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English only

ITUEvents

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#ITUWRC

Session 9
Lunar Communications: WRC-27 Agenda Item 1.15 (Lunar communications in the space research service (SRS))

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Why Explore Space?

Diverse Employment Across Sectors:

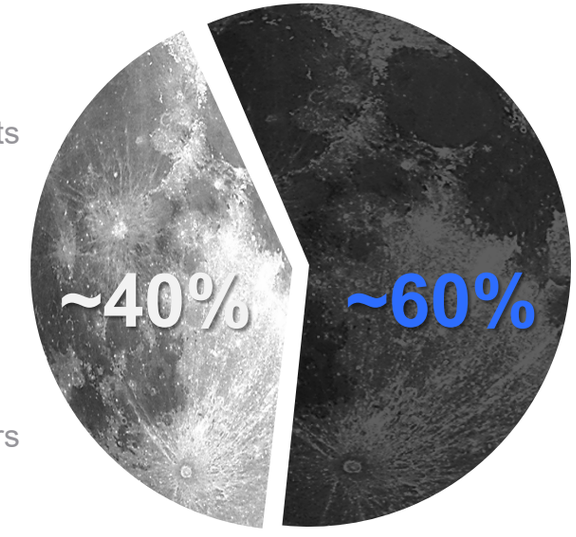
Recent Job Numbers from the North American Space Economy

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:

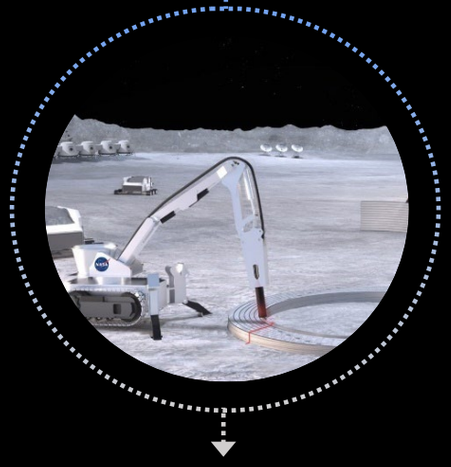
- Administration
- Legal
- Finance

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?

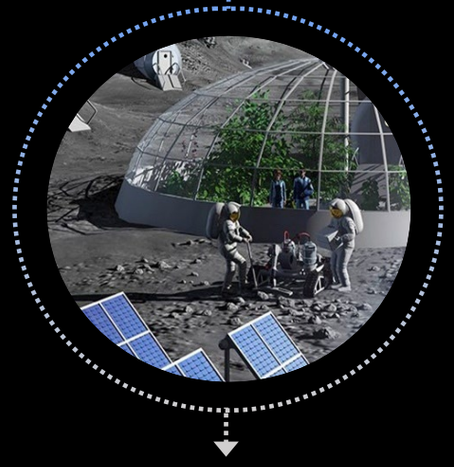
Earthly Benefits from Space Investment

Rapid Construction in Remote, Arid Environments



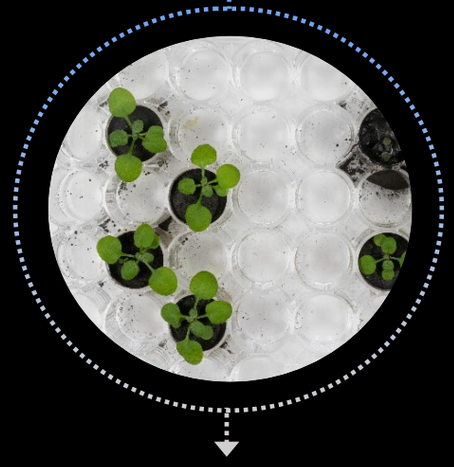
Additive Manufacturing with Regolith

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 CO_2 or heat

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."

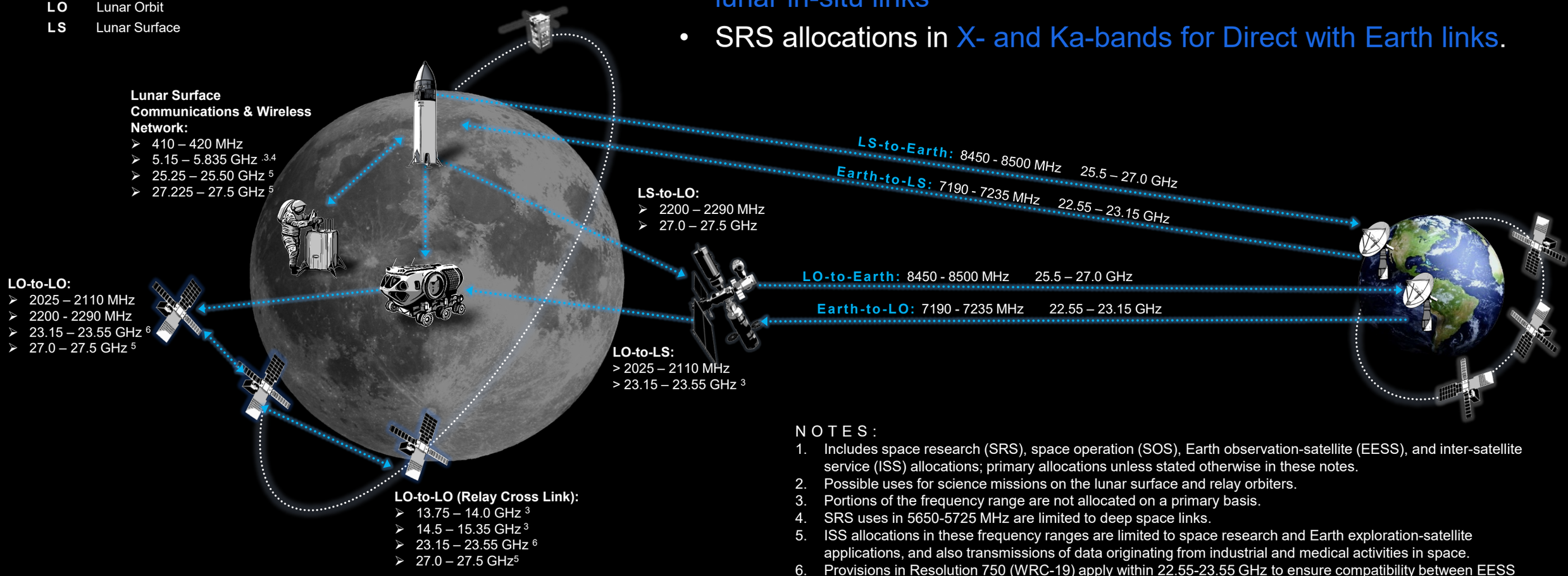
"The Bureau has advised that such use of radiocommunication service should make use of only the allocation for space research services or the space operation service (if it is for the operation of the spacecraft.)"

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.

Existing Allocations use Lunar Science and Research [1]

Effective and efficient use of existing SRS allocations:

- SRS allocations in S-band, and ISS allocations in Ka-band for lunar in-situ links
- SRS allocations in X- and Ka-bands for Direct with Earth links.

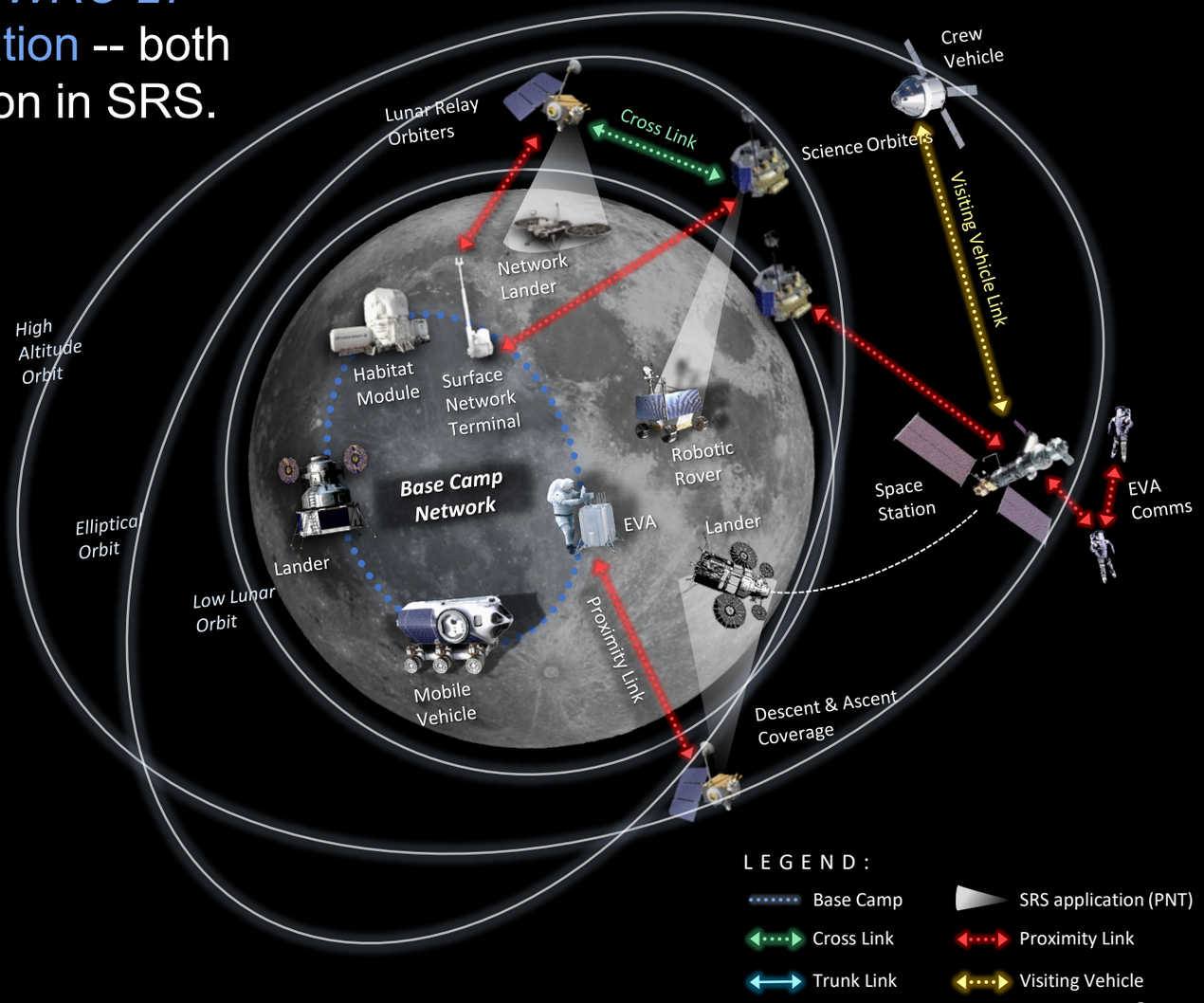


NOTES:

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. Possible uses for science missions on the lunar surface and relay orbiters.
3. Portions of the frequency range are not allocated on a primary basis.
4. SRS uses in 5650-5725 MHz are limited to deep space links.
5. 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.
6. 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.

AI 1.15, RES 680 (WRC-23)

- *Resolves to invite the ITU-R to complete in time for WRC-27* decision to enable near term scientific lunar exploration -- both robotic and human missions on and around the Moon in SRS.
  - Frequency ranges under study for possible new or modified SRS allocations include:
    - 390-406.1 MHz, 420-430 MHz, 440-450 MHz (outside 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

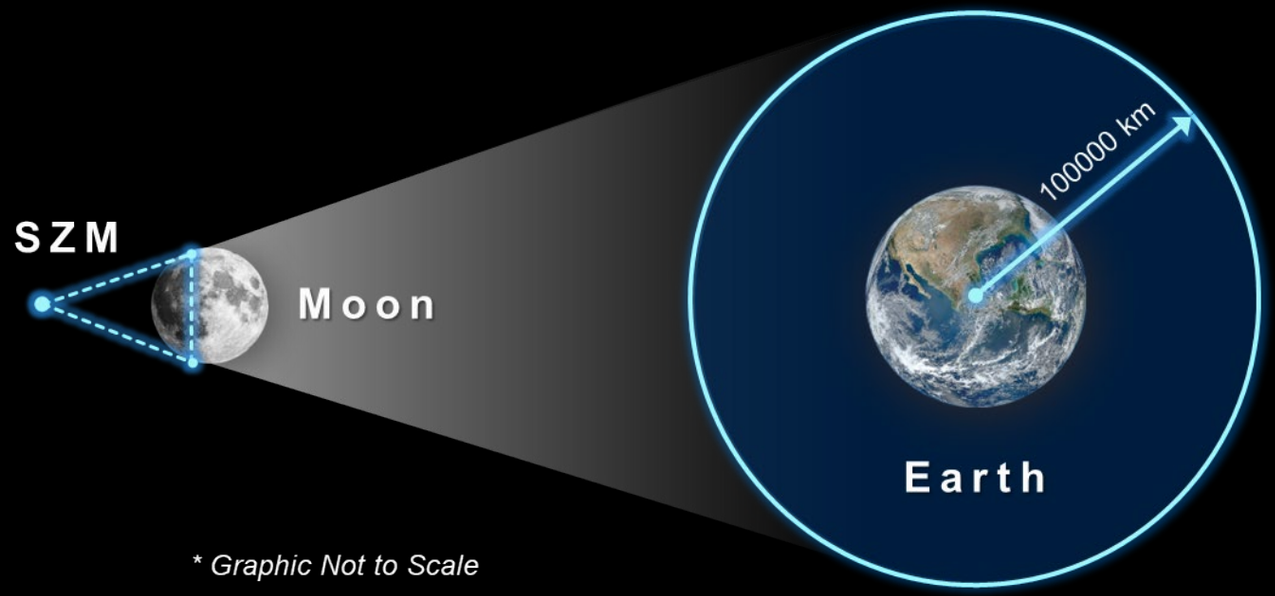


Enables development of future space applications operation in recognized and protected spectrum, without causing harmful interference to incumbent services, and in accordance with the RRs.

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

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.



** Graphic Not to Scale*

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,
- except 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.

Article 22 Section V Radio astronomy in the shielded zone of the Moon

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.

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)*

International Telecommunication Union – Radiocommunication Sector Working Party 7B

Enables both scientific and technology programs by intelligent use of the radio-frequency spectrum.

- Responsible for the **transmission** and **reception** of **telecommand, tracking and telemetry** data for space services (see definitions at right).
- Studies communication systems for use with **crewed and uncrewed spacecraft,** communication **links between planetary bodies,** the use of **data relay satellites,** and the **technical and operational characteristics of spacecraft.**
- Develops and maintains the Recommendations to enable sharing of the limited orbital and spectrum resources; these define the preferred frequency bands, bandwidths required, protection and sharing criteria for spacecraft, and orbital locations for data relay satellites, in the **SA series of Recommendations and Reports.**

Space Services Defined

- ***Space Research Service:*** *A radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes.*
- ***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.*
- ***Earth Exploration Satellite Service:*** *A radiocommunication service between earth stations and one or more space stations, which may include links between 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.*
- ***Meteorological Satellite Service:*** *An earth exploration-satellite service for meteorological purposes.*

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WRC-27 agenda item 1.15

THANK YOU!

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