Space Sustainability
International Telecommunication Union

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Presentation to EPFL, Switzerland 19 May 2025

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ITU Space Sustainability Gateway: https://www.itu.int/space-sustainability/

ITU Space Connect monthly webinars: https://www.itu.int/space-connect/

ITU Space Sustainability Annual Forums: https://www.itu.int/ssf/

ITU SpaceExplorer on data filings:
https://www.itu.int/itu-r/space/apps/public/spaceexplorer/networks-explorer

ITU training on filings: https://www.itu.int/wrs-24/

ITU Space Radio Services: https://www.itu.int/en/ITU-R/space/Pages/default.aspx

ITU-R Study Groups: https://www.itu.int/en/ITU-R/study-groups/Pages/default.aspx

Space Sustainability:

The ITU Radio Regulations remain essential and unique mechanism to control radio interference,

to ensure a stable environment and equitable sharing of global natural resources.

Radiocommunication services and applications

Terrestrial Fixed and Mobile Services

Aeronautical and Maritime Services

Space and Science Services

Broadcasting Services

Radiocommunication services and applications

1. **Space RADIO FREQUENCY SPECTRUM**

2. **From ORBITS**

Space and Science Services

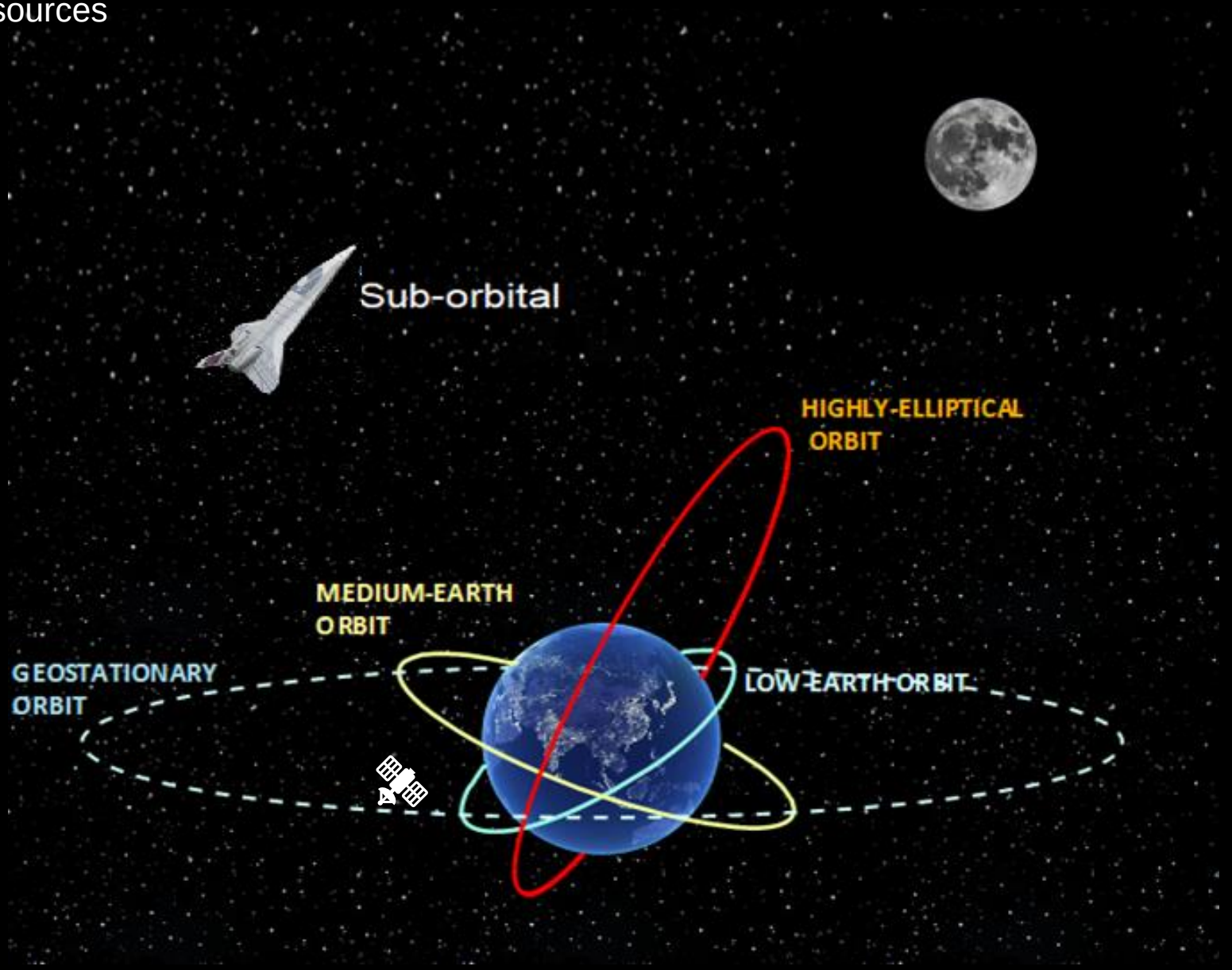
1 Space RADIO FREQUENCY SPECTRUM

1.467 to 1.492 GHz	1.518 to 1.675 GHz	1.97 to 2.69 GHz	3.4 to 7.025 GHz	10.7 to 14.5 GHz	17.3 to 30 GHz
Audio Broadcasting to fixed and mobile units	Civilian Services	Television & radio broadcasting	Television, & data services		

Applications use two limited natural resources

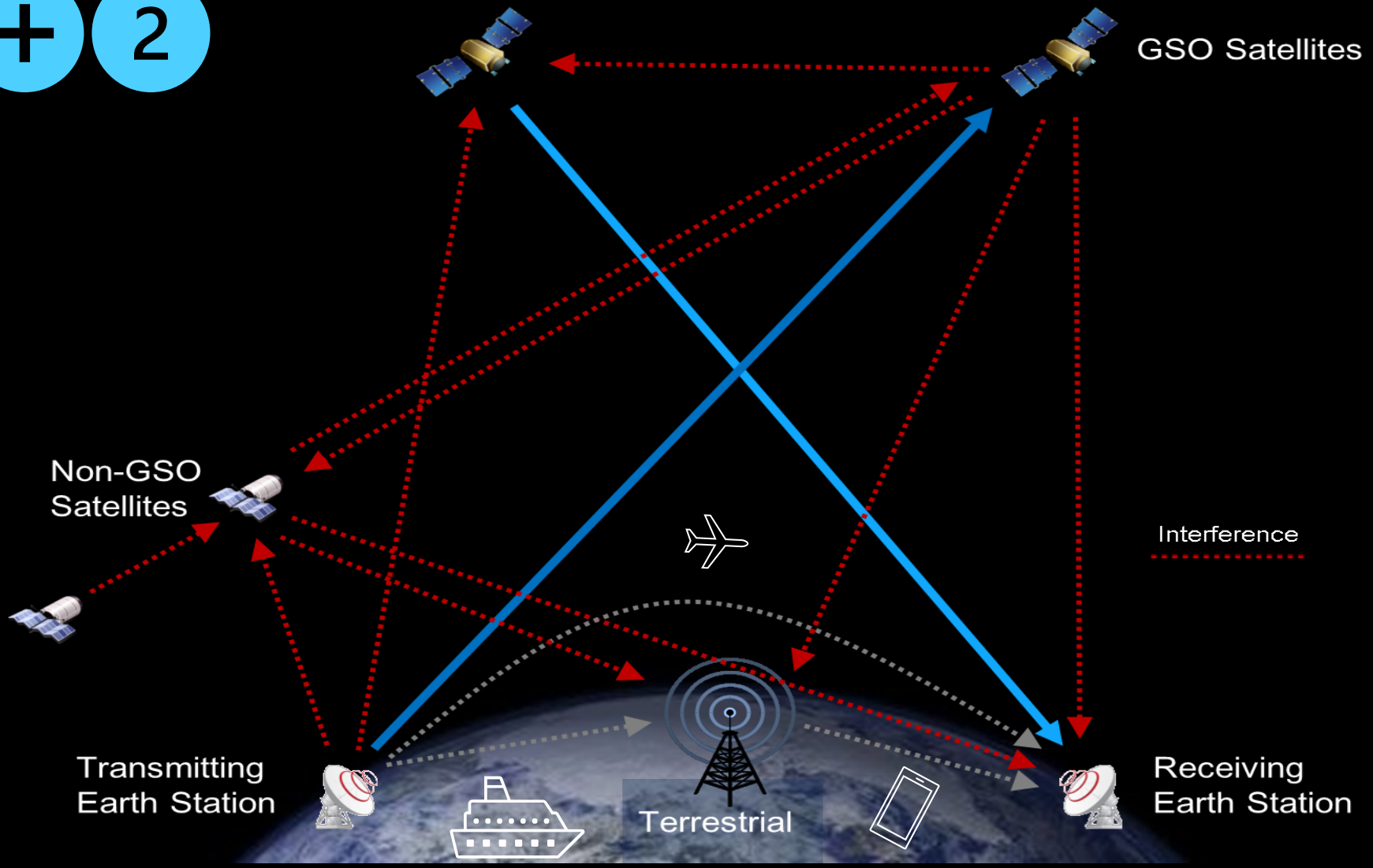
2

From ORBITS



Is space big enough for sustainable activities?

1 + 2



Is space big enough for sustainable activities?

Yes, if regulated.

We need **international binding and evolutive regulations**

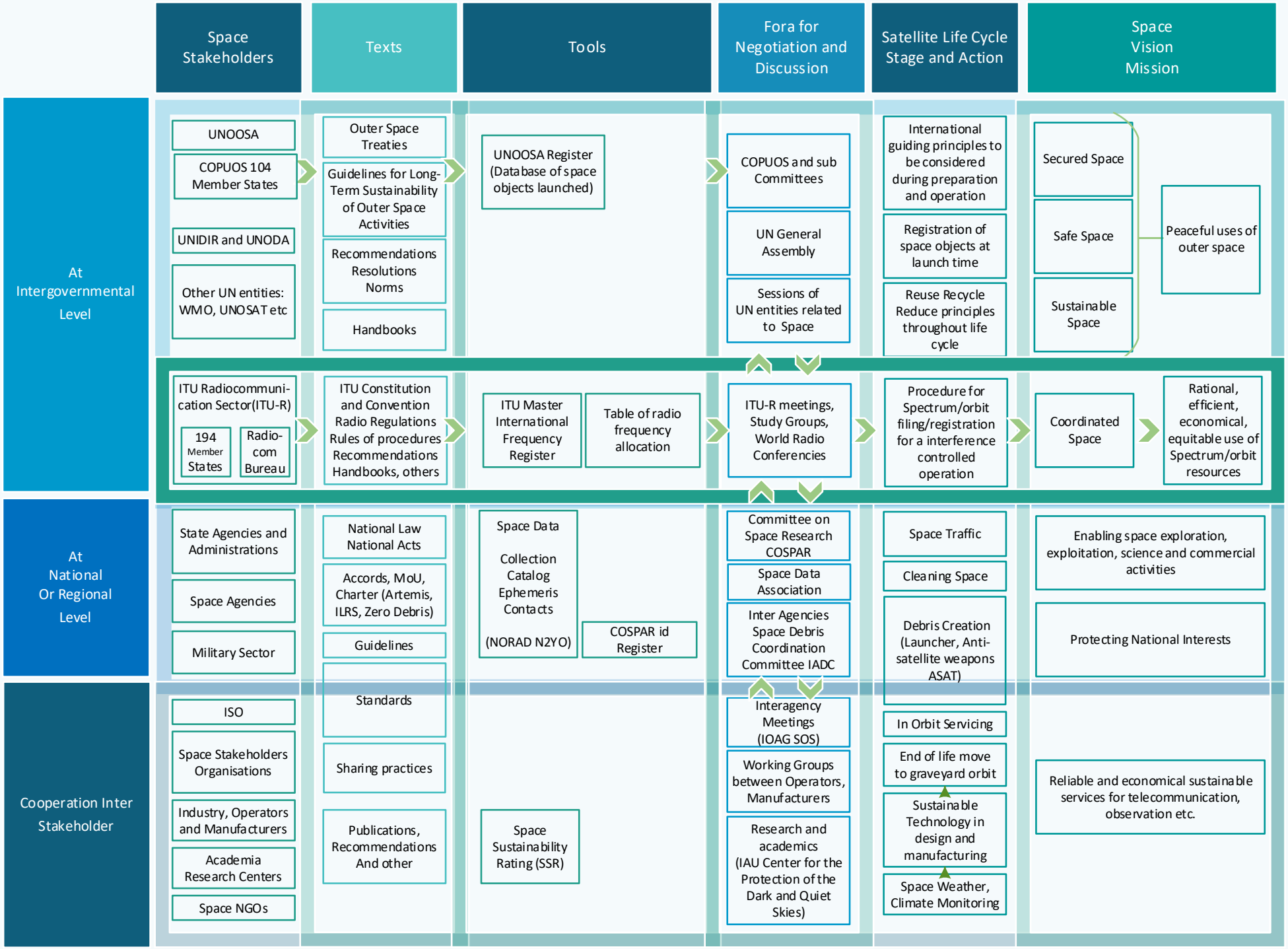
for the use of **radio frequency spectrum from orbits**

The Space Sustainability environment

By Veronique Glaude and Cessy Karina
IAC-2022

*** This is an evolutive map:**

Share your views and propose amendments!



The International Telecommunication Union (ITU)

the UN Specialized Agency for ICT

ITU-Radiocommunication Sector

Allocation of frequency bands to Radio Services

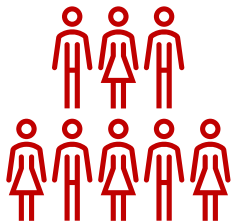
Procedures, Plans, operational measures

Elaborate and update the Radio Regulations and best practices for the regional and international use of radio spectrum and satellite orbits

ITU Instruments

Constitution, Convention, **Radio Regulations**, Rules of Procedures, Recommendations

etc



The Radiocommunication Bureau

The secretariat of the ITU-R and the Radio Regulations

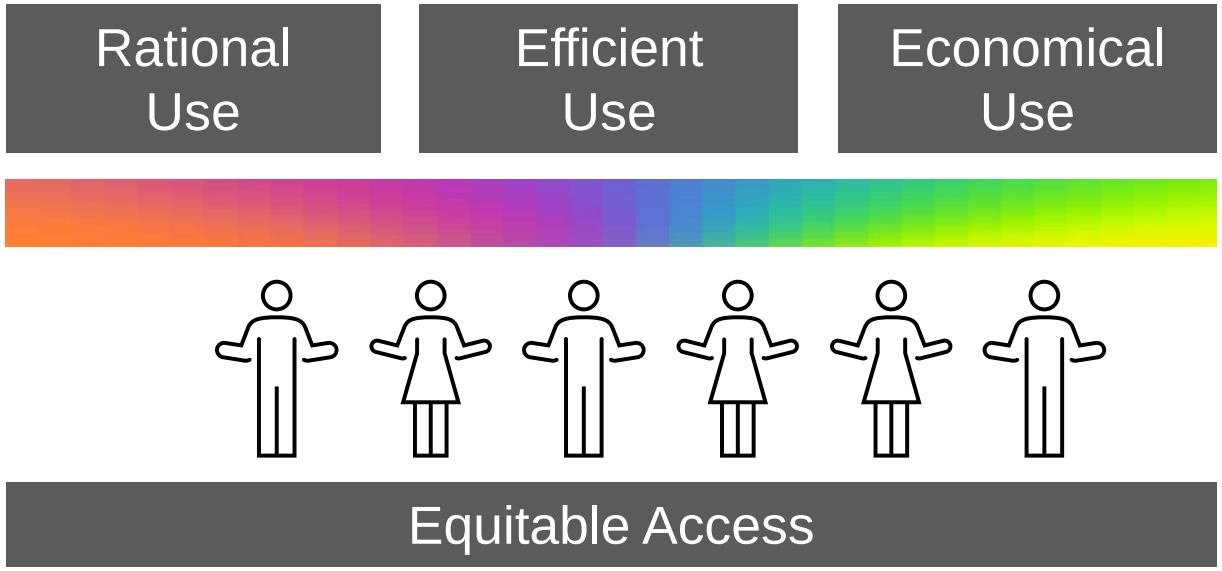
Registration of filings

Assistance and capacity building

ITU CONSTITUTION (Art.1)

*ITU shall **effect allocation of bands** of the radio-frequency spectrum, the allotment of radio frequencies and the **registration of radiofrequency assignments** and, for space services, of **any associated orbital position** in the geostationary-satellite orbit or of any associated characteristics of satellites in other orbits, in order to **avoid harmful interference** between radio stations of different countries*

ITU CONSTITUTION (Art. 44)



1 Member States shall endeavour **to limit the number of frequencies and the spectrum used to the minimum essential** to provide in a satisfactory manner the necessary services. […]

2 […and that the] limited natural resources […] must be used rationally, efficiently and economically, […] so that countries […] may have equitable access to those orbits and frequencies[…].

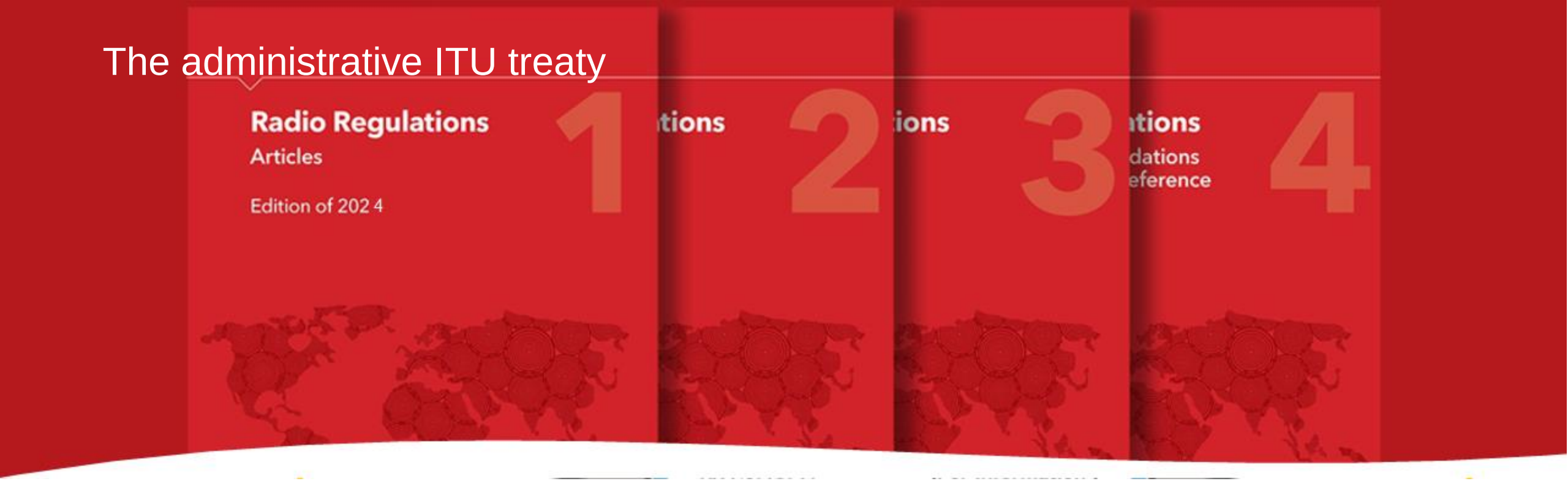
The Administrative ITU Treaty

Spectrum Regulation from 8.3kHz to 3’000GHz

and Associated Orbits
Geostationary and Non-geostationary (including LEO, MEO, HEO, celestial bodies, deep space)

40+ Treaty Conferences since 1906

The administrative ITU treaty



- **Decision by consensus and aim for harmonization**
- **Rights and obligations** definitions of Member States
- **Technical and regulatory mechanisms** combined to coordinate satellite projects
- **Recording** the satellite networks in the Master International Frequency Register

provides international recognition and right to operate free of radio signal interference

An international treaty

=

A stable environment

=

Sustainable activities in outer space

Next:

How do the Radio Regulations remain relevant?


ITUWRC
ITUWRC
ITUWRC
ITU

Radio Regulations Evolution, a 4-year cycle

Word Radiocommunication Conferences

GOAL

- adapt to changes in space activities and environment

MECHANISM

- technical preparation by the **ITU-R Study Groups**

WHO

- ITU Member States and Sector Members from Private sector and academia

OUTPUT

- “modification” of the Radio Regulations

ITUWRC DUBAI 2023

An evolutive and operational international treaty

=

Long-term Sustainable activities in outer space

Next:

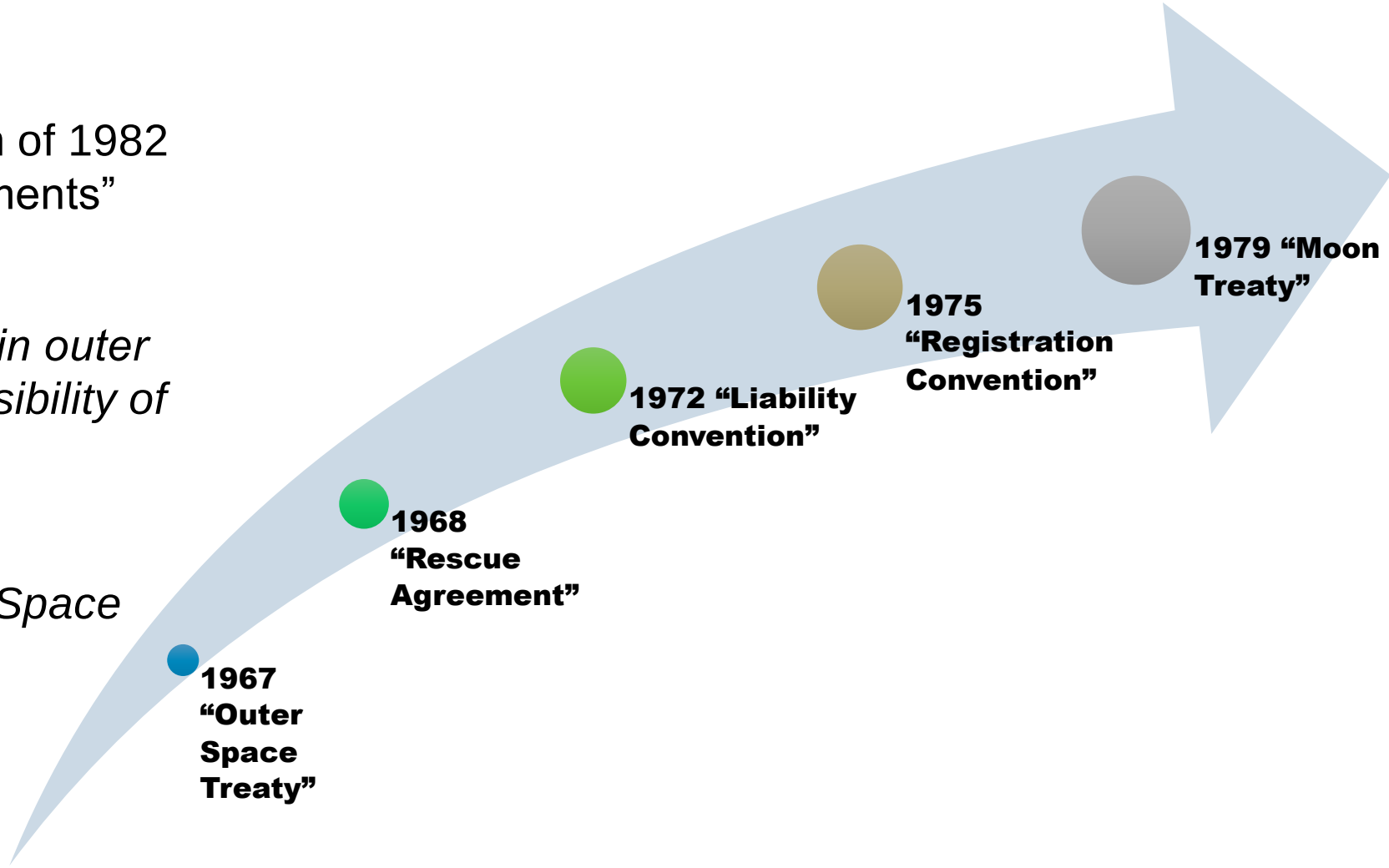
Relation with other treaties and national administrations?

ITU and the INTERNATIONAL SPACE TREATIES

ITU Constitution/Convention of 1982 is listed under “other agreements”

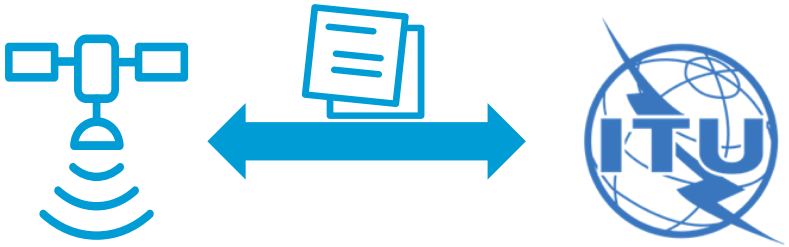
“Telecommunication issues in outer space are under the responsibility of ITU”

COPUOS agenda items on Space Sustainability



Which operational Roles?

- **At the international level**, submit filings of satellite networks to the ITU



- **At the national level**, they issue licences including space sustainability considerations

Radio Regulations Application =

Sustainable activities in outer space

How to control radio interference and obtain international recognition?

Filing a Satellite Network

For equitable access and control of interference

5

Mechanisms

ALLOCATION Frequency separation of stations of different radio services

POWER LIMITS PFD to protect terrestrial services, EIRP to protect space services, EPFD to protect GSO from Non-GSO

COORDINATION
between Administrations to ensure interference-free operations conditions, **when sharing orbit/spectrum**

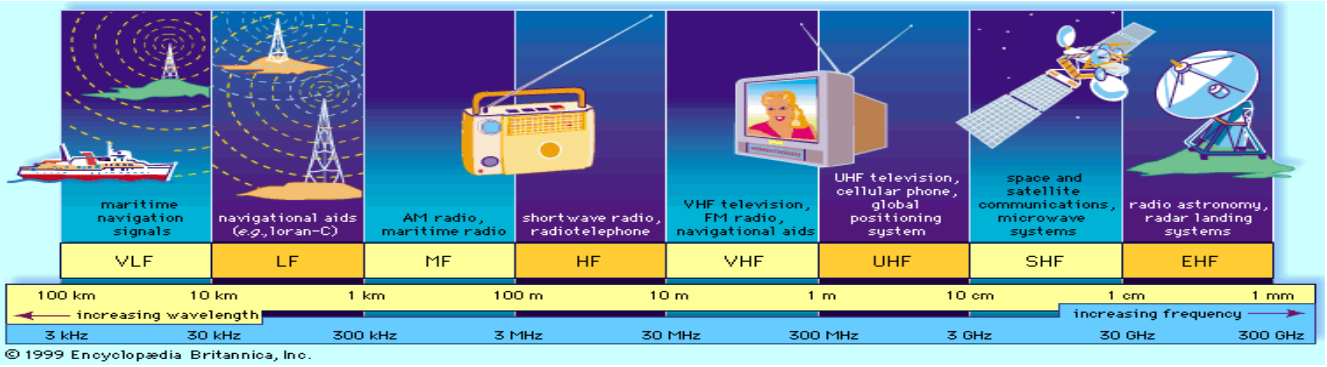
RECORDING
In the **Master International Frequency Register**
for International recognition of right to use spectrum/orbit

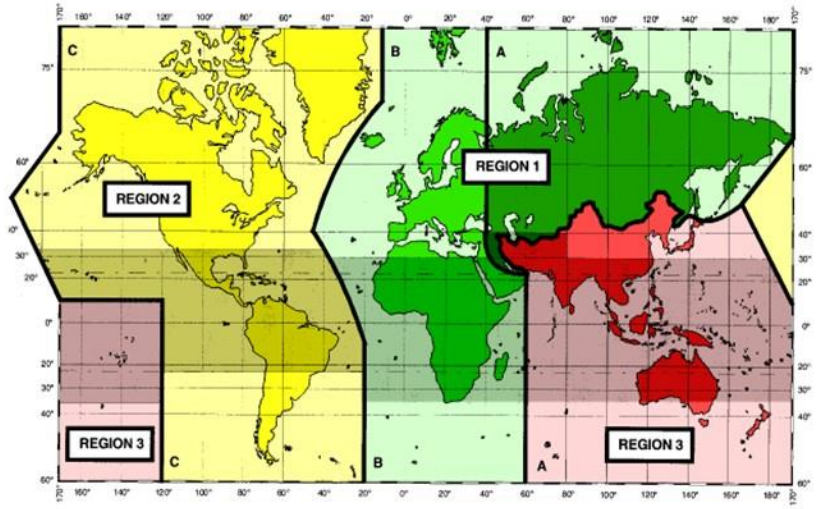
MONITORING
International monitoring system

STEP 1

In the Table of Frequency ALLOCATION (RR Art. 5)

Allocation = Services + Frequencies + Regions





STEP 2 :

Choosing Non-Plan Coordination or Plan approach?

- "*First come, first served*"
- Rights acquired through coordination with administrations concerning actual usage
- PRIORITY to efficient use

- *A priori* Plans for future use
- Rights acquired during a Planning process at a WRC
- PRIORITY to equitable access

STEP 2 :

Filing process for non-Plan Coordination approach

Submission of filling

Antenna and transmission characteristics

C

Needs of Coordination

With Existing Networks

Negotiations

to eliminate identified risk of Interference

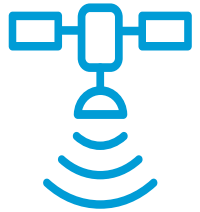
N

Notification

Record in Master International Frequency Register

Bringing into Use

International recognition to use spectrum from orbit



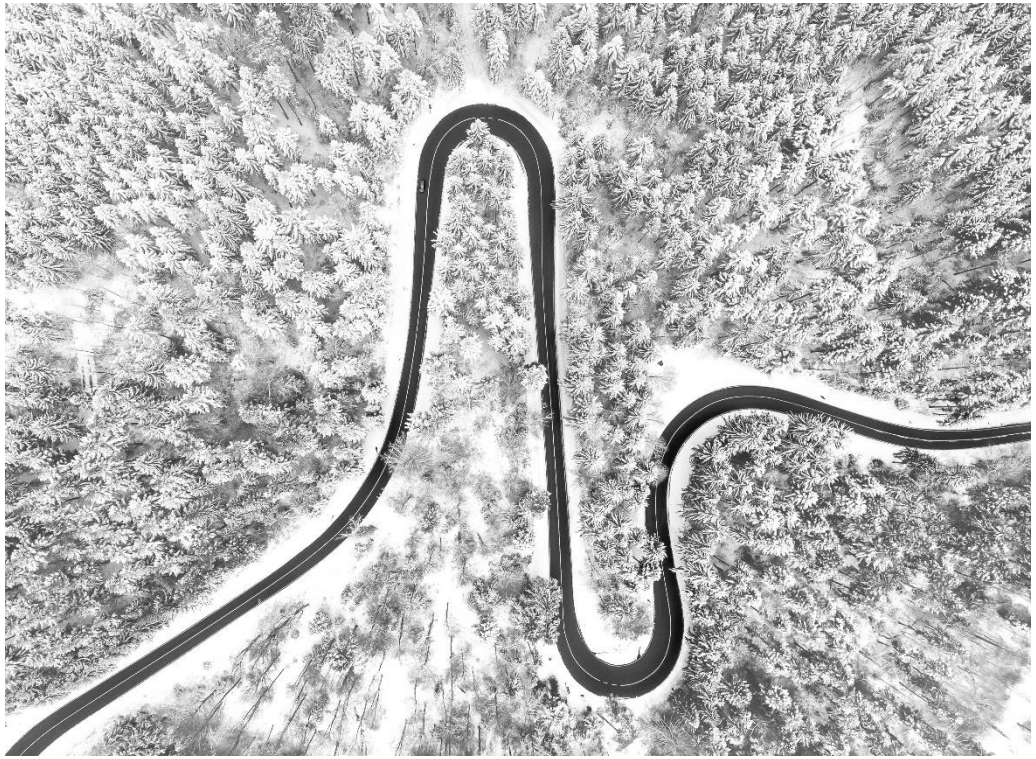
Maximum 7 years

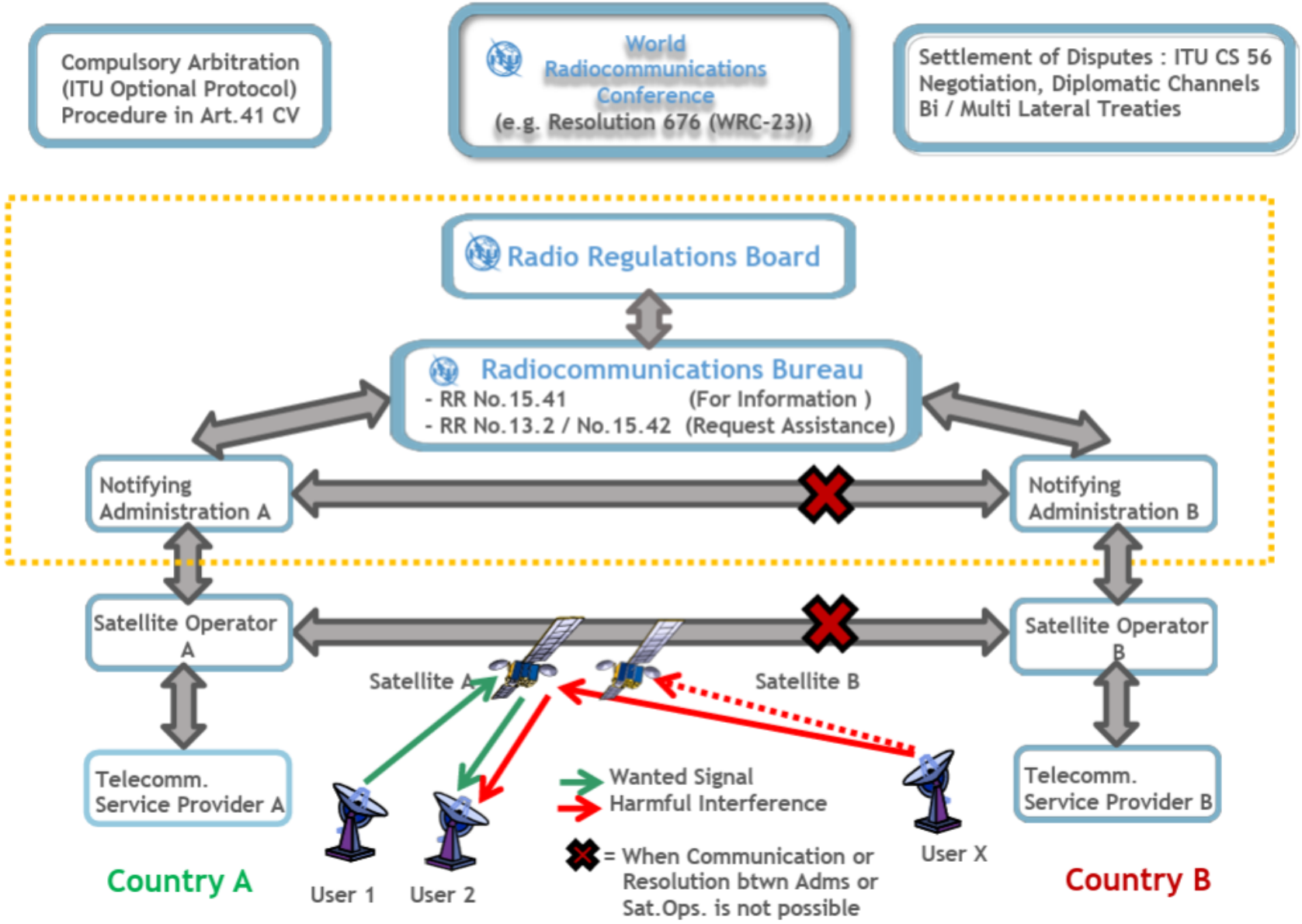
Source: Nos. 9.1, 9.5D, 9.52C, 9.43, 11.44.1, 11.25, 11.44 of Radio Regulations

What if radio interference occurs during operation of the satellite?

Provisions in case of interference infringement of the Constitution or Radio Regulations

Radio Regulations Board to address cases





ITU Tool:

Satellite
Interference
Reporting
and
Resolution
System

– SIRRS

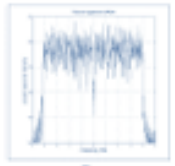
194 Member States

61 years of Space Regulation

72 Members States with access to Space Resources

2600 Satellite Networks Operating

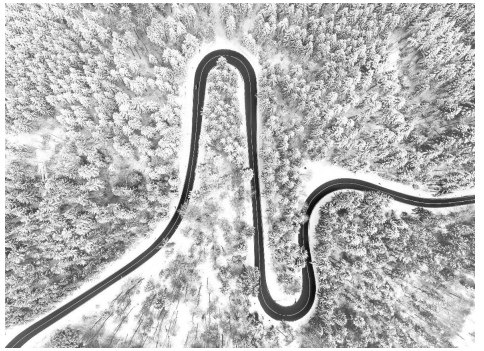
6.2 THz of Spectrum Coordinated and Recorded



99.86% Spectrum Free of Harmful Interference

< 0.1 % Interference Variation per year

- ❑ Fixed Satellite Service, Broadcasting Satellite Service and associated Space Operations Functions in the frequency bands 6/4 GHz and 14-17-18/10-12 GHz
- ❑ Earth Exploration Satellite Service (passive) in 1400-1427 MHz band
- ❑ Mobile-Satellite-Service in the frequency bands 1 626.5-1 660.5 MHz, 1 980-2 010 MHz and 2 670-2 690 MHz
- ❑ Radio Astronomy Service in the frequency band 1610.6-1613.8 MHz
- ❑ **Radio Navigation Satellite Service (RNSS) in the 1164-1215 MHz and 1559-1610 MHz frequency bands**



Harmful Radio Interference Reported to ITU

ITU Space Radio Monitoring

Memoranda of Understanding signed with Germany, Pakistan, Korea, China, Vietnam, Belarus , Brazil, Oman

Report ITU-R SM. 2182-1
LIST VIII Article 16: International Monitoring System

To identify, geolocate and eliminate harmful interference to space services

https://www.itu.int/en/ITU-R/space/Pages/ITU-Space-RadioMonitoring.aspx

when Administrations request assistance from the Bureau under RR No 13.2

Sustainable activities in outer space

The Radio Regulations

multiple mechanisms

to maintain the use of radio spectrum sustainable

Current Evolutions

World Radiocommunication Conference 2023,

a Milestone for the Outer Space Regulations

ITUWRC
DUBAI 2023

Regulation added for non-GSO systems

Orbital tolerance transparency

Specific tolerances on the orbital characteristics of space stations below 15’000 kilometres (MEO-LEO)

Modified post-milestone procedure

Reductions of number of satellites in a non-GSO system after completion of the milestone process

(RR Resolution 35)

Regulation related to new non-GSO systems

Regulation of

Inter-satellite links

To allow data availability in near-real time, for weather forecasting, disaster risk reduction etc

Non-GSO fixed-satellite service earth stations in motion (ESIMs)

New frequencies to deliver high-speed broadband onboard aircraft, vessels, trains, and vehicles. Also to follow disasters where local communication infrastructure is damaged or destroyed

Protecting GSO network from non-GSO FSS systems

aggregate interference limits adjusted

for in 10-30 GHz

Radio services equitable access improvement

Resolution 559 (WRC-19)

41 national Administrations regained spectrum and orbital resources

WRC-23 agenda item 7 Topics D, E, F, H and I

Improvement for equitable access to the geostationary orbit

WRC-23 agenda item 7 Topic K

Enhancement of equitable access in ITU Regions 1 and 3.

Radio services for science evolution

WRC-23 agenda item 1.12

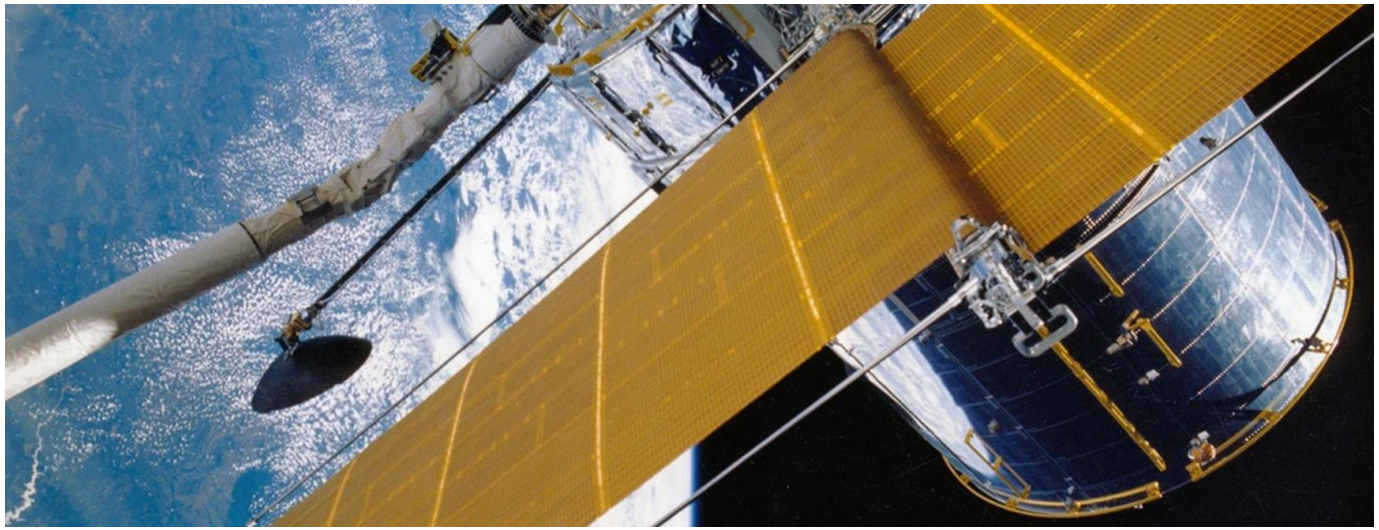
Spaceborne radar sounders

WRC-23 agenda item 1.13

High data transmission speeds

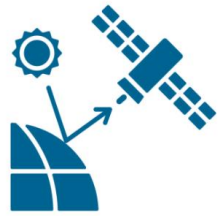
WRC-23 agenda item 1.14

Ice Cloud Measurements and atmosphere gases measurement



WRC-23 agenda item 9.1-a:

Space Weather Observation Sensors



Protection of Radio Navigation Satellite Systems

WRC-23 Resolution 676

Prevention and mitigation of harmful interference to the radionavigation satellite service in the 1 164-1 215 MHz and 1 559-1 610 MHz frequency bands and Resolved to:

Urge Administrations

1. To apply necessary measures to avoid the proliferation, circulation and operation of **unauthorized transmitters** that cause, or have the potential to cause, harmful interference to RNSS;
2. […] To **encourage collaboration [and] cooperation[…]**
3. **To report to the Bureau** cases of harmful interference affecting RNSS, in accordance with Article 15.

Looking ahead to World Radiocommunication Conference 2027 (WRC-27)

An unprecedented number of proposals related to space

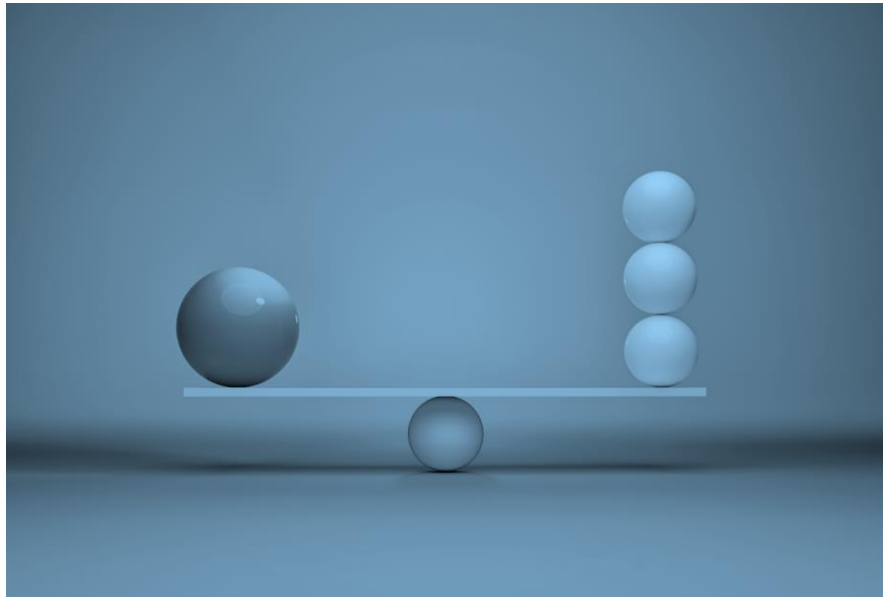
Balancing innovation with protection

WRC-27 agenda item 1.5

unauthorized operations of non-geostationary-satellite

AND

Evolution of IMT, non-GSO constellation, interconnection between networks Terrestrial-Space, sciences needs, space weather detection etc.



Space Science Issues

Studying spectrum for Future Lunar Communications

on the lunar surface,

between lunar orbit and surface

In 2022 and 2023

"Space Sustainability"

entered ITU agreed texts

Space Sustainability - why at ITU?

Expansion of the private sector activities
>> sustainability concerns

ITU Regulations is unique as solution because:

- ✓ **Its 62 years of experience** in regulating Space Radio Services from Orbits (1963 Space Conference)

- ✓ **Its forum** for all regions, space sectors, governments, industry, academia

ITU Members decide and instruct the ITU in Resolutions about Space Sustainability

ITU Plenipotentiary Conference

RESOLUTION 218
(BUCHAREST, 2022)

ITU's role in the implementation of the "Space2030" Agenda: space as a driver of sustainable development, and its follow-up and review process

instructs the Secretary-General and the Directors of the Bureaux

1 to engage in the **high-level dialogue** with relevant United Nations entities and promote BR's activities related to space;

2-3-8 to provide annually to the **ITU Council reports** on Space Plans, "Space2030" Agenda and UN-Space;

4 to strengthen **global partnerships and cooperation** among all stakeholders;

5 to promote **cooperation for access** to benefits of space activities;

6 to undertake **capacity building** for developing countries, LDCs, SIDS and LLDCs in the application of the Radio Regulations;

7 to **collaborate with the UNOOSA**, to the extent practicable, in strengthening capacity-building activities.

ITU Members decide and instruct the ITU in Resolutions about Space Sustainability

ITU Plenipotentiary Conference

RESOLUTION 219
(BUCHAREST, 2022)

Sustainability of the radio-frequency spectrum and associated satellite-orbit resources used by space services

resolves

1 to instruct the Radiocommunication Assembly, as a matter of urgency, to perform the necessary **studies** through relevant ITU Radiocommunication Sector (ITU-R) study groups on the issue of the **increasing use of radio-frequency spectrum and associated orbit resources in nonGSO orbits** […];

encourages Member States

to participate actively in these studies by submitting contributions to ITU-R; **when authorizing non-GSO systems, to take all necessary actions** :

- to avoid unacceptable interference […] and
- to ensure the efficient use of radio-frequency spectrum and associated satellite-orbit resources;
- to this effect, the necessary regulatory frameworks need to be developed for the operation of non-GSO systems,

ITU Members decide and instruct the ITU in Resolutions about Space Sustainability

Radiocommunication Assembly RA-23

RESOLUTION ITU-R 74
(Dubai, 2023)

Activities related to the sustainable use of radio-frequency spectrum and associated satellite-orbit resources used by space services

Extract:

resolves, as a matter of urgency, to invite the ITU Radiocommunication Sector

1 to continue **technical activities** in support of long-term sustainability with a focus on non-GSO systems

2 to develop a **Handbook** on best practices for the sustainable use of frequencies and associated non-GSO orbits,

instructs the relevant Radiocommunication study groups

- to study a new **Recommendation** on non-GSO space stations after the end of their life,

instructs the Director of the Radiocommunication Bureau

- to create a **website** containing a compendium of links
- to **collaborate** and exchange information with other United Nations organizations dealing with space activities, as well as with **UNOOSA and COPUOS**

ITU Capacity Building Activities about Space Sustainability

itu.int/ssf/

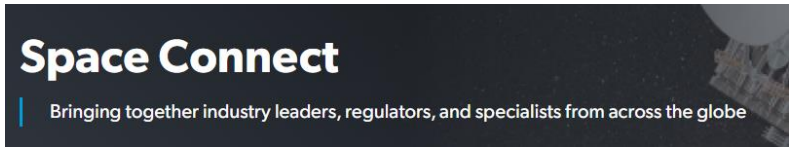
Annual Forum
convening top leaders and experts from space sector that are committed to the responsible use of the space.

An opportunity to present, discuss and dive deeply into the policies, best practices, guidelines and strategies.

itu.int/space-sustainability/

ITU portal dedicated to Space Sustainability
developed with the objective of facilitating the access, dissemination, and exchange of relevant information among space stakeholders.

ITU Members and concerned Space Stakeholders are invited to Submit regular updates.



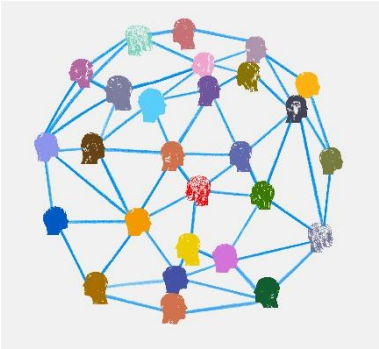
itu.int/space-connect/

Monthly virtual episodes
exploring the rapidly evolving space sector.

Bringing together industry leaders, regulators, and specialists from across the globe.

Is the Radio Regulations a sustainable solution?

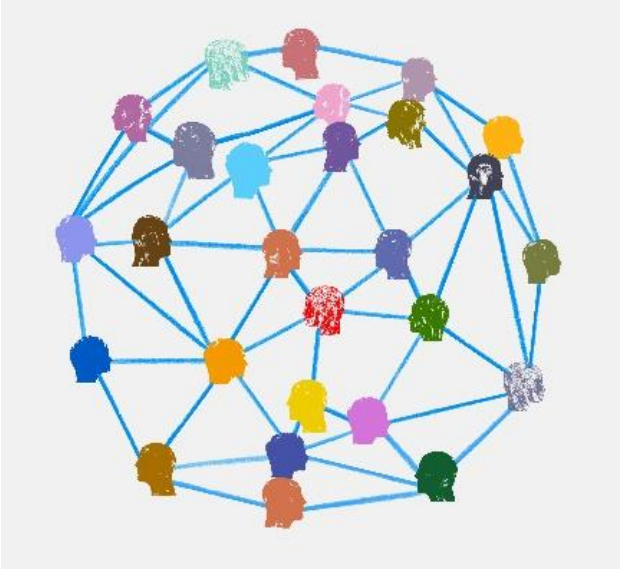
Trends and challenges in the Outer Space Sector for the Radio Regulations



Private investors and new technologies allowing new needs of spectrum and associated orbits

ITU and the Radio Regulations mechanism may be challenged by actors **NOT** coming from the telecom world

but it is evolving including now formal consideration of Space Sustainability



ITU addresses in its mandate various aspects of space sustainability:

technical, economical, governance and geopolitical

=> For your group work