THE HAGUE
INTERNATIONAL
SPACE RESOURCES
GOVERNANCE WORKING GROUP

INTRODUCTION

By

Giuseppe Reibaldi, Executive Secretary

THE HAGUE INTERNATIONAL SPACE RESOURCES GOVERNANCE WORKING GROUP

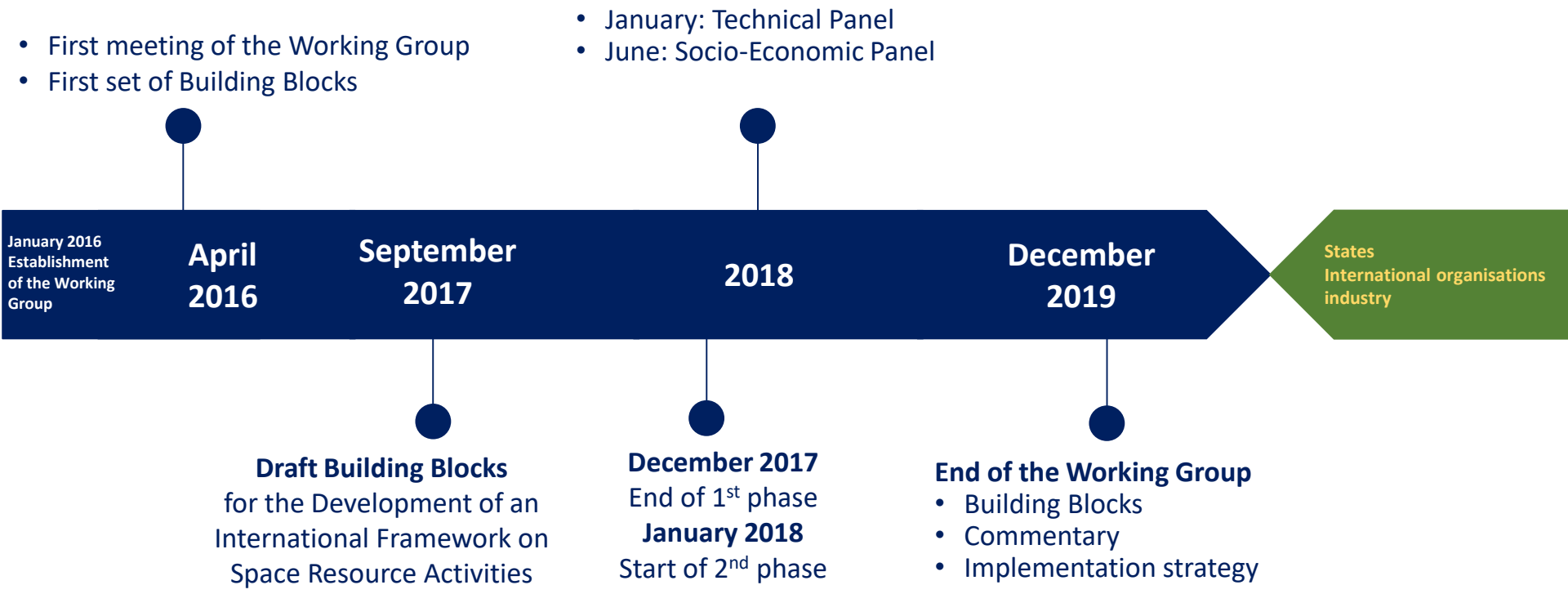
Terms of Reference

- Assess the need for a framework for space resource activities related to the use of mineral and volatile materials on the Moon and other Celestial Bodies
- In case of need, to lay the groundwork for the definition of such a framework based on the UN Treaties on outer space
- The groundwork required included the identification and formulation of building blocks for the governance of space resources with possible implementation of a relevant forum for the negotiations

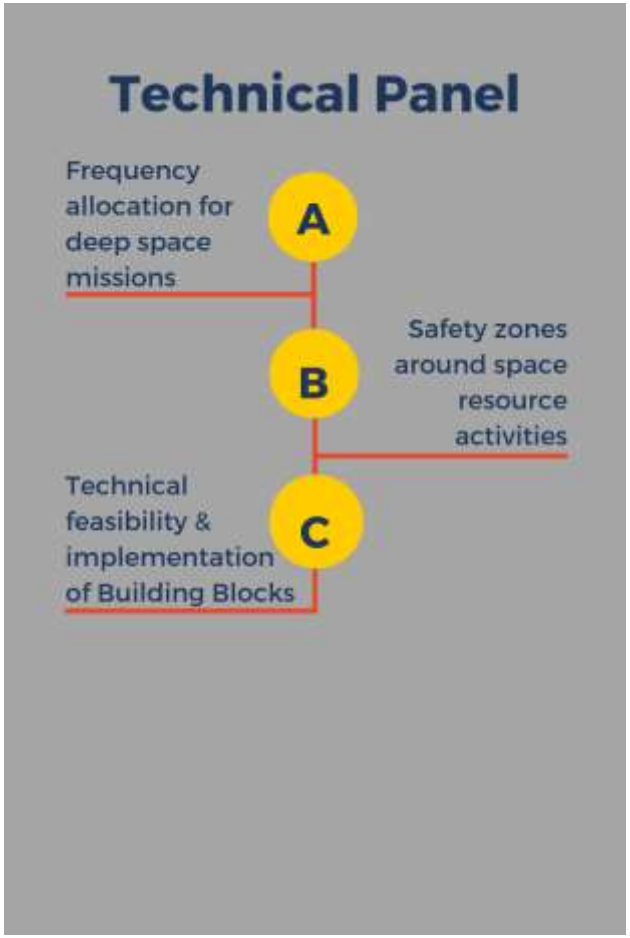
Deliverables

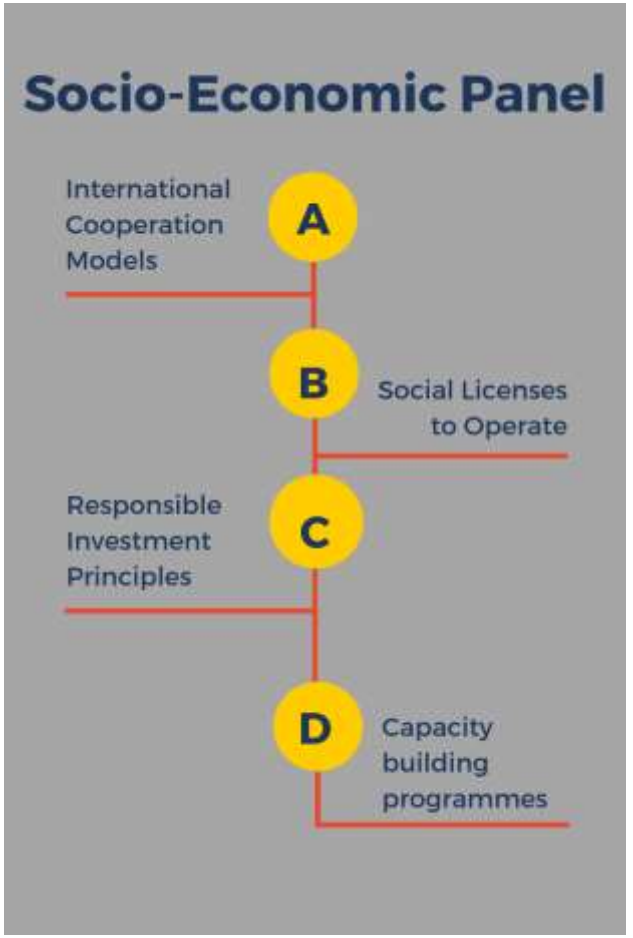
- Identification and formulation of building blocks for the governance

  of space resources activities as a basis for negotiations on an international framework
- Commentary to the Building Blocks


January 2016
Establishment
of the Working
Group
April
2016
First meeting of the Working Group
First set of Building Blocks
September
2017
Draft Building Blocks
for the Development of an
International Framework on
Space Resource Activities
-open consultation-
2018
January: Technical Panel
June: Socio-Economic Panel
December 2017
End of 1st phase
January 2018
Start of 2nd phase
December
2019
End of the Working Group
Building Blocks
Commentary
Implementation strategy
States
International organisations
industry

Members & Observers from: industry, governments, space agencies, international organizations, civil society, academia


Technical Panel
Frequency allocation for deep space missions
A
B
Safety zones around space resource activities
Technical feasibility & implementation of Building Blocks
C


Socio-Economic Panel
International Cooperation Models
A
B
Social Licenses to Operate
Responsible Investment Principles
C
D
Capacity building programmes

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Technical Panel Presentation

Kyle Acierno, Chairman of the Technical Panel

Panel Terms of Reference and Organization

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Panel Terms of Reference

- Foster dialogue and cooperation between governments, industry, international organizations, academia and civil society on socio-economical aspects of space resources activities;
- Identify technical challenges related to the use of space resources;
- Advise the WG about the current status of developments and feasibility on the implementation of the proposed building blocks and propose new, if required;

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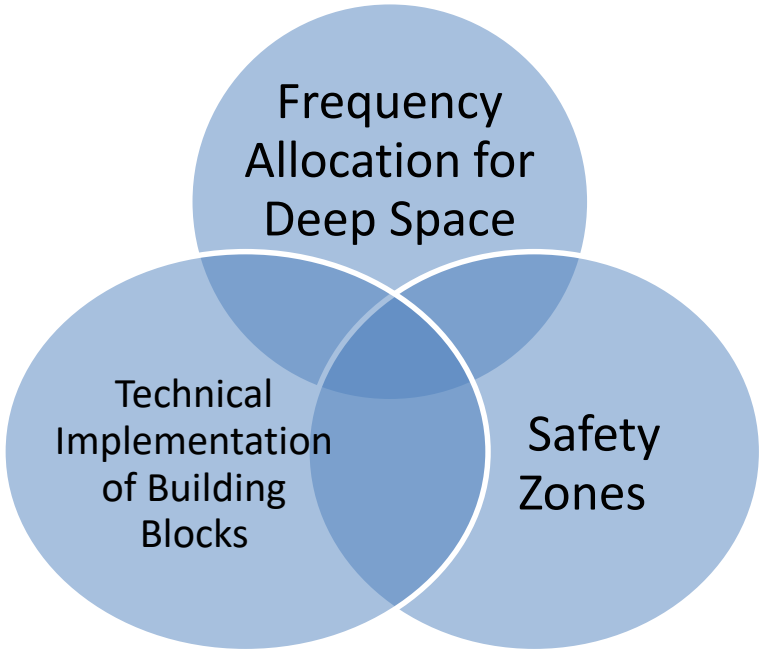
Panel Organization

- The Panel's expertise was drawn from numerous industries with specialties in telecommunications, engineering, mining, science and economics
- In total, over 25 professionals joined 3 Teams
- While there are many issues concerning the technical aspects of space resource utilization, some are **extremely urgent,** especially given the number of up-coming commercial missions



- In order to properly address the most pressing issues of up-coming lunar mission the technical panel was split into 3 teams, each responsible for a specificc issue

Tiger Team Summaries

Frequency Allocation Team

Coordinating use of radio frequencies & associated orbits for missions to, and on celestial bodies (Deep Space Missions)

Team Lead

- Scott Millwood, DLR

Team Members

- Attila Matas (Orbit Spectrum)
- Deepika Jeyakodi (Airbus)
- Emilie Marley Siemssen (GOMSpace)
- Matthew Cosby (Goonhilly Earth Station)
- Mitsuhiro Sakamoto (International Telecommunications Union)
- Jan King (Astro Digital)
- Sebastian Hernandez (Fugro Satellites)
- Franz Schilling (ispace)

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Frequency Allocation Team

Coordinating use of radio frequencies & associated orbits for missions to, and on celestial bodies (Deep Space Missions)

Key Challenges

- **ITU has a mandate to allocate and register radio frequencies for all radio services** including those in GEO and any other frequencies & orbits relating to activities around and on celestial bodies (e.g. Moon)
- At present Member States are only able to assign lunar frequencies to radio stations around the Moon in the frequency bands allocated for “research” (**space research services**) or operational purposes of spacecraft (**space operation services**)
- Member States have developed **a practice of assigning lunar frequencies for “research purposes” to commercial entities**, given absence of commercial category
- the current status of early commercial lunar ventures might be reasonably classified as “research”, but as commercial activities increase, the **allocation of lunar radio frequencies should reflect the reality of activities** of a range of stakeholders
- this requires the **development of a framework to effectively allocate lunar frequencies for commercial purposes**

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Key Reccomendations

- Interference between radio frequencies carries a risk of harmful interference with lunar and space activities of other parties, representing a risk to safety, persons, property & environment. The **effective allocation of lunar and deep space frequencies** & orbits will be required to to **mitigate this risk**

- Consider the protection of “endorsed sites of scientific interest” or even the “integrity of science”, ex. Shielded Zone of the Moon. Not a “site” and more about preventing interference with deep space radars and telescope

- Develop a new lunar and deep space frequency allocation model to ensure that all States have access on the basis of equality & in accordance with international law

- The World Radio Council should put the question of allocation of lunar frequencies & orbits on the Agenda for and triggers research into commercial use & models of allocation to ensure the commercial enterprise of all States have access

- The World Radio Conference should propose new ITU Frequency Allocation Tables for lunar orbits and frequencies with a new category of commercial use

Saftey Zone Team

Coordinating zones of safety for active missions on the Moon and other Celestial bodies

Team Lead

- Mike Gold, Maxar

Team Members

- Allan Scott (University of Canterbury)
- Kieran Carroll (Gedex)
- Peter Stibrany (Deep Space Industries)
- Lindy Elkins-Tanton (Arizona State University),
- Angel Abbad-Madrid (Colorado School of the Mines)

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Safety Zones Team

Coordinating zones of safety for active missions on the Moon and other Celestial bodies

Key Challenges

➢There is an increasing need to coordinate a ‘zone of safety’ to control traffic and protect assets from different upcoming missions and to avoid harmful interference for other missions, including potential impacts on designated lunar heritage sites.

➢Currently there is a lack of clarity of the technical requirements that companies need to successfully implement to protect their mission and guarantee safety in the proximity of others as well as the environment.

➢Widely varying environments and activities make it impossible to use a uniform system for determining safety zones.

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Key Recommendations

The following principles have been developed to govern establishing and maintaining safety zones for the extraction of extraterrestrial resources on the Moon, asteroids, or any other celestial body.

Principles

1. Safety zones should be established, maintained, and terminated in a manner that protects public and private personnel, equipment, and operations from harmful interference.
2. Safety zones will be established, maintained, and terminated in a manner that fully complies with the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.
3. Safety zones should be established by determining the area in which nominal operations of the relevant activity or an anomalous event could reasonably cause harmful interference with other parties' personnel, equipment, or operations.
    1. The size and scope of a safety zone will take into account the environment of the relevant celestial body and the nature of the operations being conducted.
    2. The size and scope of the safety zone will be made in a reasonable manner leveraging commonly accepted scientific and engineering principles.
    3. If the nature of the operation on a celestial body changes, the size and scope of a safety zone will be altered accordingly and may be terminated when the operation ceases.
4. The entity establishing, maintaining, or terminating a safety zone shall be able to publicly provide the basis for the zone to the extent practicable without violating national export control laws or the confidentiality of commercial information and/or intellectual property.
5. Safety zones shall be utilized in a manner that encourages the robust, safe, and efficient extraction and utilization of space resources.

BACK-UP CHARTS

The Building Blocks

1. Objectives	2. Definition of key terms	3. Scope	4. Principles	5. International responsibility for space resource activities
6. Jurisdiction and control over space-made products used in space resource activities	7. Access to space resources	8. Utilization of space resources	9. Due regard for corresponding interests of all countries and humankind	10. Avoidance and mitigation of potentially harmful impacts resulting from space resource activities
11. Technical standards for, prior review of, and safety zones around space resource activities	12. Monitoring and redressing harmful impacts resulting from space resource activities	13. Sharing of benefits arising out of the utilization of space resources	14. Registration and sharing of information	15. Provision of assistance in case of distress
16. Liability in case of damage resulting from space resource activities	17. Visits relating to space resource activities	18. Institutional arrangements	19. Settlement of disputes	20. Monitoring and review

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Definition of key terms

- Space resource: abiotic, in situ, mineral/volatile material
- Space resource activity: search/recovery, extraction, procedure
- Space-made product: wholly/partially from space resources
- Operator: governments, international/non-governmental entities conducting space resource activities

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Access to and rights over resources

- Attribution of priority rights for search/recovery over specific area and for limited period
- Registration and recognition of priority rights
- Acquisition of rights over resources and products

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Safety measures

- Safety review prior to authorization
- Safety zones or other area-based measures
  - Equipment, procedure, process safety assessment
  - Conformity assessment
  - standardisation
- For limited area and duration
- Overlap of safety zones – access restriction

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Impact of space resource activities

- Impacts:
  - Damage to person/environment/property
  - Adverse changes to Earth's environment
  - Harmful contamination of space/celestial bodies
  - Harmful interference with ongoing activities
  - Debris/planetary protection
  - Natural/cultural/scientific sites
- Avoidance & mitigation of harmful impact
- Monitoring & redress of harmful impact
  - Response measures
  - Adaptive management

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Sharing of benefits

- Enable, facilitate, promote, foster benefit-sharing
- Capacity building
- Access to and exchange of information & expertise
- Joint Ventures
- Non-mandatory monetary sharing
- Encourage operators to share benefits

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Adaptive governance

- Evolutionary framework
- Adaptation to changing circumstances
- Contemporary technology and practices
- Regulation at the appropriate time
- Review of the framework
- Adjustment/termination of space resource activity

Thank you!
Questions?