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COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE
Scientific and Technical Subcommittee
Forty-third session
Vienna, 20 February - 3 March 2006
Agenda item 9
Use of Nuclear Power Sources in Outer Space

JOINT UNITED NATIONS/INTERNATIONAL ATOMIC ENERGY AGENCY TECHNICAL WORKSHOP ON THE OBJECTIVES, SCOPE AND GENERAL ATTRIBUTES OF A POTENTIAL TECHNICAL SAFETY STANDARD FOR NUCLEAR POWER SOURCES IN OUTER SPACE (VIENNA, 20-22 FEBRUARY 2006)

Session 1. BACKGROUND

Presentation on "Ongoing, Planned and Currently Foreseeable NPS Applications in Outer Space and Their Scope and Rationale"

Note by the Secretariat

1. In accordance with paragraph 16 of General Assembly resolution 60/99 of 8 December 2005, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space will organize, jointly with the International Atomic Energy Agency, a technical workshop on the objectives, scope and general attributes of a potential technical safety standard for nuclear power sources in outer space, to be held in Vienna from 20 to 22 February 2006.

2. The presentation contained in the present conference room paper was prepared for the joint technical workshop in accordance with the indicative schedule of work for the workshop, as agreed by the Working Group on the Use of Nuclear Power Sources in Outer Space during the intersessional meeting held in Vienna from 13 to 15 June 2005 (A/AC.105/L.260).

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Ongoing, Planned and Currently Foreseeable NPS Applications in Outer Space and Their Scope and Rationale

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European Space Agency

Outline

General European Situation

Ongoing and Planned ESA NPS Applications

Current ESA Situation and Activities related to NPS

Foreseeable ESA NPS Applications

Rationale for the use of NPS by ESA

General European Situation

European Situation

- use of nuclear technology for electricity generation controversial
- well-informed, educated public sensitive to decisions related to nuclear activities

General ESA Approach to the use of NPS in outer space

- "avoid whenever possible" - thoroughly explore all alternatives (fully consistent with NPS Principles 1992, Principle 3)
- full focus on safety
- transparency (ESA Member States and general public)

Ongoing NPS Applications by ESA

NPS used on two ESA spacecraft

- **Ulysses**

  launch: 1990; NPS: 1 RTG

  current situation: operational in polar solar orbit

- **Cassini/Huygens**

  launch: 1997;
  NPS: 3 RTG on Cassini, RHU on Cassini and Huygens

  current situation:

  - Cassini operational / in orbit around Saturn
  - Huygens: on surface of Titan, non-operational

Both missions in co-operation with US

- nuclear aspects and launch under US responsibility

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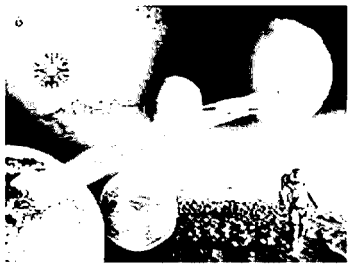
European Space Agency

Planned NPS Applications

Aurora Exploration Programme



- 2 robotic missions to Mars in preparation

  ExoMars (near-term)

  Mars Sample Return

- Mars Exploration mission "*ExoMars*"

  planned launch date: 2011

  RHU option for Mars Surface Rover

  Radioisotope power sources identified as potentially required, enabling technology

  - thermal control and management

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European Space Agency

Current Situation

European Decision Process

- potential need for radioisotope based power sources identified
- Multi-Agency Institutional European Expert Working Group

  Identified NPS as "key enabling technology for European space activities"

  Identified three options for Europe

  Recommended "*seeking international co-operation and making use as much as possible of existing international competence*"

  Recommended a phased approach with a short- to medium-term goal to "*establish a knowledge and know-how base for nuclear power sources for space, invest in the capability to handle, test and launch nuclear power source technology and use these independently for its science and exploration missions*"

- ESA Ministerial Council December 2005

  decision in favour of a development programme for *ExoMars*, including NPS related activities within the *Aurora Core Programme*

Current Situation

Nuclear Power Source devices:

- no ESA-developed nuclear power sources for space applications

Technical Aspects:

- Assessment of suitability of European integration and launch facilities for the integration and launch of nuclear power sources for space applications
- Assessment of technical options for small RPS ongoing

Administrative Aspects:

- Elaboration of a European safety framework for the launch and use of nuclear power sources for space applications

  administrative framework

  safety standards

  approval process

Foreseeable Potential ESA Needs for NPS

Radioisotope-based Power Sources:

- Space Science Missions - ESA "*Cosmic Vision*"

  missions to outer solar system (Jovian system, TNO, boundaries of heliosphere)

- Space Exploration Missions - ESA "*Aurora*" Programme

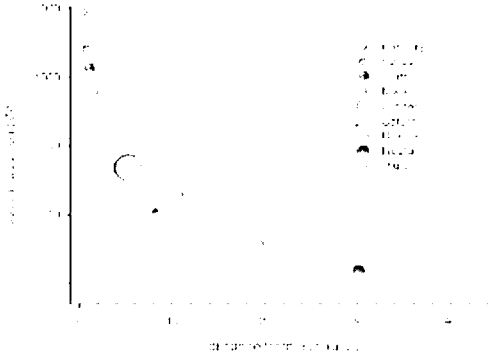
  Mars surface missions (e.g. *ExoMars, Mars Sample Return*)

  Lunar surface missions

Fission Reactor-based Power Sources

- no currently planned or foreseeable ESA missions requiring nuclear fission reactors

Rationale for NPS applications



Ulysses

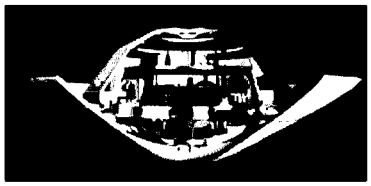
- distance from sun

Cassini/Huygens

- distance from sun
- thermal needs on surface of Titan

ExoMars

- operational constraints, lifetime, survivability
- volume and mass constraints
- (all successful Martian landers used NPS)



Outer Solar System spacecraft

- insufficient solar power level

Conclusions

ESA has been using nuclear power sources on two spacecraft: Ulysses, Cassini/Huygens

ESA has identified the potential need for nuclear power sources within its exploration and science programmes

European Advisory bodies have identified nuclear power sources as a key enabling technology for European ambitions in space

ESA is currently preparing the required technical and administrative framework enabling Europe to use radioisotope power sources for space applications