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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 4. PRESENTATIONS PERTINENT TO OBJECTIVE I.A. (CONTINUED)

**Presentation on “Considerations on Minimum Essential Safety Elements of an
International Safety Framework for NPS Applications in Outer Space”**

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).



Considerations on Minimal Essential Safety
Elements of an International Safety Framework
for NPS Applications in Outer Space

presented by Leopold Summerer
European Space Agency



Outline

General Considerations

Approach to *European Space Nuclear Safety Framework*

Essential Safety Elements

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General Considerations

General Approach:

- basis:
 - UN Space treaties and specifically Outer Space Treaty 1967
 - Principles Relevant to the Use of NPS in Outer Space, 1992
 - Relevant nuclear and environmental protection agreements (A/AC.105/781)
 - ESA Convention, 1975
- peaceful international co-operation

Principal Aim:

- Internationally accepted, unambiguous, high safety standards for NPS applications in outer space
- These are expected to:
- increased general safety level of NPS applications in space through the implementation of international standards into national standards/legislation
 - improve the procedural transparency and trust
 - improve international co-operation

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General Considerations

Technical and Programmatic Considerations

- *solar* and *nuclear* energy are the only viable options for extended space missions according to present knowledge
- *Outer Solar System*
Nuclear power sources, especially radioisotope-based power sources, constitute the only available option for supplying sufficient heat and electricity to spacecraft travelling to the outer solar system (orbit of Jupiter and beyond)
- *Lunar Surface*
The long, dark and cold lunar nights make nuclear power sources a likely necessity for sustained presence on the Moon.
- *Martian Surface*
Nuclear power sources seem to be required for Martian surface landers at higher latitudes and for missions able to reliably survive Martian dust storms.

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MINIMAL ESSENTIAL SAFETY ELEMENTS OF AN INTERNATIONAL SAFETY FRAMEWORK
STSC-IAEA WORKSHOP, VENICE, 20-22 FEBRUARY 2006

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General Considerations

Technical and Programmatic Considerations

- all activities involving nuclear power sources require special safety measures
- the combination of two, by definition, *hazardous* activities (the launch and other phases of spacecraft and the use of nuclear power) requires even increased safety measures
- the *perception* by the general public of risks associated with space and nuclear activities require
 - the conduct and communication of transparent, credible and reliable safety and risk assessment processes
 - the use of NPS on missions of benefit and interest to the general public
- Europe possesses the technical and industrial knowledge for the successful development and safe use of NPS for space applications
- Europe has a good safety record for its terrestrial nuclear activities

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MINIMAL ESSENTIAL SAFETY ELEMENTS OF AN INTERNATIONAL SAFETY FRAMEWORK
STSC-IAEA WORKSHOP, VENICE, 20-22 FEBRUARY 2006

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European Working Group on NPS

The development, integration, launch and use of nuclear power sources for space applications require multiple actors

Multi-Agency Institutional European Expert Working Group

- chaired by EC representatives
- involving representatives of ESA and EC Member States covering all relevant areas
- mandate: *"elaboration of high-level decision-enabling recommendations [...] on the development and use of NPS for Europe"*

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Recommendations by European WG

WG recommended European Approach to Safety of NPS

- *Safety is of primary importance for all activities involving nuclear power sources. Following the IAEA general nuclear safety objectives, a defence-in-depth strategy needs to be followed to protect individuals, society and the environment by establishing and maintaining effective defences against radiological hazards. [...] Besides safety, security as well as non-proliferation aspects need to be considered.*

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Recommendations by European WG

specific safety related recommendations

- *In line with existing national provisions and the ongoing elaboration within UN COPUOS of an international technically based framework for the safety of nuclear power source applications in space, a European safety framework should be set up, characterised by the following general principles:*
 1. *A clear definition of responsibilities.*
 2. *Separation of the technical assessment from the administrative process.*
 3. *Protection of the regulatory/licensing process from government influence and interference. [in the frame of a European process]*
 4. *Use of the expertise of relevant advisory committees to promote stake-holder and public confidence.*

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Minimum Essential Safety Elements of an International Safety Framework
STSC-IAEA Workshop, Vienna, 20-22 February 2008

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Safety-related Recommendations

Short-term actions:

- Establish European framework for NPS
- Expedite the establishment of (possibly binding) international safety standards - support for UN COPUOS NPS related activities
- Establish European safety standards
 - if possible as implementation of international standards
 - in line with directions of to be agreed international standards
- Research on NPS within European Framework Programme(s) for Research

Medium-term actions:

- Adaptation of current and foreseeable European launch infrastructure (installations, procedures, emergency response)

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Approach to European NPS Safety Framework

International nuclear safety related standards and procedures

- Principles relevant to the use of NPS applications in outer space (GA Res. 47/68, 1992)
- IAEA general nuclear safety objectives/standards; defence-in-depth approach
- recommendations of ICRP on ionizing radiation dose limits (ICRP60, EC Directive 96/29/ Euratom)
- (to be elaborated) international safety framework

European space and nuclear safety standards and procedures

- existing appropriate standards and procedures (e.g. transport, installation safety, radiation protection, environmental protection)
- similarly high safety standards as in terrestrial nuclear power plants

Experience of partners: US and Russian Federation

- risk levels / hazard classifications / probabilistic risk assessments
- approaches and methodologies

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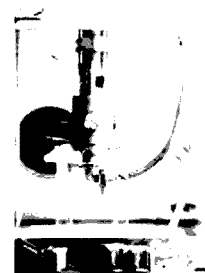
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Approach to NPS Safety

Starting situation:

- experience and high safety level of terrestrial nuclear activities in Europe
- experience during past two missions involving RPS (Ulysses, Cassini/Huygens)
- early prototypes and continuous studies



ORR-242 fueled ABC RTG prototype testing in Karlsruhe (D) during 1960s

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International Safety Framework

Essential elements:

- based on, in line with and going further than 1992 Principles (GA Res. 47/68, 1992)
- adopting or fully in line with IAEA safety standards for related ground-based activities (e.g. handling, integration, transport; in case these aspects would be included)
- in line with IAEA safety fundamentals and radiation safety standards
 - “Radiation Protection and the Safety of Radiation Sources” (Safety Fund. publ.)
 - “International basic safety standards for protection against ionizing radiation and for the safety of radiation sources” (Safety Requ. publ.)
- making reference to exposure limits as defined, continuously revised and updated (according to scientific progress) by the ICRP and UNSCEAR
- including *all* types of use of nuclear power sources in outer space

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International Safety Framework

Aspects regarding procedural options as identified by the WG (A/AC.105/L.254/Rev.2)

- all currently proposed option in principle possible
- importance of a clearly defined and predictable process
- preference for a fast process
- preference for processes more likely to
 - lead to a *comprehensive and “strong”* international framework
 - lead to a high *technical quality* of the end product
- preference for a process with the option for international intergovernmental organisations to play a substantial role

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