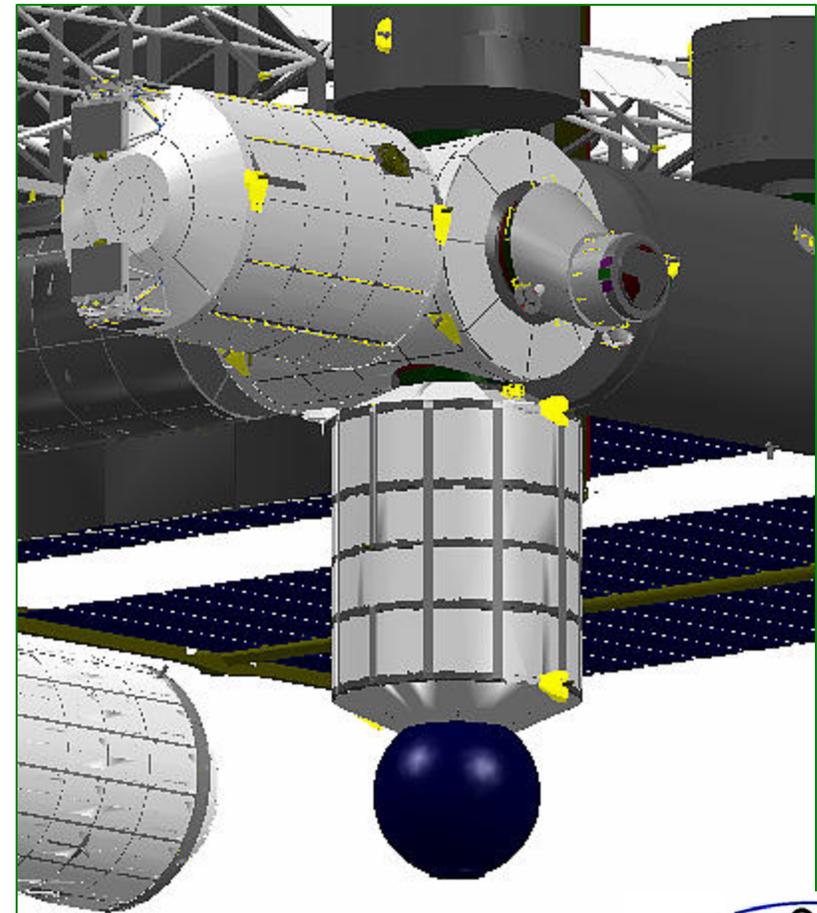


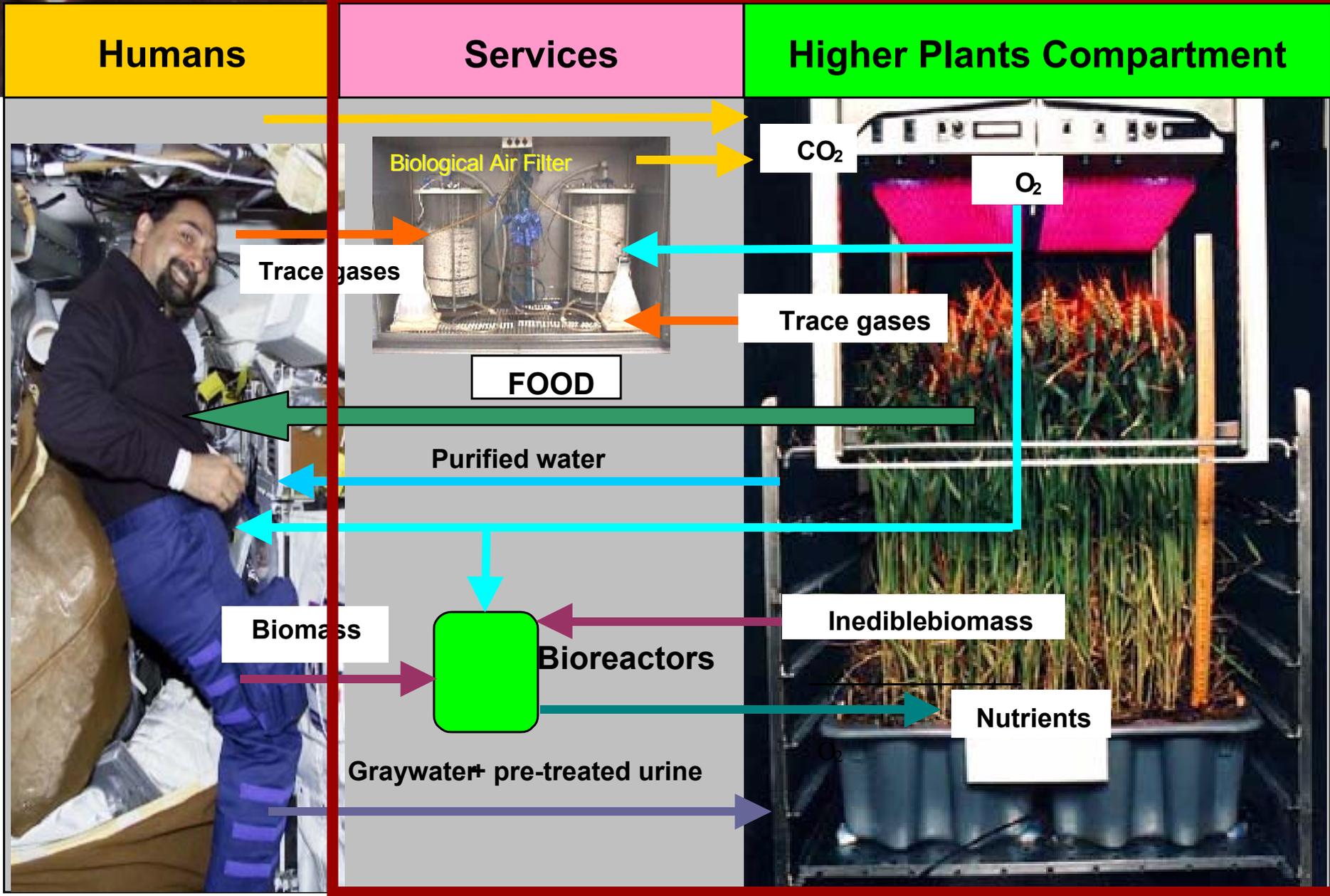
**Cupola**

# Human Exploration



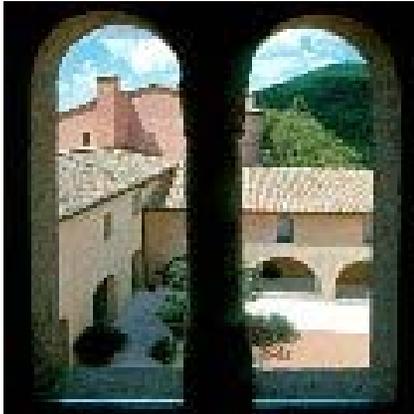
- Inflatable Modules (National programme (phase B):
  - Objectives: technological R&D to develop pressurized modules for orbiting structures, planetary surface habitats with a small volume at launch and a large volume once deployed
  - Key technologies: Thermal and pressure aspects, leakage, radiations, deployment (A/R), resistance to meteorites impacts, air contamination and monitoring.
  
- Life Support Systems
  - MELISSA (ESA)
  - CAB (Nat.)





Pictures courtesy of NASA

# Int. Collaboration in Global Space Exploration



## Keyword = Collaboration

### 2005: Workshop on Int.l Cooperation for Sustainable Space Exploration organised jointly by ESA and ASI (Abbazia di Spineto, Italy May 3-6, 2005)

- The announcement of the US Vision for Space Exploration revamped the debate on the issue of [international cooperation for space exploration](#). Along with ESA, and its Aurora Programme, other major space fairing Nations have [plans, strategies or interest in space exploration](#). International workshops have been held over the past months to lay the foundations for [enhanced international cooperation in space exploration](#), notably the NASA ESMD workshop in November 2004 and NASA SMD to be held in March 2005.
- This ESA/ASI International Workshop is meant to take stock of the discussions and contacts as well as of the follow-on activities that have occurred so far, in order to attempt to merge the areas of discussion from previous workshops into a single set of topics and [prepare the way forward for the establishment of a coherent and effective framework for international cooperation for space exploration](#).

# Int. Collaboration in Global Space Exploration



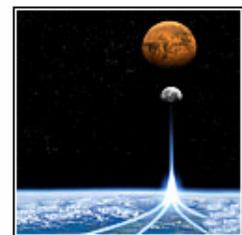
- Italy has been a strong supporter of the [Global Exploration Strategy](#) since the very beginning.
- Italy has been participating since August 2006, together with 13\* space agencies to the discussions of the definition of a vision for globally coordinated space exploration.
- These discussions led to the finalisation of a document entitled “The Global Exploration Strategy: The Framework for Coordination” (otherwise called the Framework Document). This document has been released on the 31<sup>o</sup> of May, 2007 in connection with the 3<sup>o</sup> ESA/ASI workshop on International Cooperation for Sustainable Space Exploration.
- \*The 14 space agencies are: ASI, BNSC, CNES, CNSA, CSA, CSIRO, DLR, ESA, ISRO, JAXA, KARI, NASA, NSAU and Roscosmos.



International Cooperation for Sustainable Space Exploration



- Home
- 3rd workshop - 2007
  - Letter of invitation
  - Draft agenda
  - IMEWG 2007
  - Registration form
- 2nd workshop - 2006
  - Agenda & Presentations
  - Participants 2006
  - The Spineto Declaration
- 1st workshop - 2005



### Key meeting on long-term space exploration

30 May 2007 Fourteen space organisations from all over the world will gather in Italy to discuss further coordination for long-term space exploration efforts.

[Full story](#)

19-Jun-2007

**Workshop convenors**

- Simonetta Di Pippo
- Daniel Sacotte

**Jointly organised by:**




### Welcome statement Mrs Di Pippo and Mr Sacotte

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are conducting collectively on the issue of space exploration from a global and international cooperation perspective.

[Full story](#)



### 3rd Workshop on International Cooperation for Sustainable Space Exploration

ESA and ASI have the pleasure of welcoming representatives of the international space agencies and organisations to the 3rd Workshop on International Cooperation for Sustainable Space Exploration to be held in

# Int. Collaboration in Global Space Exploration



## The Framework Document

- provides an extended rationale for Exploration;
- identifies a common set of exploration themes and values;
- It is not a proposal for a single global programme but it recognizes that individual space exploration activities can achieve more through coordination and cooperation;
- calls for a voluntary, non-binding coordination mechanism among interested space agencies.
  
- Such a mechanism could provide participating agencies:
  - a forum to discuss their interests, objectives and plans in space exploration;
  - a forum to promote space exploration
- Such a mechanism, through which nations can collaborate, could help to strengthen both individual projects and the collective effort related to Exploration.

# Int. Collaboration in Global Space Exploration



## Italy's plans for the future

- **National Space Plan 2009-2011**
- **ESA Ministerial Council in November 2008**
  - Resources devoted: ~50% ESA Programmes ~ 50% National Programmes (Nat. – Bi-multilateral)
- **Science Missions:**
  - Participation to the ESA Horizon 2000 - Cosmic Vision programmes: Bepi Colombo, Solar Orbiter, Marco Polo (?), Laplace (?), Tandem (?)....
  - Nat-Bi-Multilateral mission: tbd as a complement to the ESA programmes to achieve the objectives of the PSN.

# Int. Collaboration in Global Space Exploration



## Italy's plans for the future

- **Exploration:**
  - ESA Programmes:
    1. ISS exploitation, utilisation and evolution
    2. Human spaceflights capabilities (CSTS (ESA-Russia, other elements tbd)
    3. Mars Exploration: ExoMars - Mars-NEXT – MSR + Aurora Core
  - National Programmes:
    - ✓ Astronauts flights and ISS utilisation (MPLM MoU)
    - ✓ MAÛIA (Nat. PI Lunar mission)
    - ✓ Hayabusa-2 (collaboration with JAXA)
  - TBD: Inflatable habitat modules (demo mission), Mars Telecom Orbiter, Moon, or other elements (tbd) to achieve the overall objectives of the PSN.

# Int. Collaboration in Global Space Exploration



## Conclusion

- The Framework Document exercise saw the active involvement among the others of both ESA and the major European national space agencies.
- The recently concluded STS-120 / Esperia mission put in evidence that synergy of national vision (ASI-NASA MPLM MoU) and opportunities with ESA's structure can lead to great results.
- This is the approach followed with the Global Strategy, paving the way to present and future exploration endeavours.
- National objectives can be achieved through combination of different models of collaboration if supported by an underlying vision.
- Europe demonstrated in 2001 and confirmed in 2005 its commitment and interest to space exploration with the Aurora programme whose goals and objectives are even more relevant and sound today.