Session 6: Working Party 7B Overview

(https://www.itu.int/en/ITU-R/study-groups/rsg7/rwp7b/Pages/default.aspx)

Speaker: Cathy Sham, Chair ITU-R Working Party 7B

Seminar on Science Services in preparation for WRC-27

9-10 December 2025
MCMC Centre of Excellence,
Cyberjaya, Selangor, Malaysia

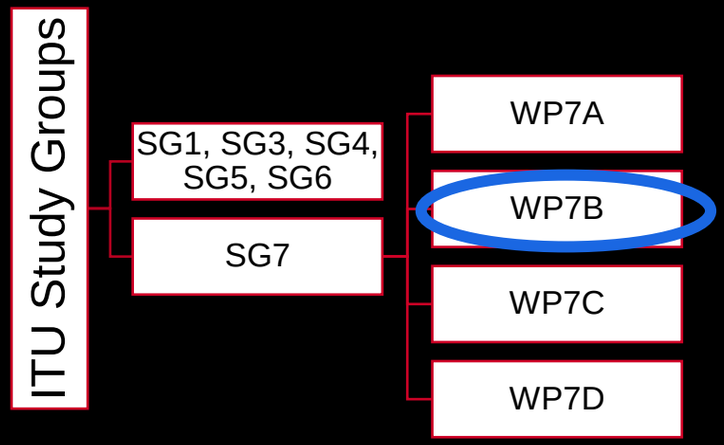
SCIENCE SERVICES IN PREP FOR WRC-27

Space Research Service (SRS)

Working Party 7B

Responsibilities & Scope

- WP 7B is responsible for the transmission and reception of telecommand, tracking and telemetry data for space operation, space research, Earth exploration-satellite, meteorological satellite services.
- Also includes links for crewed and uncrewed spacecraft, communication links between planetary bodies and the use of data relay satellites.
- Remote sensing missions, using allocations such as EESS (active), EESS (passive), SRS (active), SRS (passive), and radio astronomy observation missions may also utilize SRS for command, space telemetry and mission telemetry.



Chair: Ms. Cathy Sham

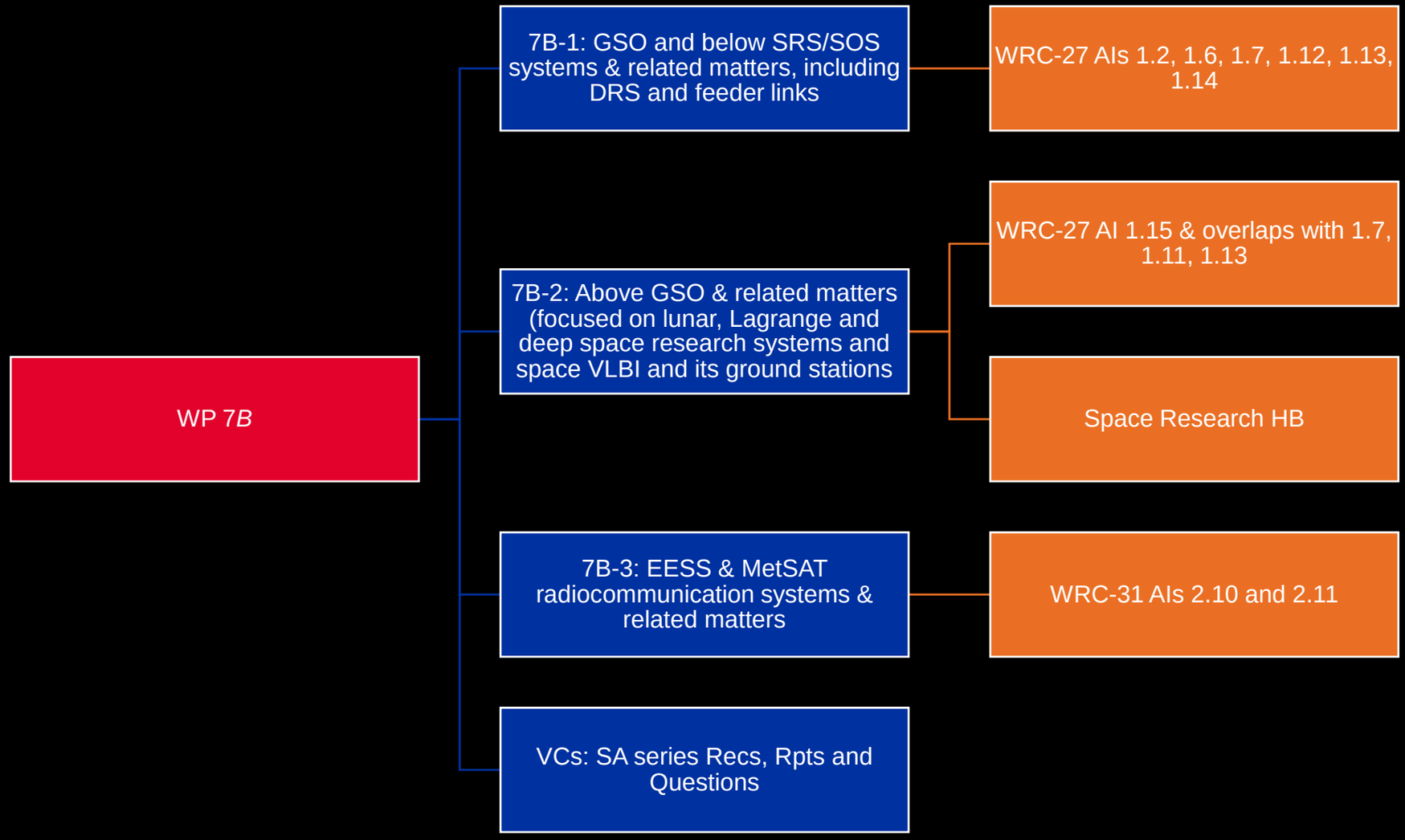
Vice-Chair:
Mr. Anton Stepanov

VC & Working Group 7B-1:
Mr. Ted Berman

VC & Working Group 7B-2:
Mr. Kevin Knights

Working Group 7B-3:
Mr. Philippe Tristant

Working Party 7B Structure & Working Group Terms of Reference (2024-2027 Study Cycle)

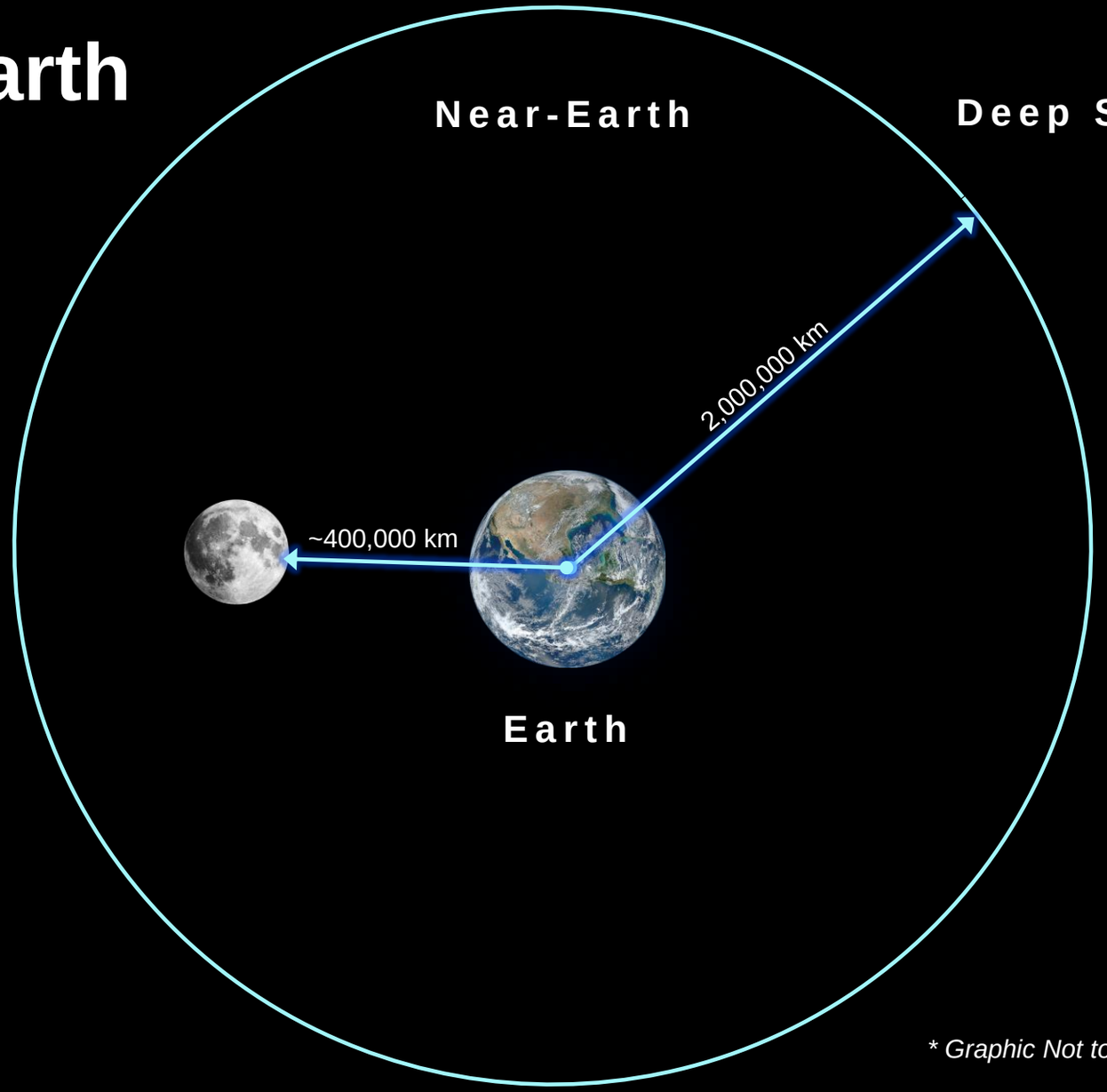


ITU RRs Article 1 Terminologies

- *1.3* *telecommunication:* Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems (CS).
- *1.6* *radiocommunication: Telecommunication* by means of *radio waves*
- *1.8* *space radiocommunications:* Any *radiocommunication* involving the use of one or more *space stations* or the use of one or more *reflecting satellites* or other objects in space.
- *1.13* *radio astronomy:* Astronomy based on the reception of *radio waves* of cosmic origin.
- *1.22* *inter-satellite service:* A *radiocommunication service* providing links between artificial *satellites.*
- *1.23* ***Space Operation Service****:* A *radiocommunication service* concerned exclusively with the operation of *spacecraft,* in particular *space tracking, space telemetry* and *space telecommand. These functions will normally be provided within the service* in which the *space station* is operating.
- *1.51* ***Earth Exploration Satellite Service****:* A *radiocommunication service* between *earth stations* and one or more *space stations*, which may include links between *space stations*, in which:
  - Information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from *active sensors* or *passive sensors* on Earth *satellites*;
  - Similar information is collected from airborne or Earth-based platforms;
  - Such information may be distributed to *earth stations* within the system concerned;
  - Platform interrogation may be included. This service may also include feeder links necessary for its operation.
- *1.52* ***Meteorological Satellite Service****:* An *earth exploration-satellite service* for meteorological purposes.
- *1.55* ***Space Research Service****:* A *radiocommunication service* in which *spacecraft* or other objects in space are used for scientific or technological research purposes.
- *1.61* *station* (Each station shall be classified by the service in which it operates permanently or temporarily)
- *1.63* *earth station:* A station located either on the Earth's surface or within the major portion of the Earth's Atmosphere and intended for communication: with one or more space stations; or with one or more stations of the same kind by means of one or more reflection satellites or other objects in space.
- 1.64 ***space station***: A *station* located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere.

Deep Space vs Near Earth

- Deep space - Space at distances from the Earth equal to, or greater than, 2×10^6 km.
- Lunar missions share the same spectrum allocations as Earth-orbiting and Lagrange point (e.g. L1, L2, etc.) missions
- The Moon is in the near-Earth distance, as defined in the Radio Regulations - sharing frequencies with other Earth orbiting, Geosynchronous orbit, Lagrange point satellites.



** Graphic Not to Scale*

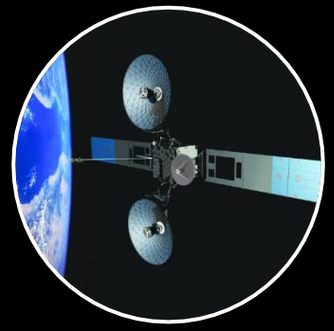
Handbook on Space Research Communication

(Updates in work, 7B/192 Annex 12)

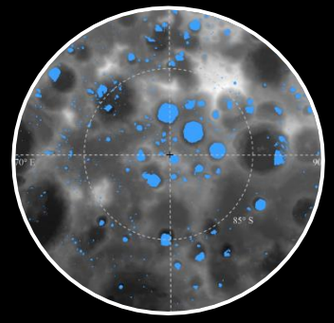
RR No. 1.55 Space Research Service:
A radiocommunication service where spacecraft or other objects in space are used **for scientific or technological research purposes**

- Mission telemetry link is the conduit for scientific and engineering data collected by the spacecraft during experimentation, active & passive sensing, probes, payloads/instrumentation. This link can also transmit audio and video.
- Spacecraft telemetry link carries condition of the spacecraft systems for health monitoring including caution & warning.
- Command link provides guidance and control, management of onboard functions and system updates.

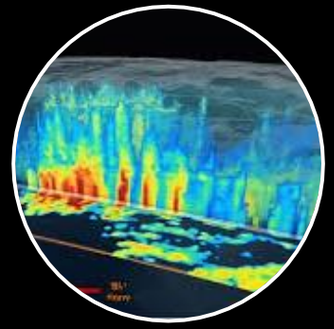
EXAMPLE SRS LINK APPLICATIONS



In-orbit laboratory, e.g. the International Space Station - Earth-to-space, space-to-Earth links, or space-to-space links -- Communications links enable the transmission of science data, tracking and commands



Active Remote Sensing – Synthetic Aperture Radars (SAR) enable the search for sub-surface water ice deposits on the Moon



Passive Remote Sensing -- Microwave imaging enables measurement of global precipitation patterns

SA-series Protection Criteria

Recommendation #	Title
SA.363	Space operation systems
SA.514	Interference criteria for command and data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services
SA.609	Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites
SA.1026	Aggregate interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit
SA.1027	Sharing criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit
SA.1154	Provisions to protect the space research (SR), space operations (SO) and Earth exploration-satellite services (EESS) and to facilitate sharing with the mobile service in the 2 025-2 110 MHz and 2 200-2 290 MHz bands
SA.1155	Protection criteria related to the operation of data relay satellite systems
SA.1157	Protection criteria for deep-space research
SA.1163	Aggregate interference criteria for service links in data collection systems for GSO satellites in the Earth exploration-satellite and meteorological-satellite services
SA.1396	Protection criteria for the space research service in the 37-38 and 40-40.5 GHz bands
SA.2044	Protection criteria for non-GSO data collection platforms in the band 401-403 MHz
SA.2078	Protection of SRS earth stations from mobile (aircraft) stations in the 2 200-2 290 MHz band

SA	Space applications and meteorology

7B/192 Annex 11: On-going review of Recommendations under the purview of WP 7B

RELEVANT RECOMMENDATIONS, REPORTS AND QUESTIONS:

- SA series of ITU-R recommendations (link)
- SA series ITU-R Reports (link)
- ITU-R Questions assigned to WP7B (link)

SCIENCE SERVICES IN PREP FOR WRC-27

Moon Spectrum

Why Explore Space?

Diverse Employment Across Sectors:

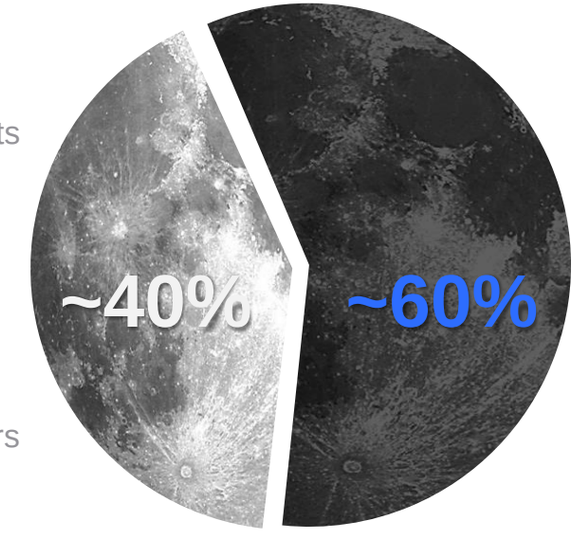
Recent Job Numbers from the North American Space Economy

College Degree

- Info Security Analysts
- Logisticians

STEM:

- Scientists (Environmental, Space, etc.)
- Aerospace Engineers
- Information Security Analysts



Non-Degree

- Industrial Machinery Mechanics
- HVAC – Postsecondary Award or Associate's

non-STEM:

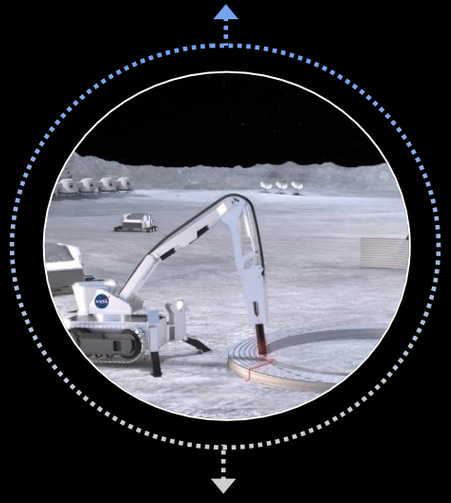
- Administration
- Legal
- Finance

Data sources: U.S. in 2023 https://blog.dol.gov/2024/04/05/find-your-place-in-space; Canada in 2022: https://www.asc-csa.gc.ca/eng/publications/2023-state-canadian-space-sector.asp#workforce

Why Conduct Science at the Moon?

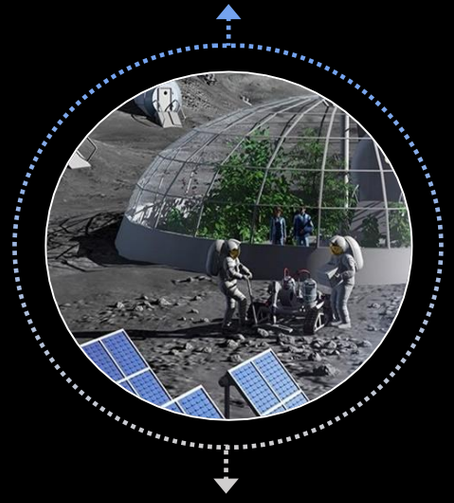
Earthly Benefits from Space Investment

Rapid Construction in Remote, Arid Environments



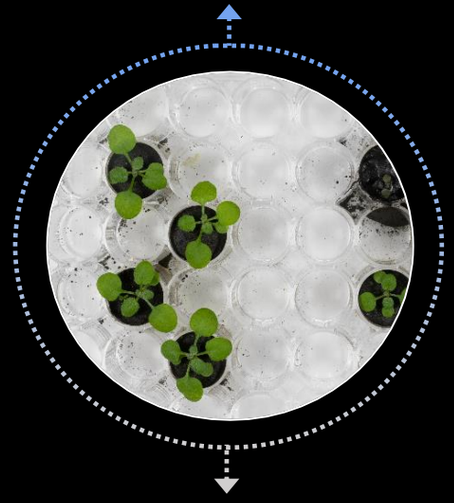
Additive Manufacturing with Regolith

Rapidly Deployable & Reliable Power for Disaster-Struck Locales



Lunar Solar Power

Resilient, Sustainable Food Production



Lunar Agriculture Experiments

3D printable waterless concrete

Eliminating toxins in water, soil and air without emitting CO2 or heat

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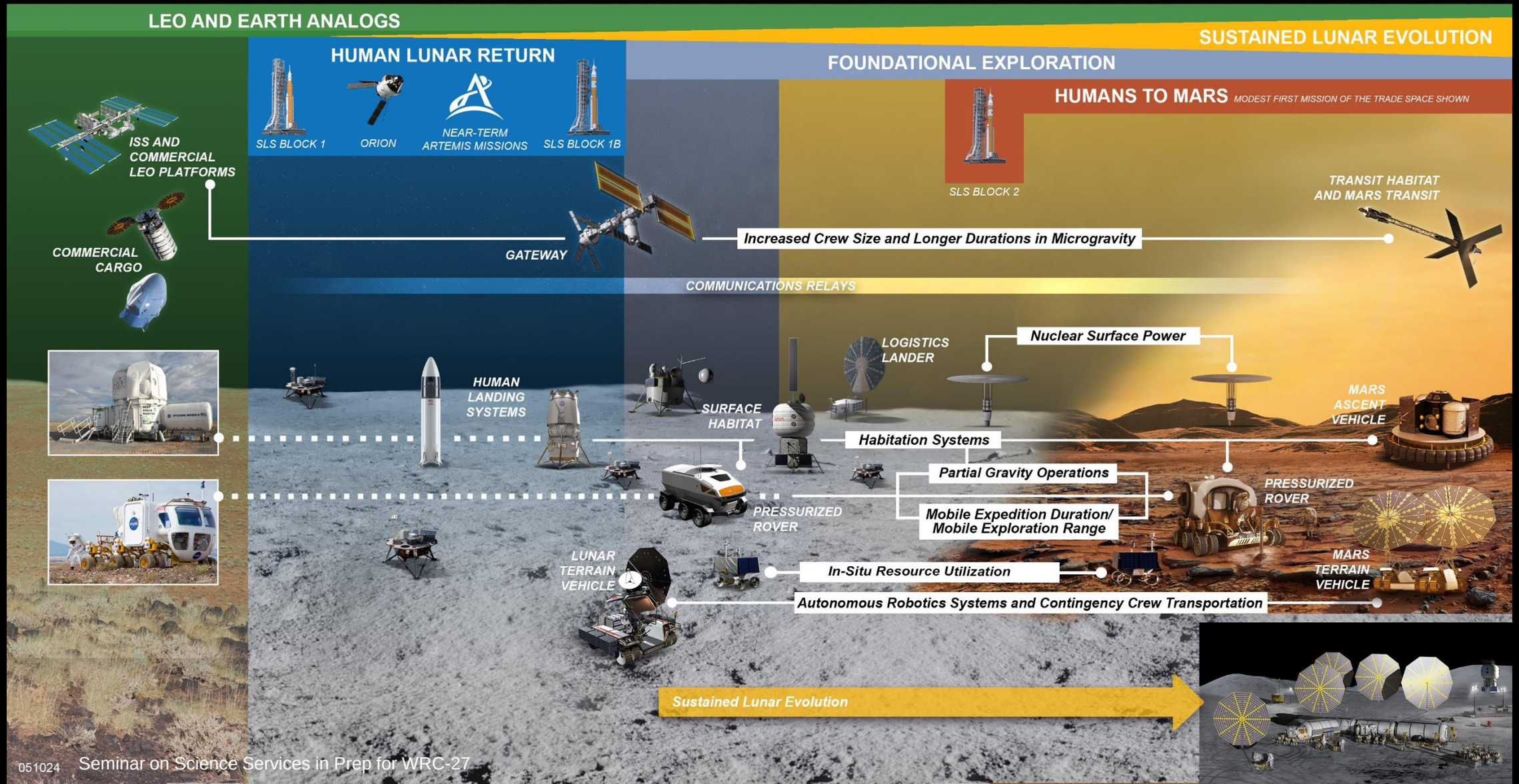
Moon to Mars Campaign Segments



Lunar Spectrum Planning: ITU-R Background

WRC-2023: Report of the Director on the activities of the Radiocommunication Sector, 3.1.9.2

“The Bureau has received enquiries from administrations and operators about the appropriate radiocommunication service to use for stations orbiting or operating on the surface of the Moon.”

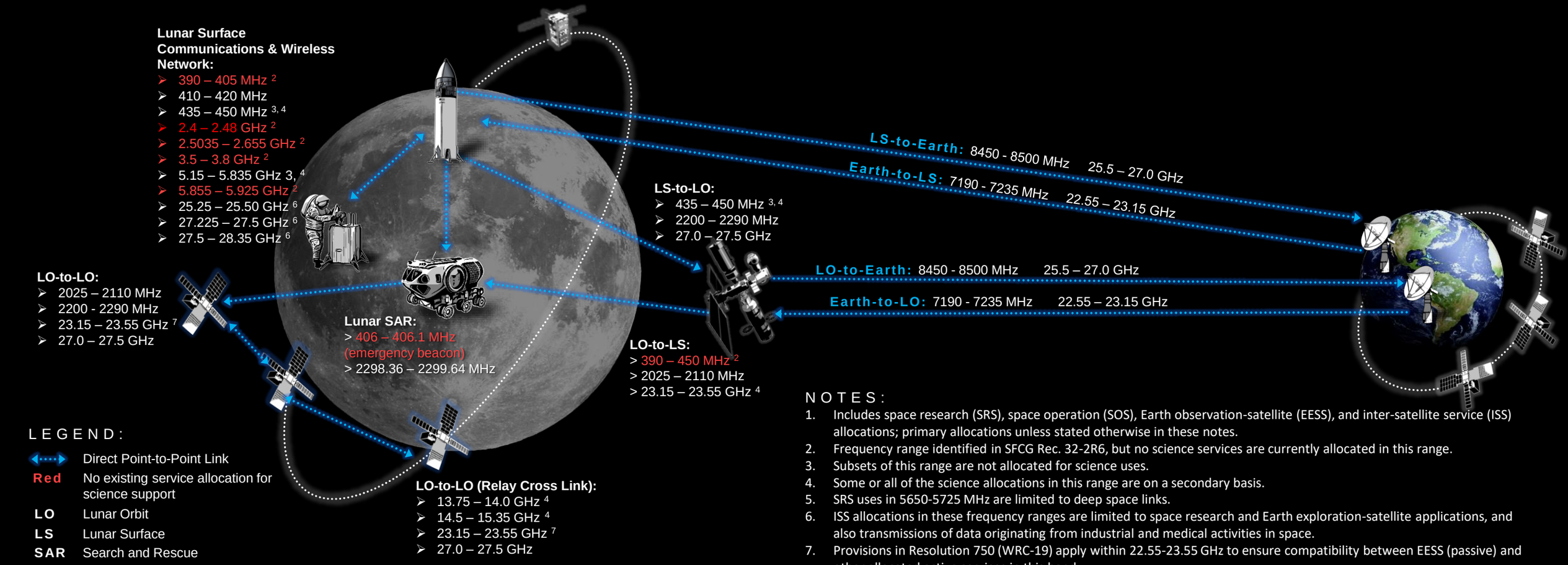
- Utilization of radiocommunication services as defined in Article 5 of the ITU Radio Regulations (RRs) affords systems in the ITU Master International Register (MFIR) protection from harmful interference as provisioned in the Radio Regulations.

Summary:

“The Bureau has advised that such use of radiocommunication service should make use of only the allocation for space research services or the space operation service (if it is for the operation of the spacecraft.)”

Spectrum Needs for Lunar Science and Research [1]

- To minimize impacts to other allocated uses on and around Earth, current lunar spectrum architectures leverage existing allocations and strive for effective and efficient spectrum use by identifying:
  - SRS allocations in S-band, plus ISS allocations in Ka-band for lunar in-situ links
  - SRS allocations in X- and Ka-bands for Direct with Earth links.
- Identified additional needs for local comm and navigation needs to enable greater scientific returns and mission success/ROI



LEGEND:

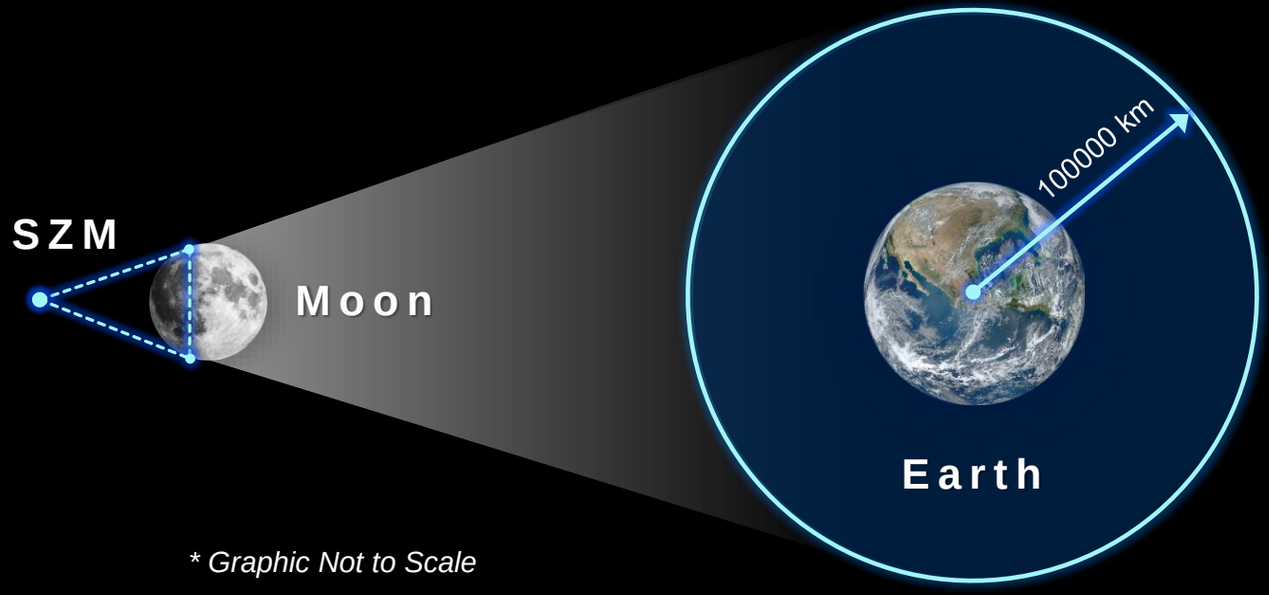
◂····▸	Direct Point-to-Point Link
Red	No existing service allocation for science support
LO	Lunar Orbit
LS	Lunar Surface
SAR	Search and Rescue

NOTES:

1. Includes space research (SRS), space operation (SOS), Earth observation-satellite (EESS), and inter-satellite service (ISS) allocations; primary allocations unless stated otherwise in these notes.
2. Frequency range identified in SFCG Rec. 32-2R6, but no science services are currently allocated in this range.
3. Subsets of this range are not allocated for science uses.
4. Some or all of the science allocations in this range are on a secondary basis.
5. SRS uses in 5650-5725 MHz are limited to deep space links.
6. ISS allocations in these frequency ranges are limited to space research and Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space.
7. Provisions in Resolution 750 (WRC-19) apply within 22.55-23.55 GHz to ensure compatibility between EESS (passive) and other allocated active services in this band.

Enabling Unique Science from the Moon

22.22.1 The shielded zone of the Moon comprises the area of the Moon's surface and an adjacent volume of space which are shielded from emissions originating within a distance of 100 000 km from the centre of the Earth.



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Shielded **Z**one of the **M**oon (SZM) is an ideal physical location from which to conduct radio astronomy observations of celestial objects and phenomena not detectable by Earth-based radio astronomy systems and other passive observations.

ITU Radio Regulations Article 22 Section V

- prohibits emissions that cause harmful interference (as agreed between relevant administrations) to radio astronomy and other passive services,
- Excepted frequencies allocated to space radiocommunication services called out under RR *Nos.22.23 – 22.24.*
- protection from harmful interference (22.22.2) of radio astronomy and passive services in the SZM, is achieved through agreements between concerned administrations (No.22.25).

Article 22 Section V

22.22 § 8 1) In the shielded zone of the Moon[31] emissions causing harmful interference to radio astronomy observations[32] and to other users of passive services shall be prohibited in the entire frequency spectrum except in the following bands:

22.23 *a)* the frequency bands allocated to the space research service using active sensors;

22.24 *b)* the frequency bands allocated to the space operation service, the Earth exploration-satellite service using active sensors, and the radiolocation service using stations on spaceborne platforms, which are required for the support of space research, as well as for radiocommunications and space research transmissions within the lunar shielded zone.

22.25 2) In frequency bands in which emissions are not prohibited by RR Nos. **22.22** to **22.24**, radio astronomy observations and passive space research in the shielded zone of the Moon may be protected from harmful interference by agreement between administrations concerned.

[31] **22.22.1** The shielded zone of the Moon comprises the area of the Moon's surface and an adjacent volume of space which are shielded from emissions originating within a distance of 100 000 km from the centre of the Earth.

[32] **22.22.2** The level of harmful interference is determined by agreement between the administrations concerned, with the guidance of the relevant ITU-R Recommendations.

SCIENCE SERVICES IN PREP FOR WRC-27

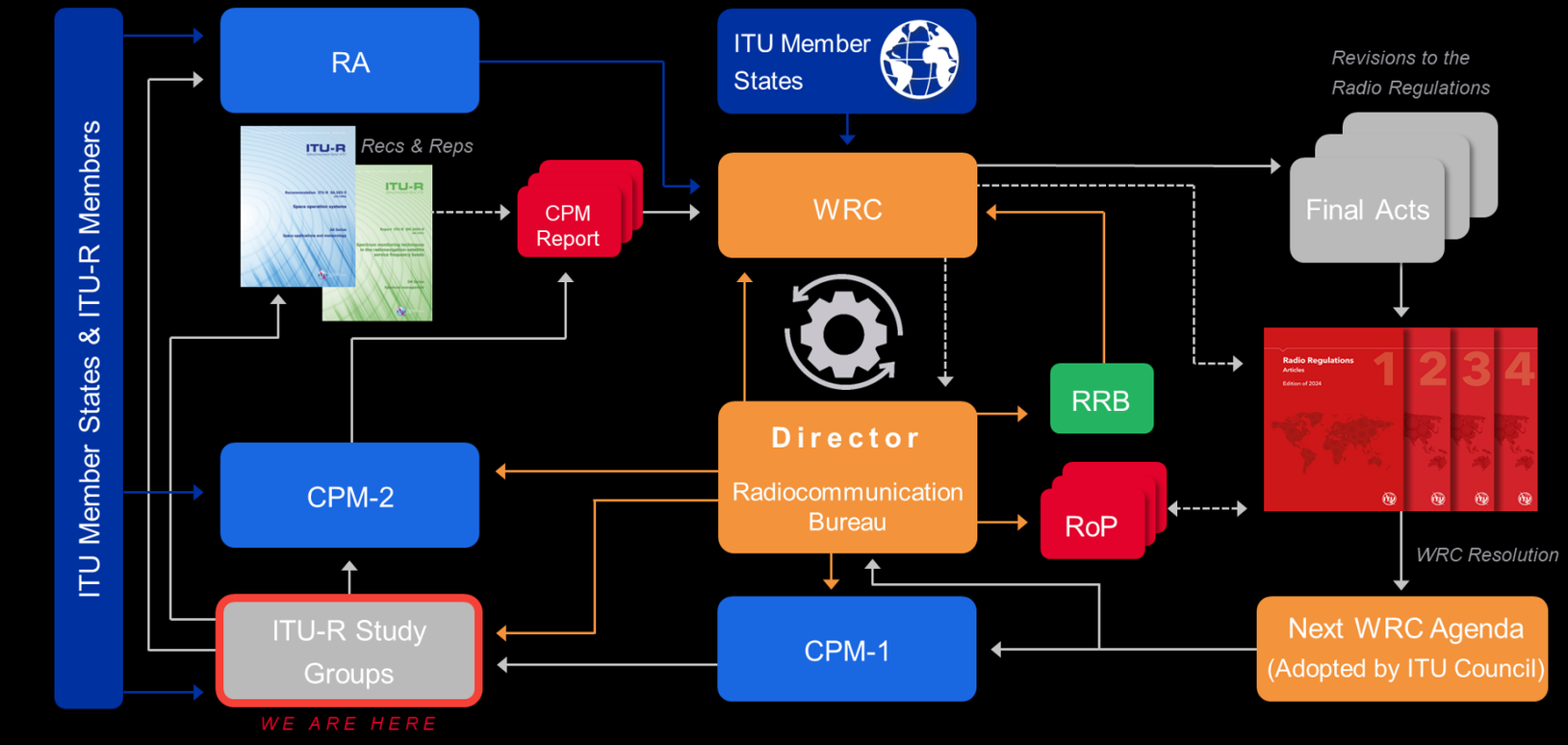
WRC-27 AI 1.15

Long Lead Process, ~ every 4-year WRC Cycle

Background and History

- Founded in 1865 to harmonize and standardize cross-border telegraph networks
- Plans and manages global radio spectrum and satellite orbits, develops technical standards for seamless connectivity, and advances access to information and communications technologies through the WRC Cycle (shown at right)
- 194 member countries and over 1000 organizations are committed to international cooperation to sustainably close the digital divide

The ~4-year World Radiocommunication Conference (WRC) Cycle



RA = Radio Assembly; Rec. = Recommendations; Rep. = Reports; CPM = Conference Preparatory Meeting; RoP = Rules of Procedure; RRB = Radio Regulations Board; WRC = World Radiocommunication Conference

AI 1.15, RES 680 (WRC-23)

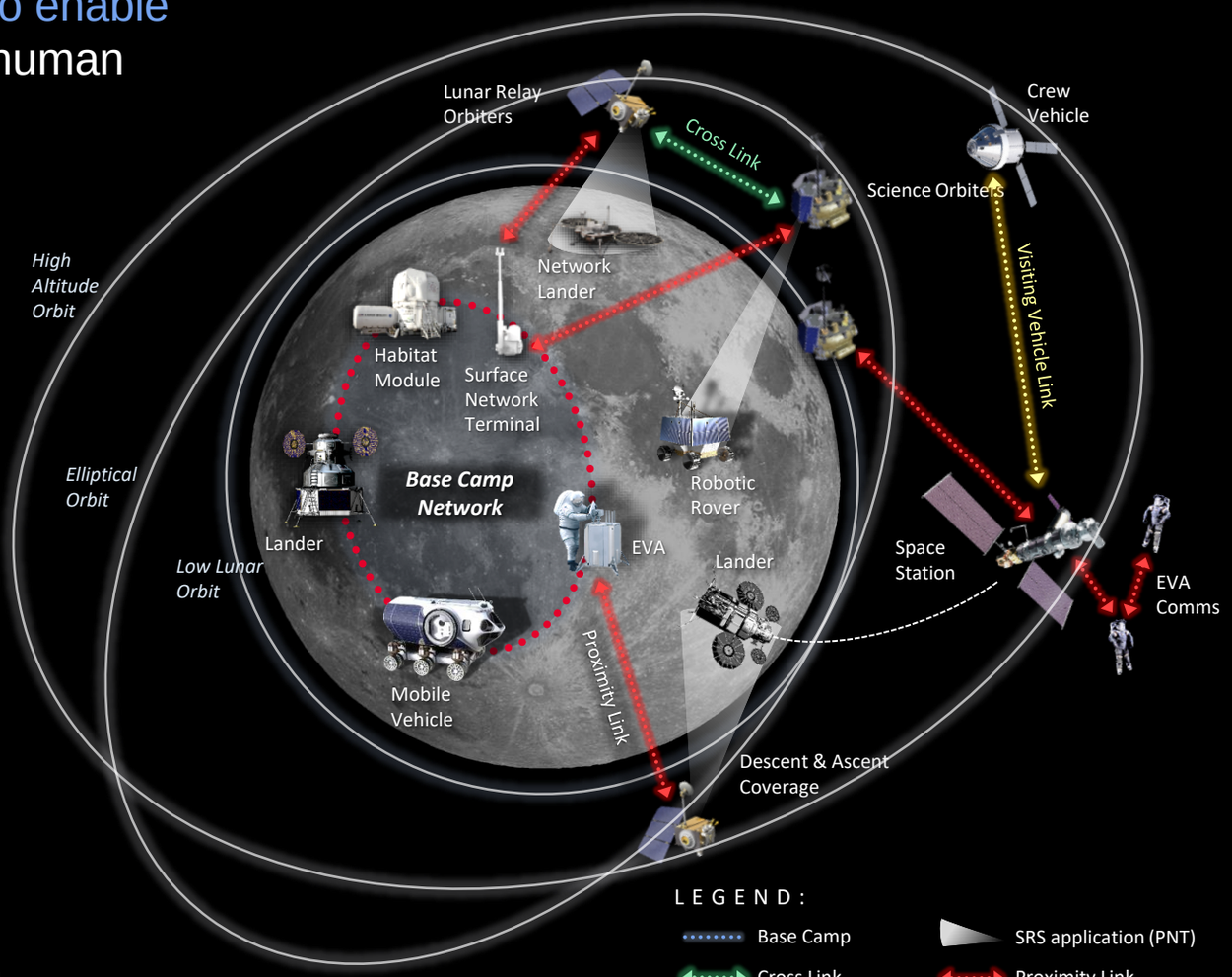
- Frequency gaps were identified (CITEL IAP to WRC-23) and now under study for a WRC-27 decision (Agenda Item 1.15) to enable near term scientific lunar exploration -- both robotic and human missions on and around the Moon.

"consider … possible new or modified space research service (space-to-space) allocations, for future development of communications on the lunar service and between lunar orbit and the lunar surface…"

- 390-406.1 MHz, 420-430 MHz and 440-450 MHz, limited to outside the Shielded Zone of the Moon (SZM)
- 2 400-2 690 MHz, 3 500-3 800 MHz, 5 150-5 570 MHz, 5 570-5 725 MHz, 5 775-5 925 MHz, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz;

Enables development of future space applications operation in recognized and protected spectrum, without causing harmful interference to incumbent services, and in accordance with the RRs.

This approach further leveraging advance wireless technologies for space applications, strengthening global technology bases, expanding involvement in space industry beyond traditional administrations.



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AI 1.15 Status

(at the conclusion of Sept 2025 WP 7B Meeting)

- Sharing studies identified under RES 680 (WRC-23) have mostly been completed, pending characteristics for certain incumbent services.
  - Propagation models from SG3 implemented
  - Studies utilized chars & protection criteria provided by contributing WPs
  - Article 22 section V provision taken into account

  Summary of WP 7B Studies Status as of Fall 2025 meeting
- Sent Liaison Statements to WPs 4A, 4C, 5B, and 5C for relevant information to support 1.15 studies with incumbent services.
- Draft CPM text for AI 1.15 initiated in sections 1, 2, 3.

  Ref. material: Annex 2 of Working Party 7B Chair's Report (Sept 2025) [TIES account required]
- Overlaps between AI 1.7, 1.11, 1.13 and AI 1.15
  - Studies utilized characteristics and protection criteria from the responsible Working Parties 5D and 4C, and lunar SRS systems in Report ITU-R SA.2553, concluded with margins above protection criteria and indicating no concern for exceedance and sharing is feasible.
  - WPs 4C, 5D and WP 7B agreed that AIs 1.7, 1.11, 1.13 and 1.15 can be studied independently based on study results and liaison activities (see Contributions to WP7B (including liaison statements between WP 4C & WP 5D) [TIES account required).

WRC-27 Agenda Item 1.15: Next Steps

- **March 2026 WP 7B meeting:**
  - Finalize study results & sharing report
  - Update draft CPM texts based on study results and proposed methods
- **September 2026 WP 7B meeting:**
  - Finalize sharing studies and update sharing report
  - Finalize draft CPM texts for submission to the CPM Steering Committee (deadline: 23 October 2026)

Ref. material: Working Party 7B Chair's Report (Sept 2025) [TIES account required]

• Work Plan* for WRC-27 Agenda Item 1.15 (2025-2026 Timeframe)

2025	
3RD WP 7B meeting (17-27 March 2025)	– Finalize collection of propagation models and technical characteristics from contributing groups and update WD towards PDN Report ITU-R SA.[LUNAR 1.15 STUDIES] based on input contributions; – Finalize PDN Report ITU-R SA.[LUNAR.SRS STATIONS CHAR] and submit to Study Group (SG) 7 for consideration; – Send liaison statement to contributing groups as necessary; – Initiate development of draft CPM text for WRC-27 agenda item 1.15 based on input contributions associated with the studies referred to in *resolves to invite the ITU-R to complete in time for the 2027 World Radiocommunication Conference* 1 to 5; – Review and update work plan as necessary.
4TH WP 7B meeting (16 – 24 Sept 2025)	– Update PDN Report ITU-R SA.[LUNAR 1.15 STUDIES], based on input contributions; – Update draft CPM text for WRC-27 agenda item 1.15 based on input contributions; – Send liaison statement to contributing groups as necessary; – Initiate studies referred to in Resolution **680 (WRC-23)** *invites the ITU-R* 1 and 2 (WD towards PDN Report ITU-R SA.[FUTURE LUNAR COMMUNICATION AND SYSTEMS STUDY) – Review and update work plan as necessary.

2026	
5TH WP 7B meeting ([March 2026])	– Continue to work on PDN Report ITU-R SA.[LUNAR 1.15 STUDIES] based on input contributions; – Continue to work on the draft CPM text for WRC-27 agenda item 1.15 based on the results of studies[1]; – Continue to work on WD towards PDN Report ITU-R SA.[FUTURE LUNAR COMMUNICATION AND SYSTEMS STUDY] in accordance with Resolution **680 (WRC-23)** *invites the ITU-R* 1 and 2; – Send liaison statement to contributing groups as necessary; – Review and update work plan as necessary. [1] Final CPM text due date is 23 October 2026 as per Addendum 1 to Administrative Circular CA/270
6TH WP 7B meeting ([September 2026])	– Finalize PDN/DN Report ITU-R SA.[LUNAR 1.15 STUDIES] for SG 7 consideration[1]; – Finalize the draft CPM text for WRC-27 agenda item 1.15 for submission to the CPM[2]; – Continue work on studies referred to in Resolution **680 (WRC-23)** *invites the ITU-R* 1 and 2 and progress WD towards a PDN Report ITU-R SA.[FUTURE LUNAR COMMUNICATION AND SYSTEMS STUDY]; – Send liaison statement to contributing groups as necessary; – Review and update work plan as necessary. [1] Draft new sharing Report completion will be adjusted to account for 2026 and 2027 SG 7 meeting timing. [2] Final CPM text due date is 23 October 2026 as per Addendum 1 to Administrative Circular CA/270.

**Work plan will be reviewed at every WP meeting and updated as appropriate; link provided is 7/B/192 annex 3 (Sept 2025)*

Resolution 680 (WRC-23), *Invites 1 & 2*

- WRC-23 recognized that lunar scientific and exploration activities can advance the development of potential future space activities beyond space research and may in the future include other relevant space radiocommunication services.
- At the September 2025 WP 7B meeting, work was initiated on a WD towards a Preliminary Draft New Report SA.[FUTURE LUANR COMMUNICATION AND SYSTEMS STUDY]
  - 7B/192 Annex 4
- Interested members of WP 7B are invited to further mature the concepts of operation and define potential applications for these operation.
  - This work is for consideration by a future competent WRC.
  - Resolution ***680*** calls for an interim report in the report of the BR Director to the WRC-27.

Ref. material: Working Party 7B Chair's Report (Sept 2025) [TIES account required]

SCIENCE SERVICES IN PREP FOR WRC-27

WRC-31

Studies in support of WRC-31 AIs
(at the conclusion of Sept 2025 WP 7B Meeting)

- **Preliminary Agenda Item 2.10,** *to consider a possible new primary allocation to the Earth exploration-satellite service (Earth-to-space) in the frequency band 22.55-23.15 GHz, in accordance with Resolution* ***664 (****Rev.* ***WRC-23****)*
  - *7B/192 Annex 8, Working Document in support of possible Report ITU-R SA.[EESS UPLINKS – 23 GHz]*
- **Preliminary Agenda Item 2.11,** *to consider an upgrade of the secondary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band [37.5-40.5 GHz] or possible new worldwide frequency allocations on a primary basis to the Earth exploration-satellite service (space-to-Earth) in certain frequency bands within the frequency range [40.5-52.4 GHz], in accordance with Resolution* ***685 (WRC-23)***
  - *7B/192 Annex 7, Working Document in support of possible ITU-R SA.[EESS-DOWNLINK-37.5 to 52.4 GHz]*

Thank you!

Any Questions, please contact:

catherine.c.sham@nasa.gov