Human Spaceflight
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Human Spaceflight Programmes and Possible Greek Participation

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Content

- The International Space Station (ISS) Programme
- Possible Greek participation:
  - European Life and Physical Science and Applications in Space (ELIPS-3)
  - Small External Payloads (SPERO)
  - European Transportation
  - Human Exploration Enabling Technologies
- Conclusion

The International Space Station programme

Source: NASA

The International Space Station Partners

- **Canadian Space Agency**
- **European Space Agency**
- **Japan Aerospace Exploration Agency**
- **National Aeronautics and Space Administration**
- **Russian Federal Space Agency**

Credits: Mr. W. Gerstenmaier, NASA

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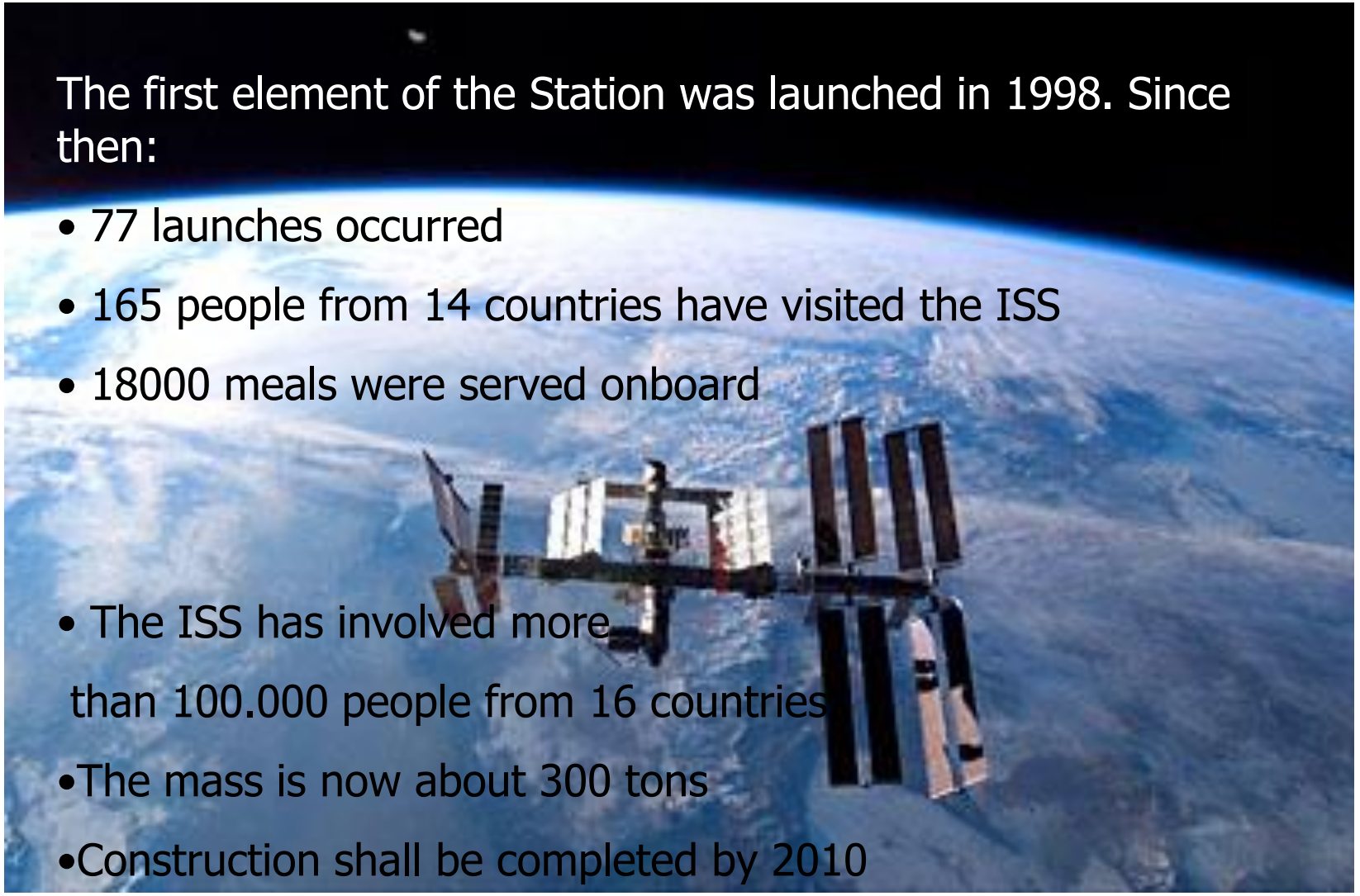
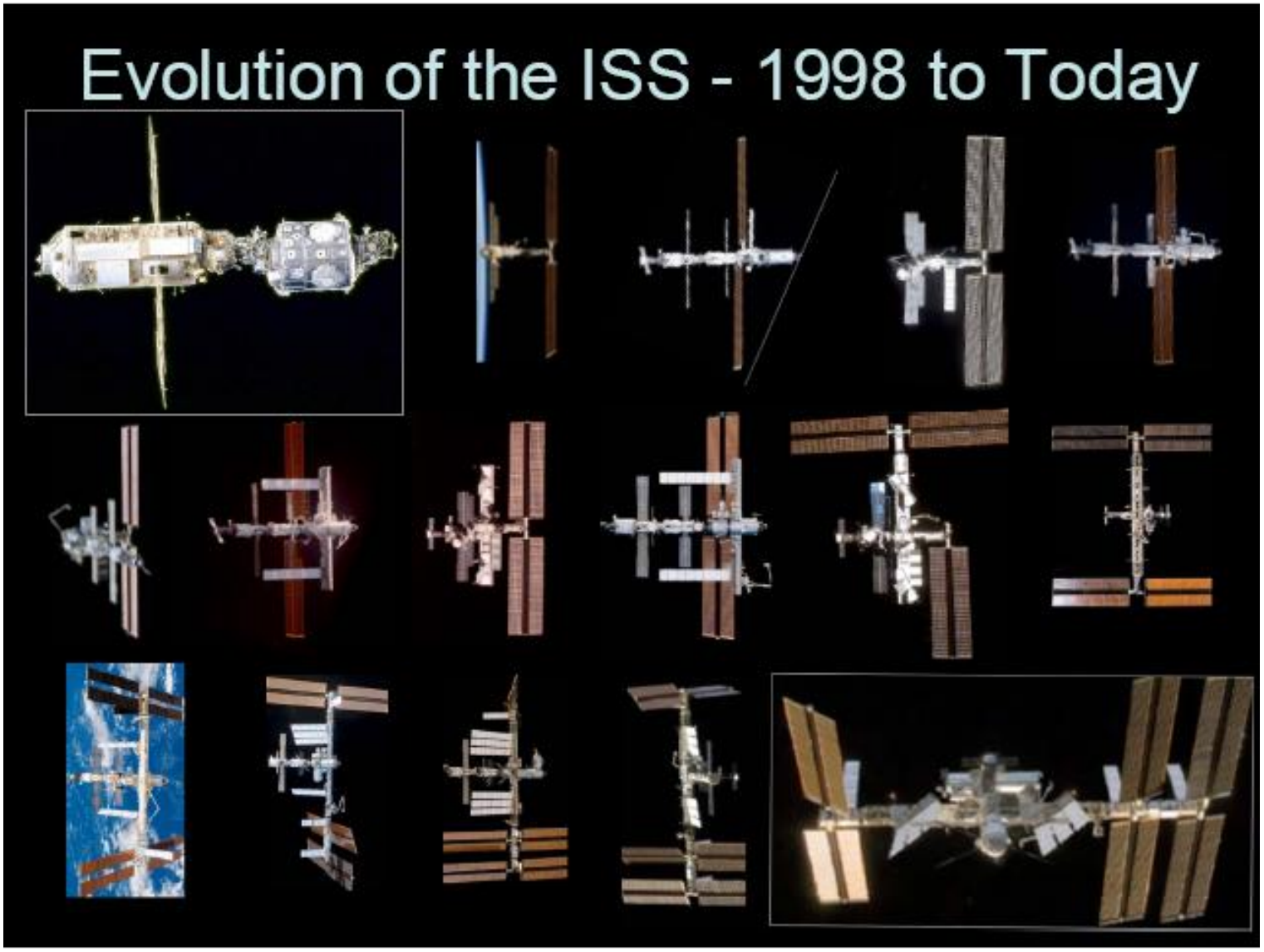
The International Space Station programme



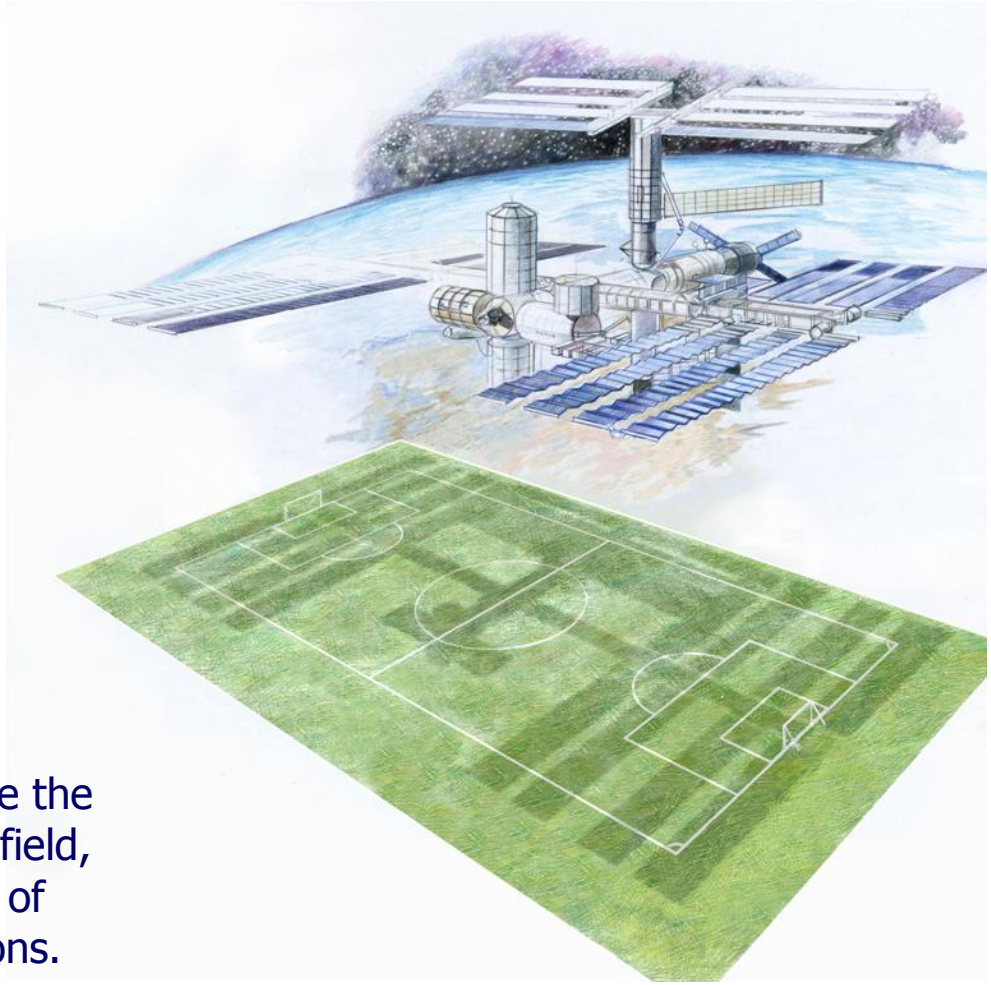
The first element of the Station was launched in 1998. Since then:

- 77 launches occurred
- 165 people from 14 countries have visited the ISS
- 18000 meals were served onboard

- The ISS has involved more than 100.000 people from 16 countries
- The mass is now about 300 tons
- Construction shall be completed by 2010


Evolution of the ISS - 1998 to Today

The International Space Station programme



The ISS, once completed, will be the size of a football field, and have a mass of more than 400 tons.

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The International Space Station programme

Mission STS 126 was just concluded, upgrading the ISS,

soon to welcome 6 permanent crew members

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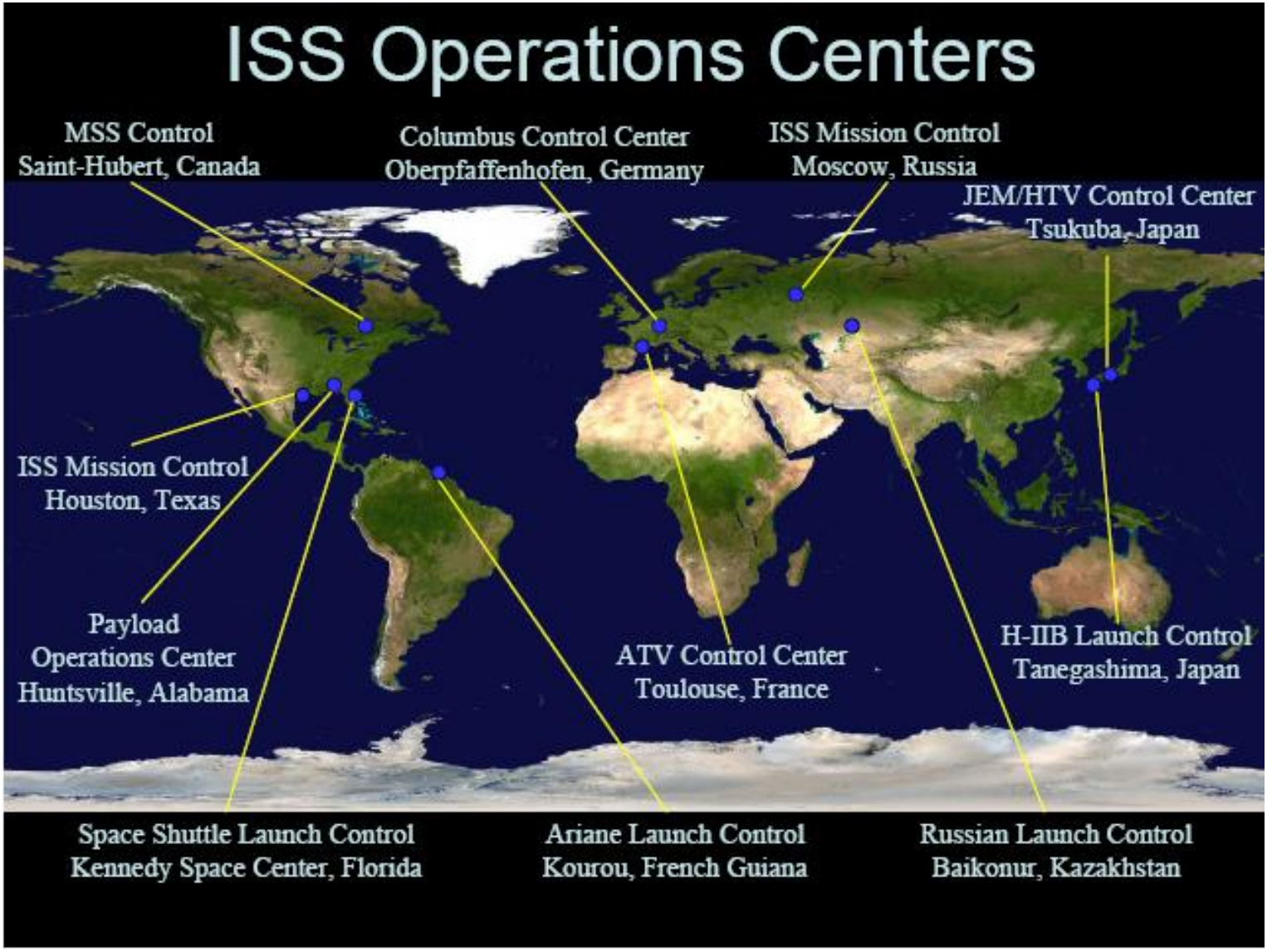
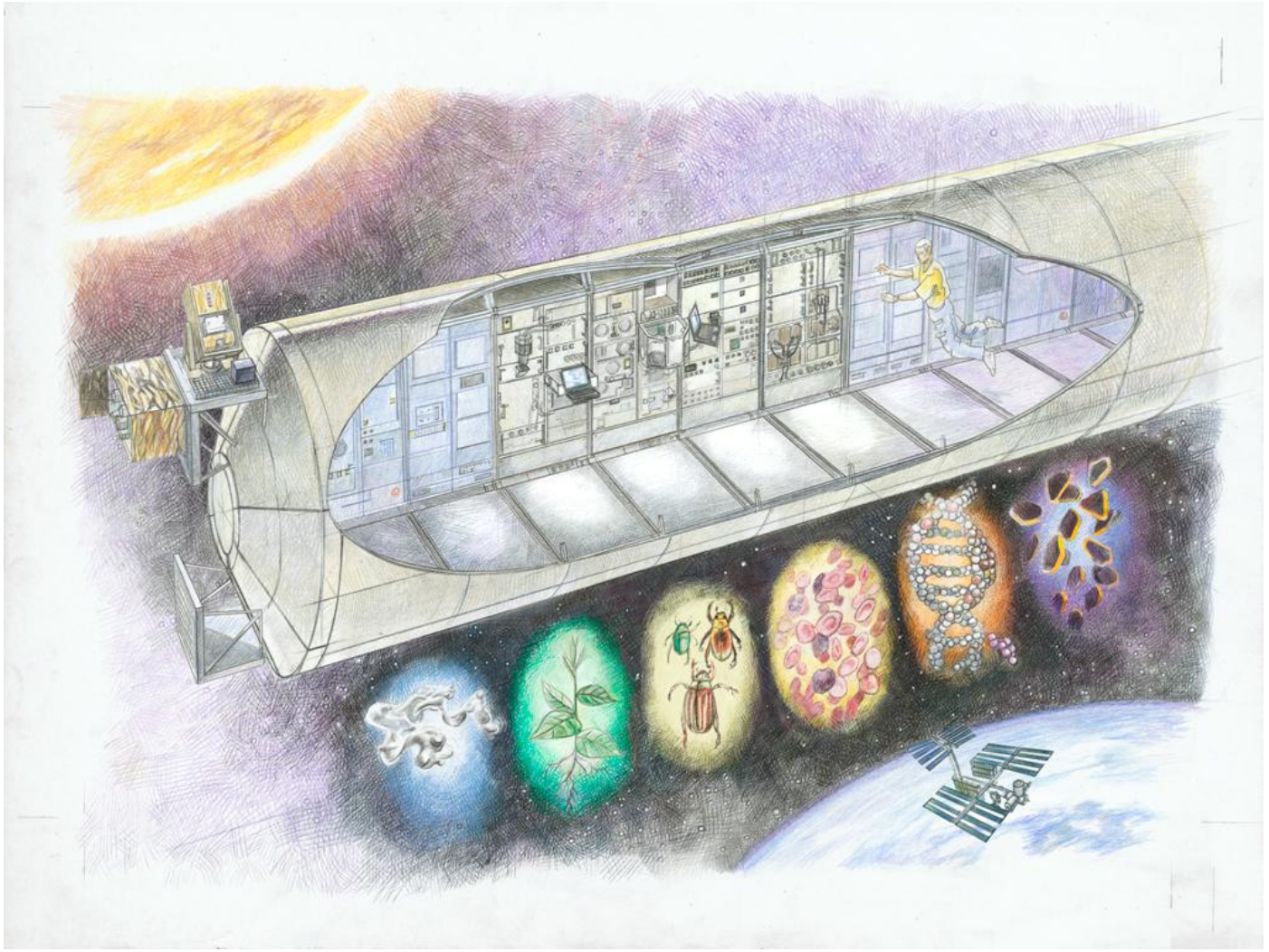

ISS Operations Centers
MSS Control
Saint-Hubert, Canada
Columbus Control Center
Oberpfaffenhofen, Germany
ISS Mission Control
Moscow, Russia
JEM/HTV Control Center
Tsukuba, Japan
ISS Mission Control
Houston, Texas
Payload
Operations Center
Huntsville, Alabama
ATV Control Center
Toulouse, France
H-IIB Launch Control
Tanegashima, Japan
Space Shuttle Launch Control
Kennedy Space Center, Florida
Ariane Launch Control
Kourou, French Guiana
Russian Launch Control
Baikonur, Kazakhstan

The International Space Station: An interdisciplinary laboratory



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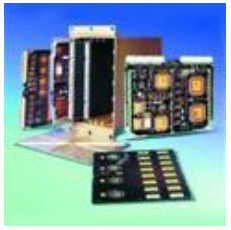
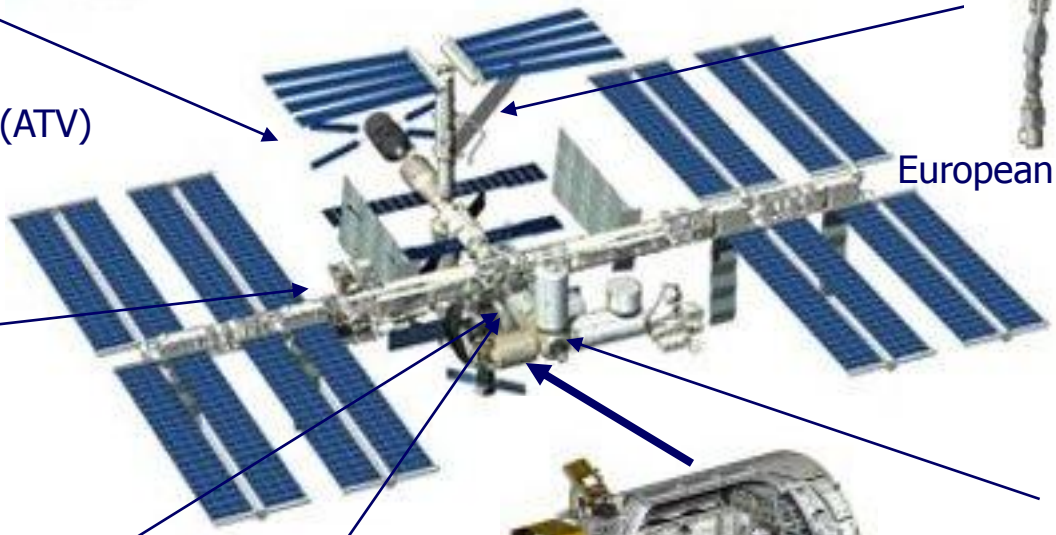
European participation in the ISS

Automated Transfer Vehicle (ATV)

European Robotic Arm (ERA)



DMS-R: ESA's Data Management System for the Russian Segment of the ISS



Node 2

Node 3

Columbus laboratory and its payload facilities

Cupola

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Columbus Laboratory and Payload Facilities

- ESA initiated preliminary study on its participation in the ISS including Columbus in 1984, following invitation by The United States to join the programme
- Final decision on the development of Columbus and its payloads was made in Toulouse in 1995
- Columbus flight module with its payload facilities was delivered to Kennedy Space Center in May 2007
- Launch of Columbus on February 7th, 2008 (mission STS-122)
- Attachment of Columbus to the ISS on February 11th, 2008
- Europe now owns a permanent laboratory in space

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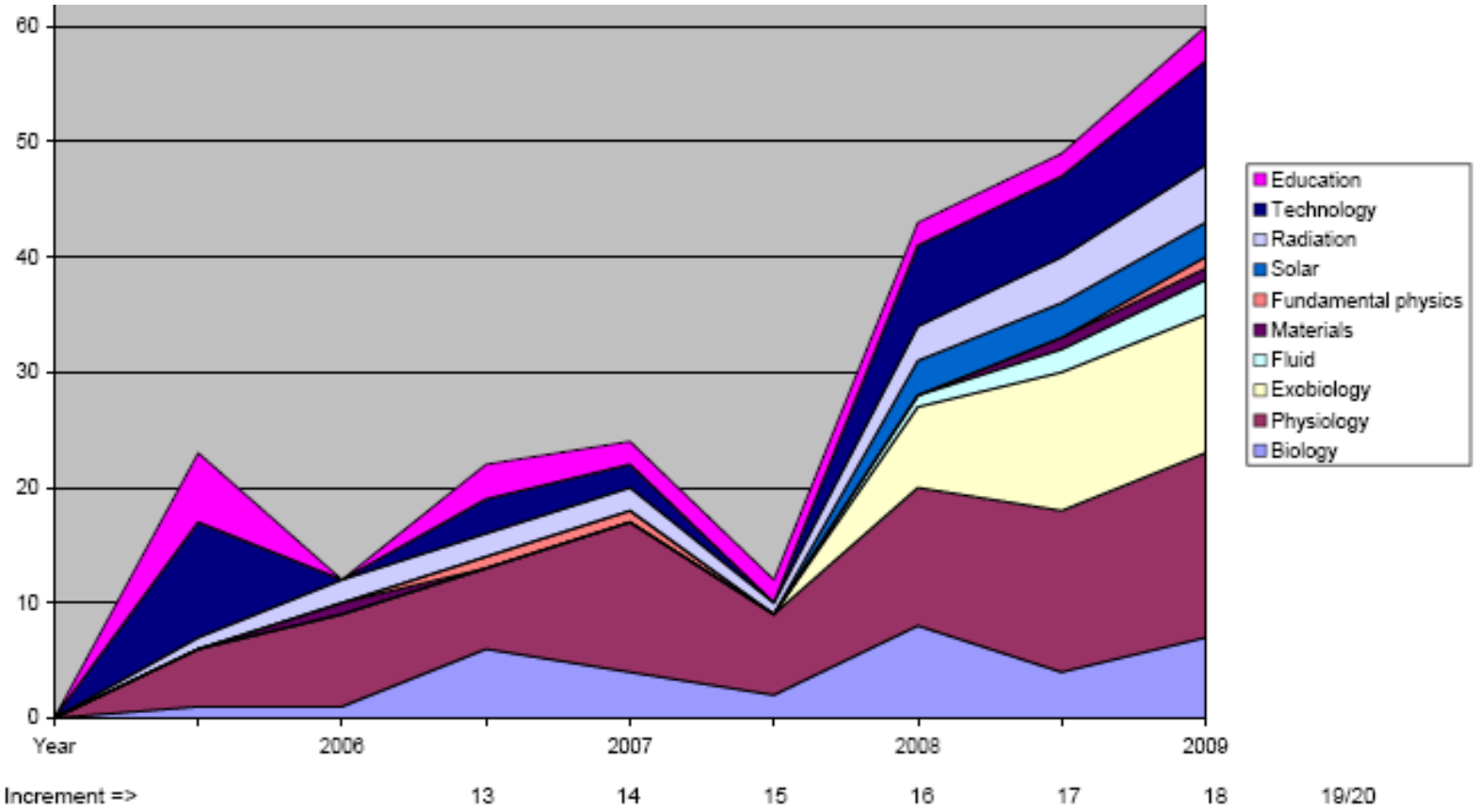
European Experiments on the ISS

- About 300 European Scientists have carried out investigations
- Educational outreach reached hundreds of thousands students in schools, museums, and science centers in Europe



Possible Greek participation

- As a full ESA member, Greece has the possibility to participate in ESA programmes exploiting existing know-how in industrial and scientific niches not yet occupied by other countries.

- The relevant activities are:
  - European Life and Physical Science and Applications in Space (ELIPS-3)
  - Small External Payloads Opportunities
  - European Transportation
  - Human Exploration Enabling Technologies

European Life and Physical Science and Applications in Space (ELIPS-3)

The main activities are:

- General activities
  - Topical Teams
  - Ground-based research
  - Microgravity Applications Programme (MAP)
  - Industry-driven R&D projects
  - Education
- ISS Utilisation hardware development

  Pre-phase A: Feasibility studies, Phase A/B: Development studies, Phase C/D: Development projects
- Non-ISS payloads

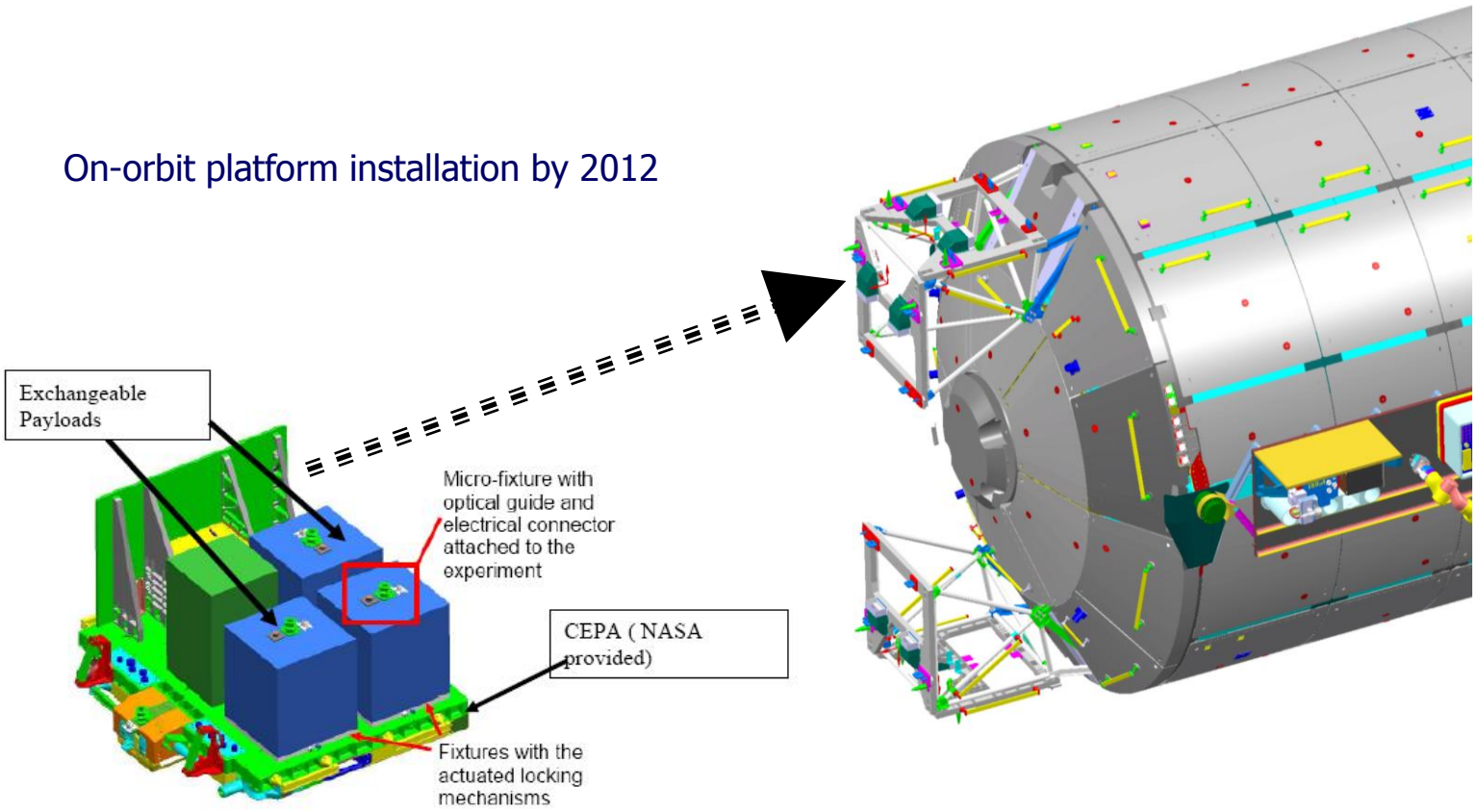
  Parabolic flights, sounding rockets

Contact: M. Zell, HSF-U

Small External Payloads Opportunities

Small Payloads External Robotics Platform (SPERO)

On-orbit platform installation by 2012

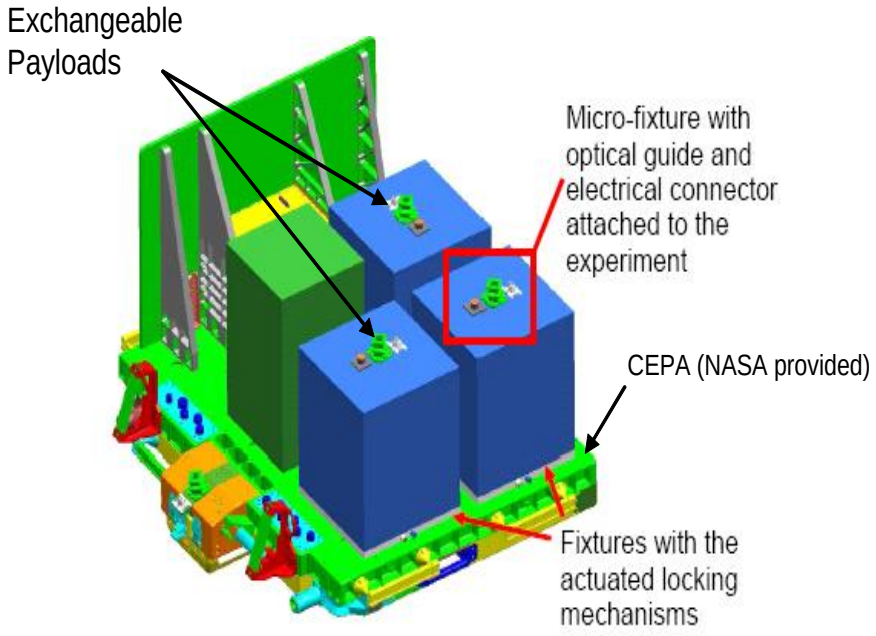


Contact: R. Nasca, HSF-UFS

Small External Payloads Opportunities

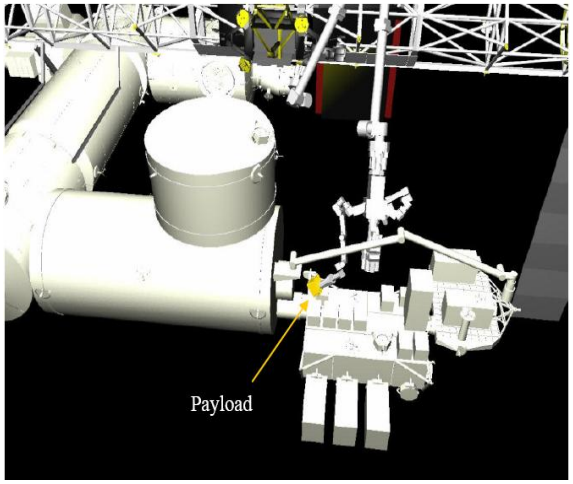
Small Payloads External Robotics Platform (SPERO) Main Features

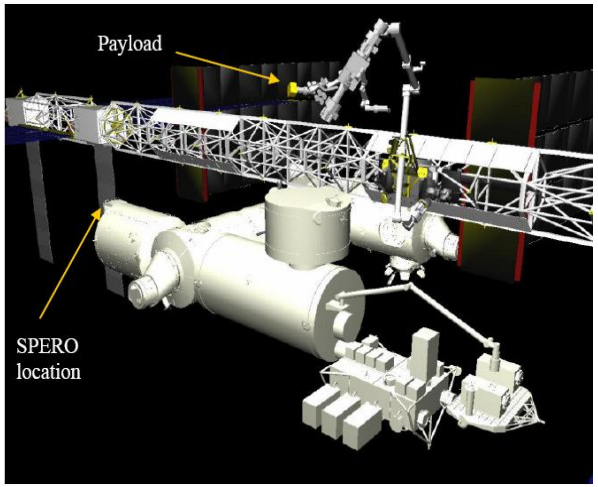
- While The Columbus External Payloads facility provides the possibility to accommodate only large external Payloads of max 370 Kg, SPERO accommodates Payloads up to 50Kg
- Small Payloads transported as pressurized cargo with ATV/HTVand installed with the ISS robotics arm (no EVA required)
- Small Payloads can be returned to Earth as pressurized cargo

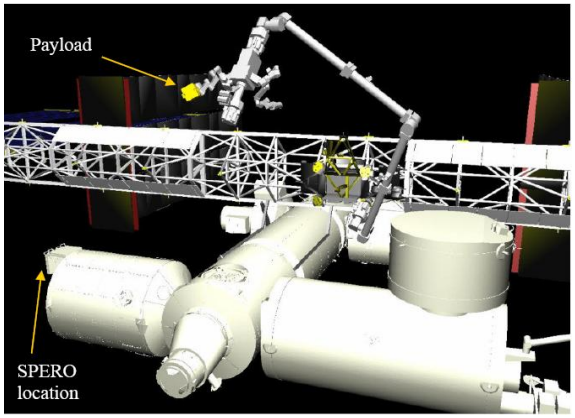


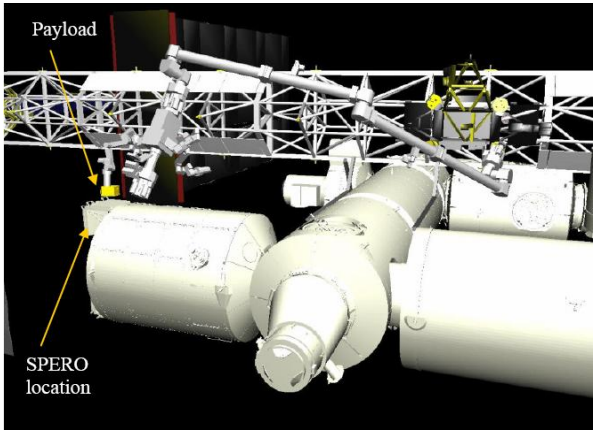
Small External Payloads Opportunities

Payloads Installation on SPERO



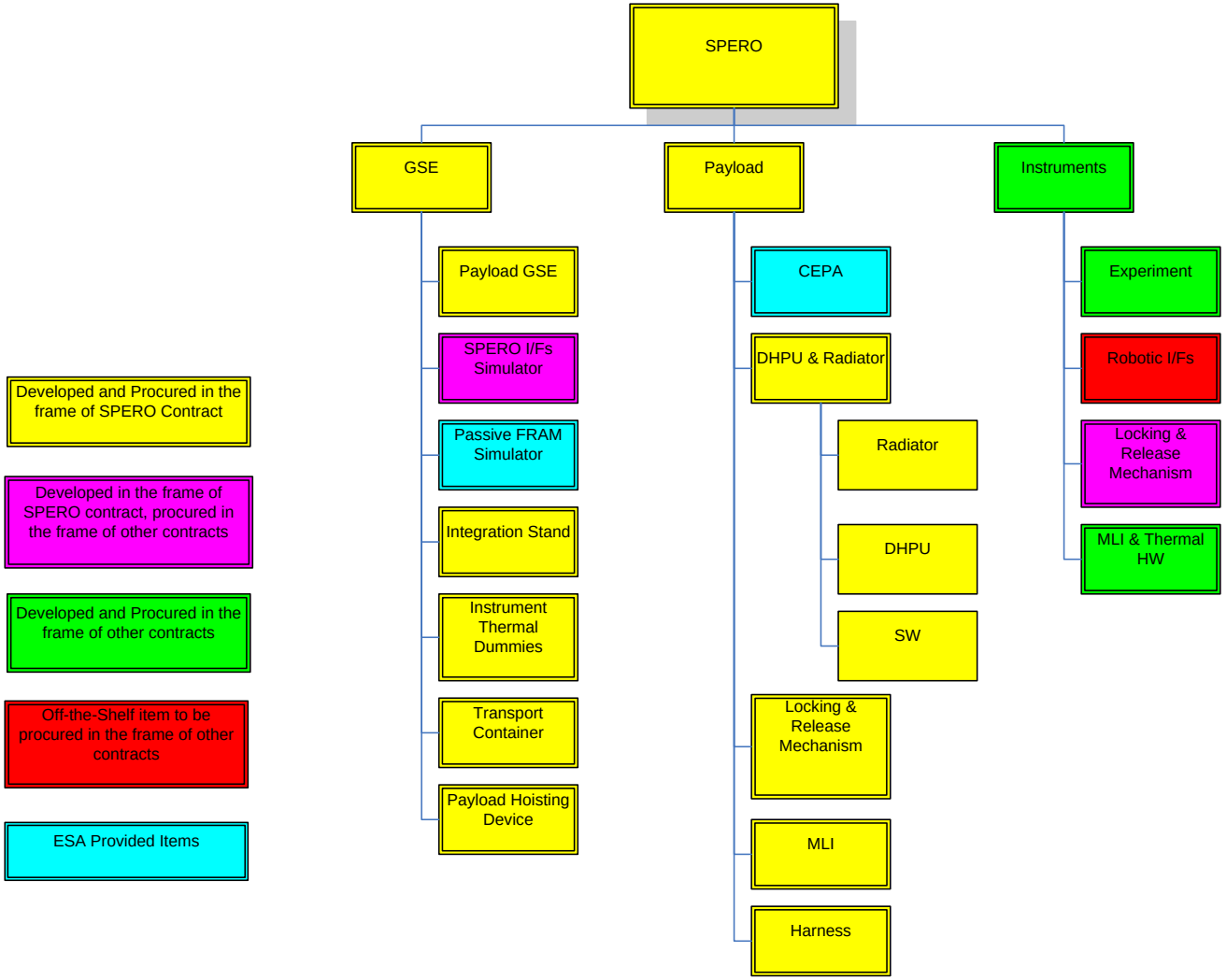






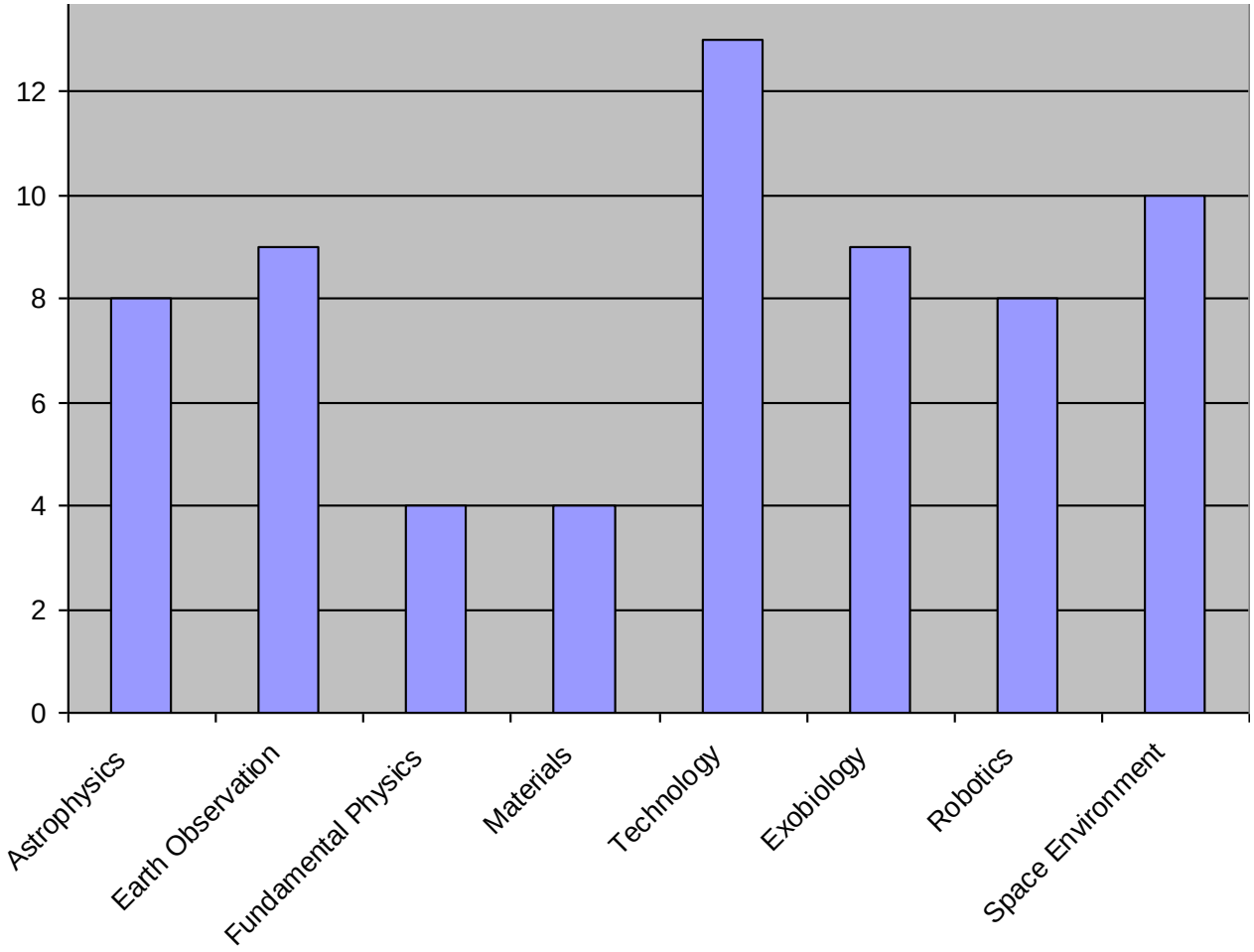
Small External Payloads Opportunities

SPERO Product tree



Small External Payloads Opportunities

Answer to SPERO call for interest by discipline



Small External Payloads Opportunities

- By Mid 2009 ESA shall release an announcement of opportunity to solicit small experiment for using the SPERO Platform, if it would be funded
  - The experiments to be proposed can be in any scientific field, making use of the exposure to outer space
  - ESA shall carry out a selection process
  - The experiments selected need to be funded and developed by the proposing organisation with ESA support
  - ESA shall fund the experiment integration/launch/operation

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European Transportation

Advanced Re-entry Vehicle -ARV-

- General objectives:
  - Step 1: upload/download for ISS operations by 2015
  - Step 2: crew transportation to Low Earth Orbit by 2020
- Activities for the period 2009-2010
  - Phase A of cargo transportation
  - Preliminary definition of Ariane 5 modification for human transportation

Contact: M. Caporicci, HSF-ET

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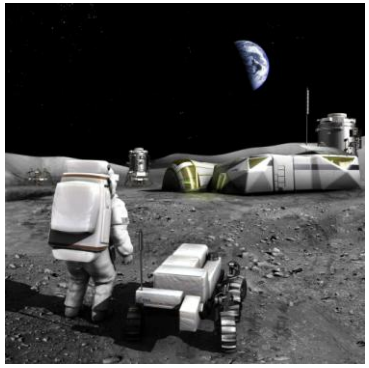
Human Exploration Enabling Technologies

Exploration Scenarios

- Exploration Scenario studies will support the definition of possible European and International exploration activities, taking into account the need for Europe to develop a common vision and long term strategic planning for exploration.
- Initialisation of selected phase A activities on promising exploration elements

Early Activities – Human Capability Development

- Objectives
  - To prepare Europe for future participation in Human spaceflight exploration missions by further developing enabling capabilities
- Activities to be pursued during the next period include:
  - Development of strategic long term habitation and life support systems
  - Development of resources and energy management systems

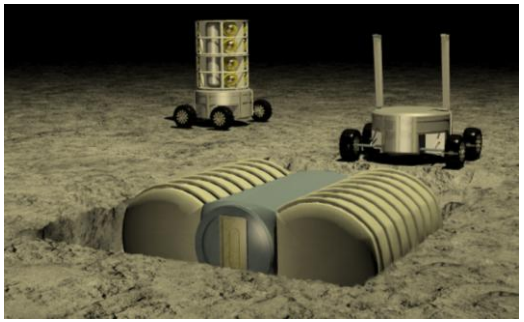


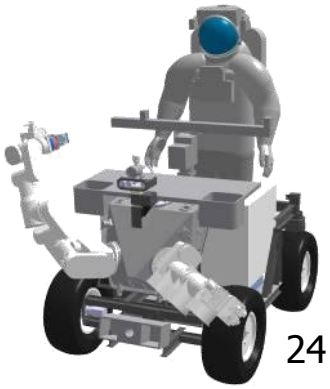
Contact: S. Hovland, HSF-EFH

Human Exploration Enabling Technologies

Early Activities – Human Capability Development

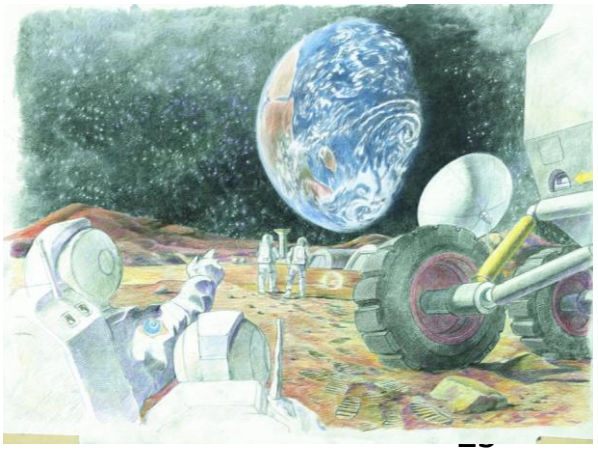
- **System Studies**
  - SpaceHaven: definition and analysis of habitation aspects on the lunar surface
  - Space Radiation effects and countermeasures
  - Lunar Dust issues and mitigation analysis and breadboarding
  - Human Factors requirements for surface missions
  - Life Support System Trade Studies for future mission types
- **Habitation**
  - Life Support capability development
  - Structures developments
- **Space Operations**
  - Communication and Navigation systems
  - Health Management Systems
  - Crew Operation Support
  - EVA Systems
  - Human Support Robotics
- **Specific Technologies- Resources and Energy Management**
  - Power Generation and Storage
  - In Situ Resource Utilisation

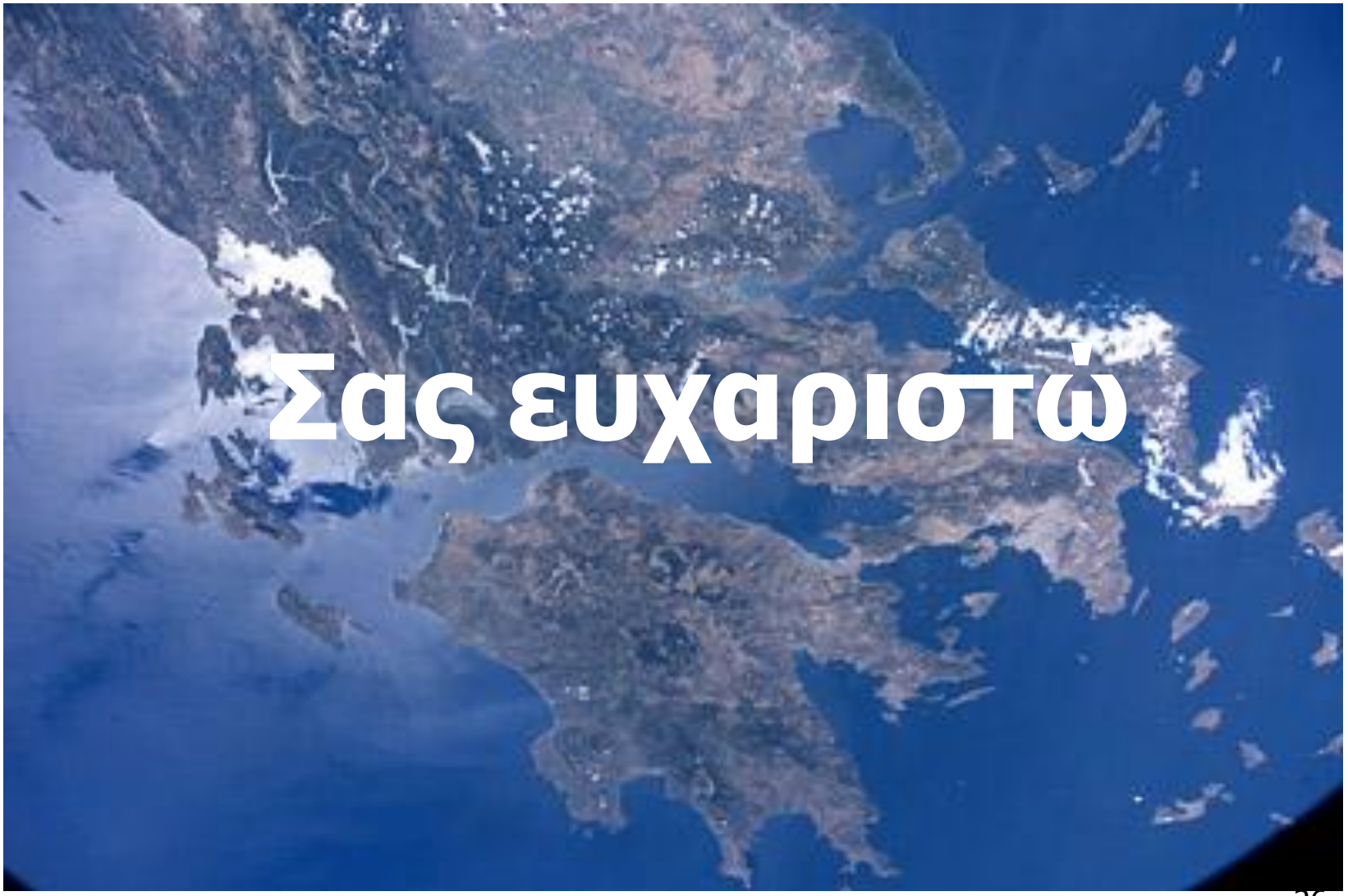




Conclusion

- Human space exploration is very challenging and ESA for its next projects needs all the skills it can gather in Europe
- Greece has a unique opportunity to participate in the Human Spaceflight Programme with industries and scientific institutes, thus helping to shape the common European future in space

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