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Item 10 of the provisional agenda*
Use of nuclear power sources in outer space

Workshop on the Use of Nuclear Power Sources in Outer Space: Implementing the International Safety Framework for Space Nuclear Power Sources Applications at ESA. Status and Plans

Presentation prepared by the European Space Agency (ESA)

* A/AC.105/C.1/L.306.

V.11-80750 (E)

Implementing the International Safety Framework for Space Nuclear Power Sources Applications at ESA

Status and Plans

European Space Agency

Presentation to the United Nations Committee on Peaceful Uses of Outer Space
Scientific and Technical Subcommittee, 48th Session
9 February 2011

European Space Agency (ESA)

International Intergovernmental Organisation

18 Member States

- Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Norway, the Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom
- Romania in process to become 19th Member State

Canada:Cooperation Agreement over 30 years

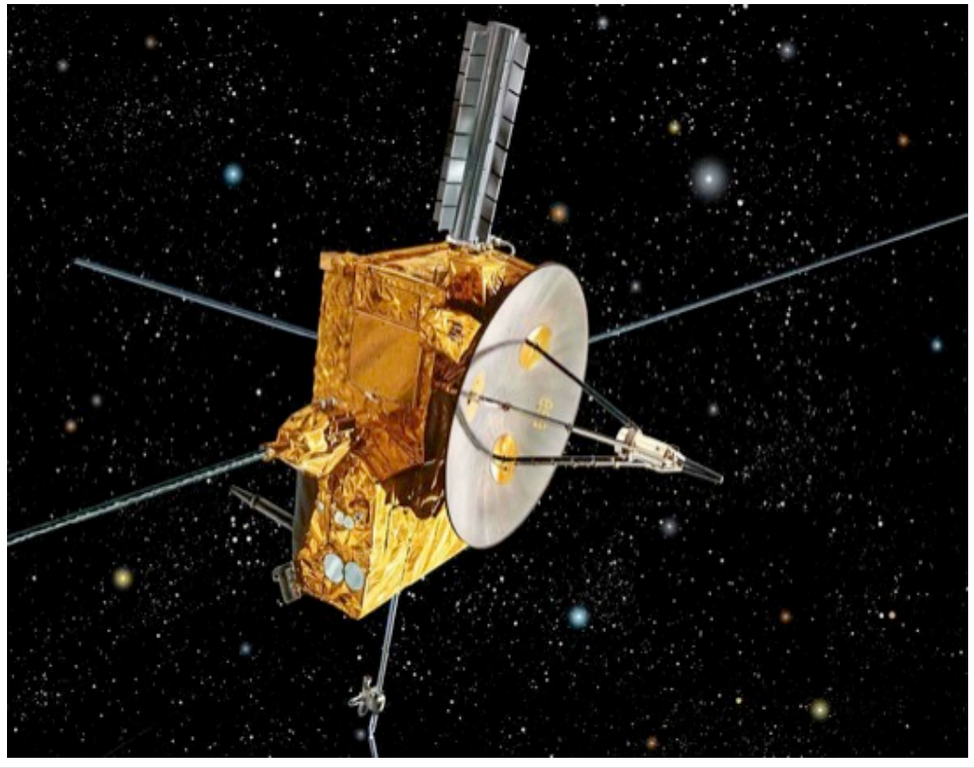
European Cooperating States

- Estonia, Hungary, Poland, Romania and Slovenia

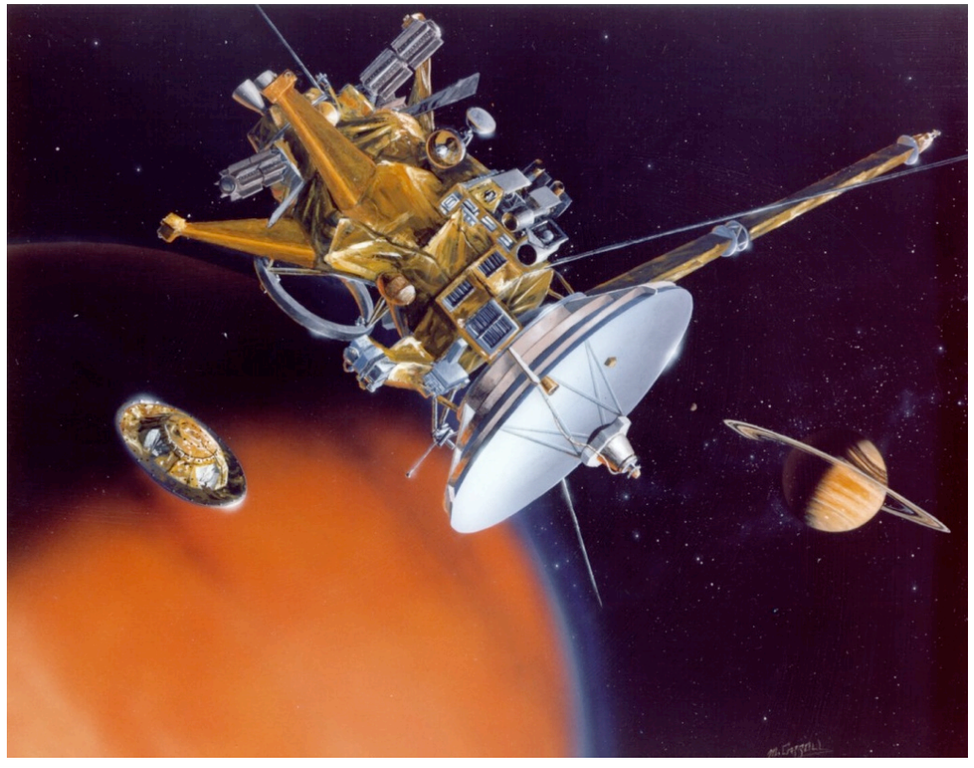
Cooperation Agreements

- Cyprus, Latvia, Lithuania, Slovakia

ESA missions involving nuclear power sources



Ulysses
1990, 1 RTG, solar polar orbit



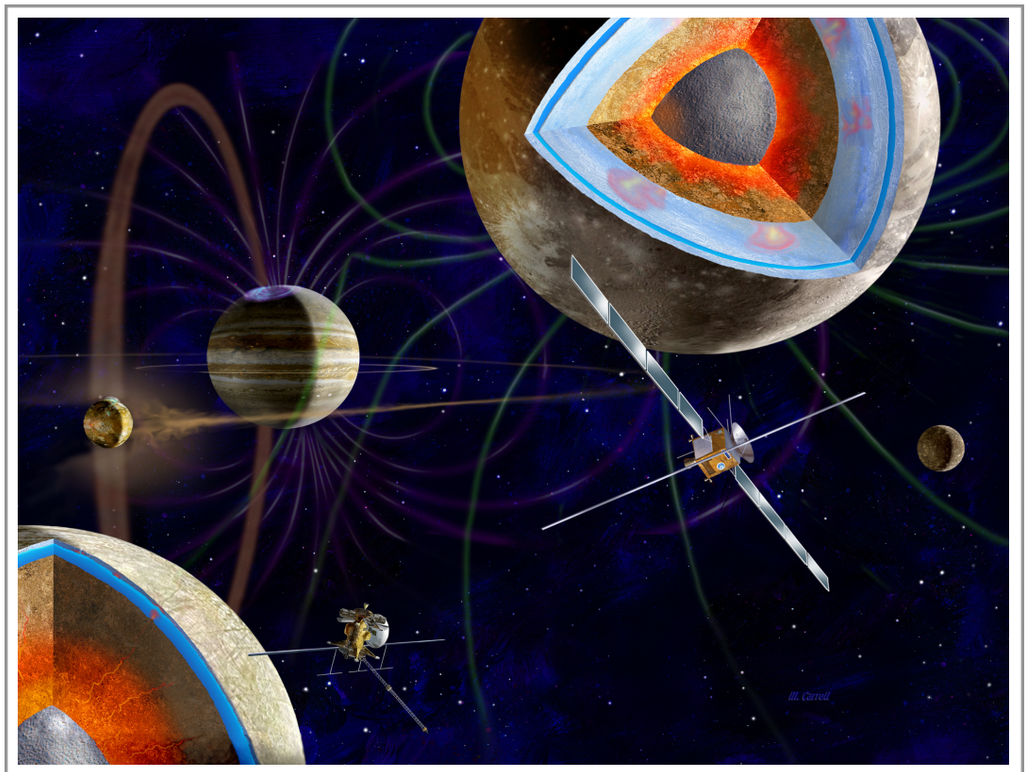
Cassini / Huygens
1997, 3 RTG, RHUs, Saturn / Titan

ESA has used the energy provided by nuclear power sources in two of its science missions. Both missions were done in cooperation with NASA, with US nuclear power sources and launched on US launchers.

Planned ESA missions involving nuclear power sources

ExoMars

2016/18; Mars orbiter and lander



Europa Jupiter System Mission / Laplace

2020, two spacecraft mission to Galilean satellites (esp. Ganymede and Europa)

ESA is currently planning and developing science and exploration missions that will need energy provided by nuclear power sources. Both missions are planned in cooperation with NASA, with US nuclear power sources.

ESA and International Safety Framework for Space NPS Applications

ESA has been supporting the preparation and development of the International Safety Framework for Space NPS Applications during the entire workplan period of the STSC-IEAE Joint Expert Group, based on the considerations that

- space NPS are the only viable energy option to power some space missions and significantly enhance others; ESA has been using space NPS in the past and is likely to need them for planned and future space missions
- NPS applications in outer space have unique safety considerations compared with terrestrial applications that are not addressed in safety guidance for terrestrial nuclear applications
- it is important to promote the safety of NPS applications in outer space via an international safety framework that reflects a broad international consensus on the on measures needed to achieve safety of all space NPS applications
- such a broad international consensus and the implementation of the framework provides assurance to the global public that space NPS applications would be launched and used in a safe manner, and facilitates bilateral and multilateral cooperation on space missions using NPS; all currently planned ESA space missions to use NPS will be done within multilateral cooperation

ESA has accompanied this process internally with study activities in preparation of a European Nuclear Safety Framework (ENSaF).

Safety at ESA

In the development of a space project several facets of safety are involved that are described in relevant standards established by ESA in cooperation with Industry (e.g., ECSS-Q-ST-40C):

Safety management

- a continuous and iterative process throughout the project life cycle devoted to study, plan and implement activities intended to minimise safety risks of a system within the project constraints
- ensures that all safety risks are adequately identified, assessed, minimised, controlled and finally accepted as part of project risk management

Safety engineering

- the technical and organisational implementation of safety in the design and operation

Safety assessment/analyses

- is performed on the system as a whole – hardware, software, human factors - and involve the identification, control and verification of associated hazards and failure scenarios

Safety assurance

- monitors and assesses the activities of safety management, assessment and engineering, and its implementation in order to provide evidence that the final outcome of the safety assessment is trustworthy

ESA has established in December 2008 an internal independent safety office.

ESA and International Safety Framework for Space NPS Applications

Considerations concerning the implementation of the safety framework within ESA:

Safety framework already used as reference document for some statements of work / contracts

Two-phases implementation process:

1. ESA-internal procedures
2. Coordination with ESA Member States, especially France for launches from CSG

Implementation of

- Guidance for governments and relevant international intergovernmental organisations related to safety policies, requirements and processes, to the justification process and to emergency preparedness and response
- Guidance for management of the organisation that conducts the mission, related to its prime responsibility for safety and its leadership and safety management
- Guidance for the technical implementation within ESA related to the core competence in nuclear safety, to the design and development process integrating safety in the entire NPS application from the earliest stages

Current Status and Conclusions

ESA has started the first phase of the implementation process

- involvement of all relevant internal organisational entities
- detailed analysis of the safety framework
- detailed analysis of the current safety processes and procedures at ESA in view of their adaptation for space NPS applications on ESA missions

Implementation of most guidelines clear and straight-forward

Some already identified open questions require deeper analysis, e.g.

- implementation of the prime responsibility of the organisation that conducts the space NPS mission and its formal arrangements with all relevant participants to the mission in case of ESA missions
- share of responsibilities between ESA and its Member States related to recommendations for governments and relevant international intergovernmental organisations that authorise, approve or conduct space NPS missions
- organisation of launch safety and emergency preparedness and response for different launch phases and accident scenarios

Appreciation of possibility for information exchange and assistance of COPUOS Member States with experience in NPS applications