



Radio Regulations and update on post WRC-15 studies

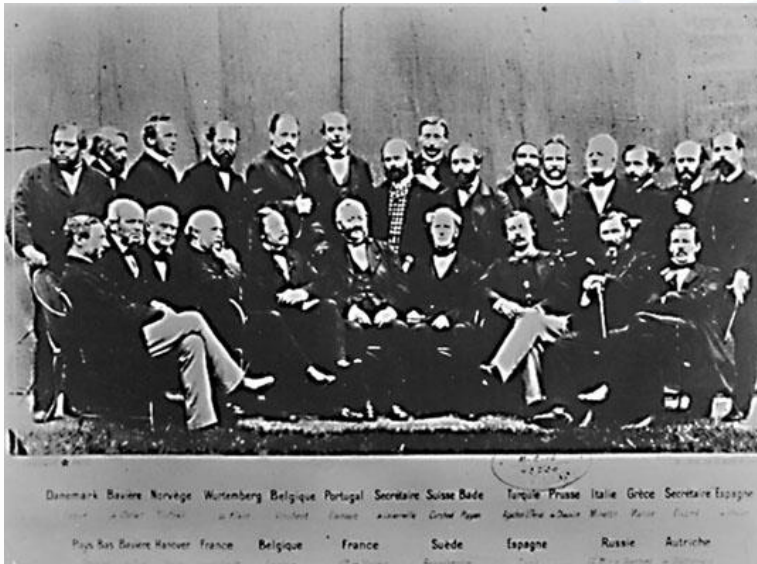
Chuen Chern Loo

Radiocommunication Bureau
International Telecommunication Union

3rd ICAO/UNOOSA Aerospace Symposium

ITU in brief

- Founded on 17 May 1865



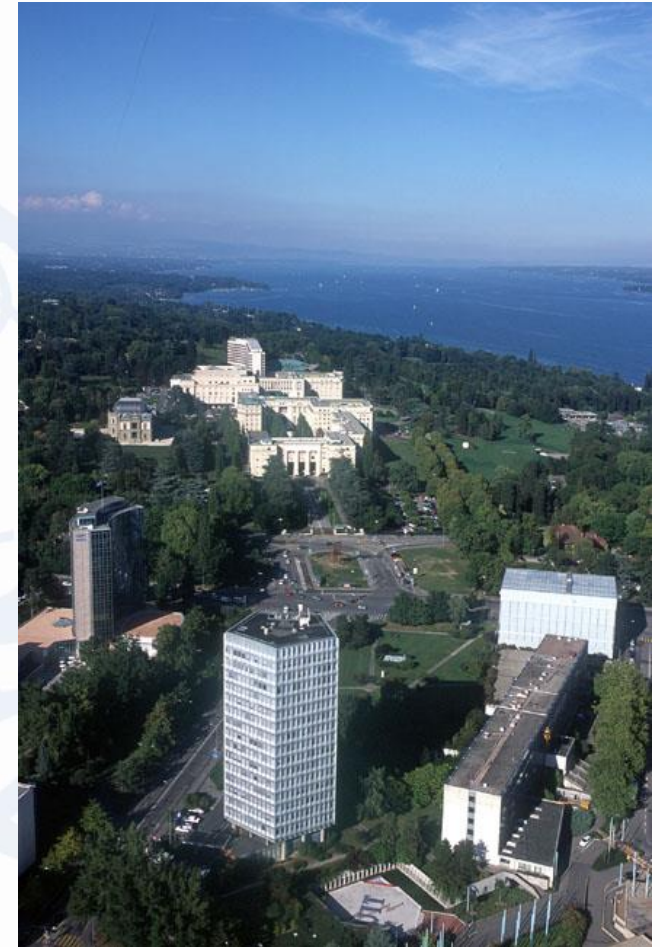
193 Member States

+

>700 Sector Members &
Associates

+

Academia



- ITU is the leading UN agency for **information** and **communication technologies**

Radio Regulations

- Intergovernmental Treaty governing the use of spectrum/orbit resources by administrations
- Define the rights and obligations of Member States in respect of the use of these resources
- Recording of a frequency assignment in the Master Register (MIFR) provides international recognition
- Update every 3-4 years by a WRC



Radio Regulations and Services

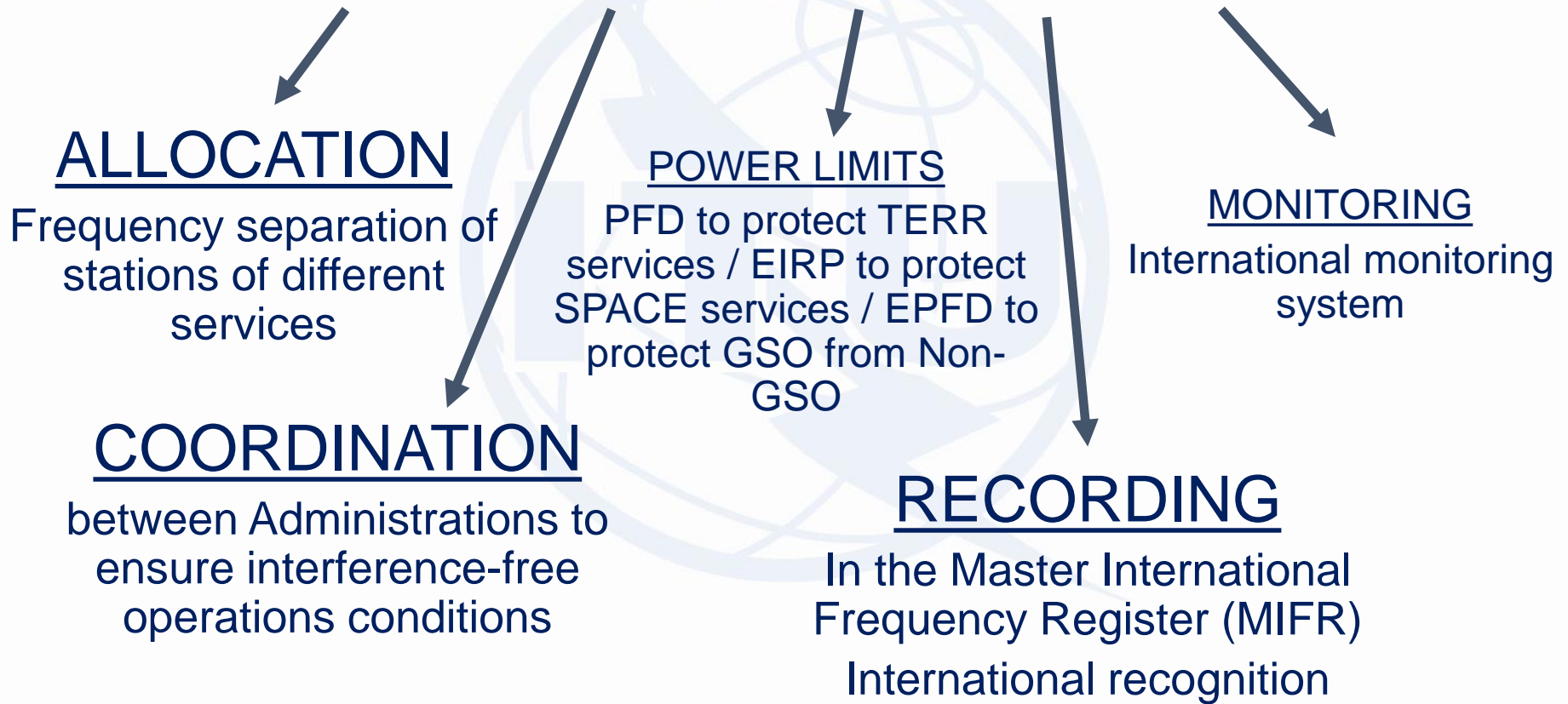
- RR classifies services that use radio communications, according to several parameters, namely:
 - Link type: Terrestrial or space (Earth-space, space-Earth, space-space)
 - Station type: fixed, mobile
 - Type of coverage: land, maritime, aeronautical
 - Type of use: communications, broadcasting, navigation, meteorological, scientific, earth observation, time standard, radio astronomy, amateur satellite, etc.
- RR allocates blocks of frequencies to defined radio services – Table of Frequency Allocations in Article 5

Common Space Services

- Fixed-satellite service (including feeder link for other services)
- Broadcasting-satellite service (sound or video)
- Mobile-satellite service (land, maritime, or aeronautical)
- Radionavigation-satellite service
- Earth exploration-satellite service (remote sensing, including active or passive sensors)
- Space research service (including active or passive sensors)
- Meteorological-satellite service
- Space operation service (for TT&C)
-

Radio Regulations Mechanisms - 1

Control of Interference



Radio Regulations Mechanisms - 2

- Two mechanisms of sharing orbit / spectrum
- Rights & obligations + applicable procedures



Coordination Approach

First come, first served for actual requirements

Planning Approach

Equitable access \Leftrightarrow Plan for future use

International Recognition

Registration in MIFR

Parking lot analogy

Coordination Approach



Planning Approach





What assignments should be notified for recording in the Master International Frequency Register (MIFR) (Article 11)?

- **Any frequency assignments of transmitting and receiving earth and space stations**
 - if the use of that assignment is capable of causing harmful interference to any service of another administration; or
 - if that assignment is to be used for international radiocommunication; or
 - if it is desired to obtain international recognition for that assignment
 - if that assignment is subject to a world or regional frequency allotment or assignment plan which does not have its own notification procedure; or
 - if that assignment is subject to the coordination procedure of Article 9 or is involved in such a case; or
 - if it is a non-conforming assignment under No. 8.4 and if the administration wishes to have it recorded for information
 -

WRC-15



2 - 27 Nov 2015

Geneva

3275
Participants

162 Member states
130 other entities

40 Topics

678 Documents

2888 proposals
2/3 common proposals
(regional or multi-countries)



WRC-15 results for space services

New frequency bands for space services to increase capacity and accommodate new applications

- 13.4-13.65GHz in R1 for FSS downlink
- 14.5-14.75GHz 30 countries in R1&2 for FSS uplink
- 14.5-14.8GHz 9 countries in R3 for FSS uplink
- 7375-7750MHz downlink for MMSS
- 7190-7250MHz uplink for EESS
- 9200-9300MHz, 9900-10000MHz and 10-10.4GHz for EESS (active)



WRC-15 results for space services

Change of conditions for use to facilitate the use of the band

- Primary allocation of FSS for feeder link of N-GSO MSS in 5091-5150MHz without any time limitation
- Extension of use of smaller antenna for ESV in 5925-6425Hz
- Removal of 5km distance limitation for Extra Vehicular Activities in 410-420MHz
- Extension of the possibility offered for ESIM in all Regions in 19.7-20.2 GHz and 29.5-30 GHz



Agenda for the 2019 World Radiocommunication Conference to meet future demand

**WRC
2019**



Broadband applications to be shared with space services (WRC-19 agenda items 1.13 and 1.14)

The following bands will be studied with a view to an **IMT-2020** identification:

- 24.25 – 27.5 GHz
- 31.8 – 33.4 GHz
- 37 – 40.5 GHz
- 40.5 – 42.5 GHz
- 42.5 – 43.5 GHz
- 45.5 – 47 GHz
- 47 - 47.2 GHz
- 47.2 – 50.2 GHz
- 50.4 – 52.6 GHz
- 66 – 76 GHz
- 81 – 86 GHz



► **Res. 238 (WRC-15)**



Studies for considering **appropriate regulatory actions for HAPS***, within existing FS alloc. at 47.2-47.5, 47.9-48.2 & 31.0-31.3**/27.9-28.2** GHz

(** outside Reg. 2, +5 ADMs @6.5/6.5 MHz) or

study new bands: 38-39.5 GHz & 21.4-22*** & 24.25-27.5*** GHz

(*high-altitude platform stations (HAPS); *** in Region 2)

► **Res. 160 (WRC-15)**



Science issues (WRC-19 agenda items 1.2, 1.3 and 1.7)



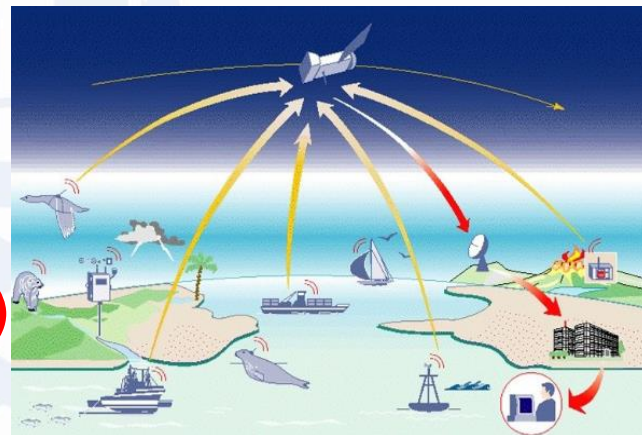
Study spectrum needs for **TT&C in the SOS** for non-GSO satellites with short duration missions & consider, if necessary, new SOS allocations

▶ **Res. 659 (WRC-15)**

Studies to consider **in-band power limits** for earth stations in **MetSat & EESS @ 401-403 MHz** for DCS* and in the **MSS @ 399.9-400.05 MHz**

▶ **Res. 765 (WRC-15)**

Studies to consider possible upgrading of the **2ndary MetSat (s-E)** allocation to **1^{mary}** status & a possible **1^{mary} EESS (s-E)** allocation @ **460-470 MHz** for DCS



▶ **Res. 766 (WRC-15)**

* Data Collection Systems (DCS) are used to monitor and predict climate change, monitor oceans, weather and water resources, weather forecasting and assisting in protecting biodiversity, improving maritime security



Satellite issues

(WRC-19 agenda items 1.4, 1.5, 1.6 & 7)



Studies on development of a **regulatory framework for non-GSO FSS systems** that may operate in the bands **37.5-39.5 GHz (s-E), 39.5-42.5 GHz (s-E), 47.2-50.2 GHz (E-s) and 50.4-51.4 GHz (E-s)**

▶ **Res. 159 (WRC-15)**

Studies to consider the **use of the bands 17.7-19.7 GHz (s-E) and 27.5-29.5 GHz (E-s)** by **earth stations in motion** communicating with GSO space stations **in the FSS** and take appropriate action

▶ **Res. 158 (WRC-15)**









Satellite Regulatory issues

▶ **Res. 86 (Rev.WRC-07)**



Other ITU-R Studies for WRC-19 (WRC-19 agenda item 9.1)

-  **9.1.1** **Res. 212 – Terrestrial & Satellite components of IMT**
(Rev.WRC-15) co-existence & compatibility @1885-2025 & 2110-2200
-  **9.1.2** **Res. 761 – IMT and BSS sound @ 1452-1492 MHz**
(WRC-15) in Regions 1 and 3
-  **9.1.3** **Res. 157 – Technical/Operational/Regulatory studies for**
(WRC-15) new N-GSO Sat. in “C-Band” allocated to FSS
-  **9.1.4** **Res. 763 – Stations on board sub-orbital vehicles**
(WRC-15)
- 9.1.5** **Res. 764 – IbR* of Rec. ITU-R M.1638-1 & M.1849-1**
(WRC-15) (MS(RLAN)@5GHz & new radar characteristics)
- 9.1.6** **Res. 958 – 1) Urgent studies on Wireless Power**
(WRC-15) Transmission (WPT) for electric vehicles
-  **9.1.7** **Res. 958 – 2) Managing unauthorized operations of**
(WRC-15) Earth Station terminals
- 9.1.8** **Res. 958 – 3) Narrowband & BB machine-type**
(WRC-15) communication infrastructures
-  **9.1.9** **Res. 162 – FSS needs @ 51.4-52.4 GHz**
(WRC-15)

<http://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-19-studies.aspx>



Overview of the ITU-R Calendar towards WRC-19

Year	January – March	April – June	July – September	October – December
2015	CPM15-2	Last meetings of the Responsible Groups	WS on WRC-15	RA-15 WRC-15 CPM19-1
2016	WP 5D (1 st)	WPs 7B & 7C (1 st) WP 4C+WP 4A (1 st) WPs 5A, 5B & 5C (1 st) TG 5/1 (1 st) WPs 1A & 1B (1 st)	WP 4C+WP 4A (2 nd)	WP 5D (3 rd) WPs 7B & 7C (2 nd) WPs 5A, 5B & 5C (2 nd) WPs 1A & 1B (2 nd)
		WP 5D (2 nd)	CPM-19 Steering	
	WP 5D (4 th)	WPs 7B & 7C (3 rd) WP 4C+WP 4A (3 rd) TG 5/1 (2 nd) WPs 5A, 5B & 5C (3 rd) WPs 1A & 1B (3 rd) WP 5D (5 th)	[TG 5/1 (3 rd)]	WP 5D (6 th) WP 4C+WP 4A (4 th) WPs 7B & 7C (4 th) [WPs 5A, 5B & 5C (4 th)] [WS on WRC-19] [WPs 1A & 1B (4 th)]
		[Responsible Groups Meetings] [TG 5/1 (4 th)]	[Responsible Groups Meetings] [TG 5/1 (5 th)]	[Responsible Groups Meetings] [TG 5/1 (6 th)] CPM-19 Manag ^{nt} Team
2019	CPM19-2	[Last meetings of the Responsible Groups]	[WS on WRC-19]	RA-19 WRC-19

[...] = planned meetings

WS on WRC-19 = ITU Inter-regional Workshop on WRC-19 Preparation

Up-to-date information online at: www.itu.int/en/events/Pages/Calendar-Events.aspx?sector=ITU-R

Broadband connectivity via Earth Stations in Motion (ESIM)

High growing demand for broadband satellite communications to mobile platforms

Frequencies around 20/30 GHz have been identified as a primary focus for new systems



WRC-15

Set conditions for ESIM operation using the bands 19.7-20.2 GHz and 29.5-30.0 GHz in all Regions



WRC-19

Address the use of the bands 17.7-19.7 GHz and 27.5-29.5 GHz for ESIM operation

WRC-15 decisions, supported by ITU-R Study Groups, facilitate the increased use and further development of ESIM, paving the way for satellite systems to provide global broadband connectivity on mobile platforms such as ships, aircraft, and land vehicles

Spectrum for Emerging Technologies Enabled by ITU-R Studies and WRC decisions

Broadband connectivity via High Altitude Platform Stations (HAPS)



**Fixed and mobile broadband,
Extension of cellular networks,
Backhauling for Mobile Broadband
to underserved communities**



Frequencies identified in the Radio Regulations for use by **HAPS**:

WRC-97

600 MHz of spectrum in the 47/48 GHz band (fixed users)



WRC-2000

600 MHz in 27/31 GHz (fixed) and 170 MHz in 2GHz (mobile users)



WRC-12

160 MHz in the 6 GHz band in five countries (gateways)



WRC-19

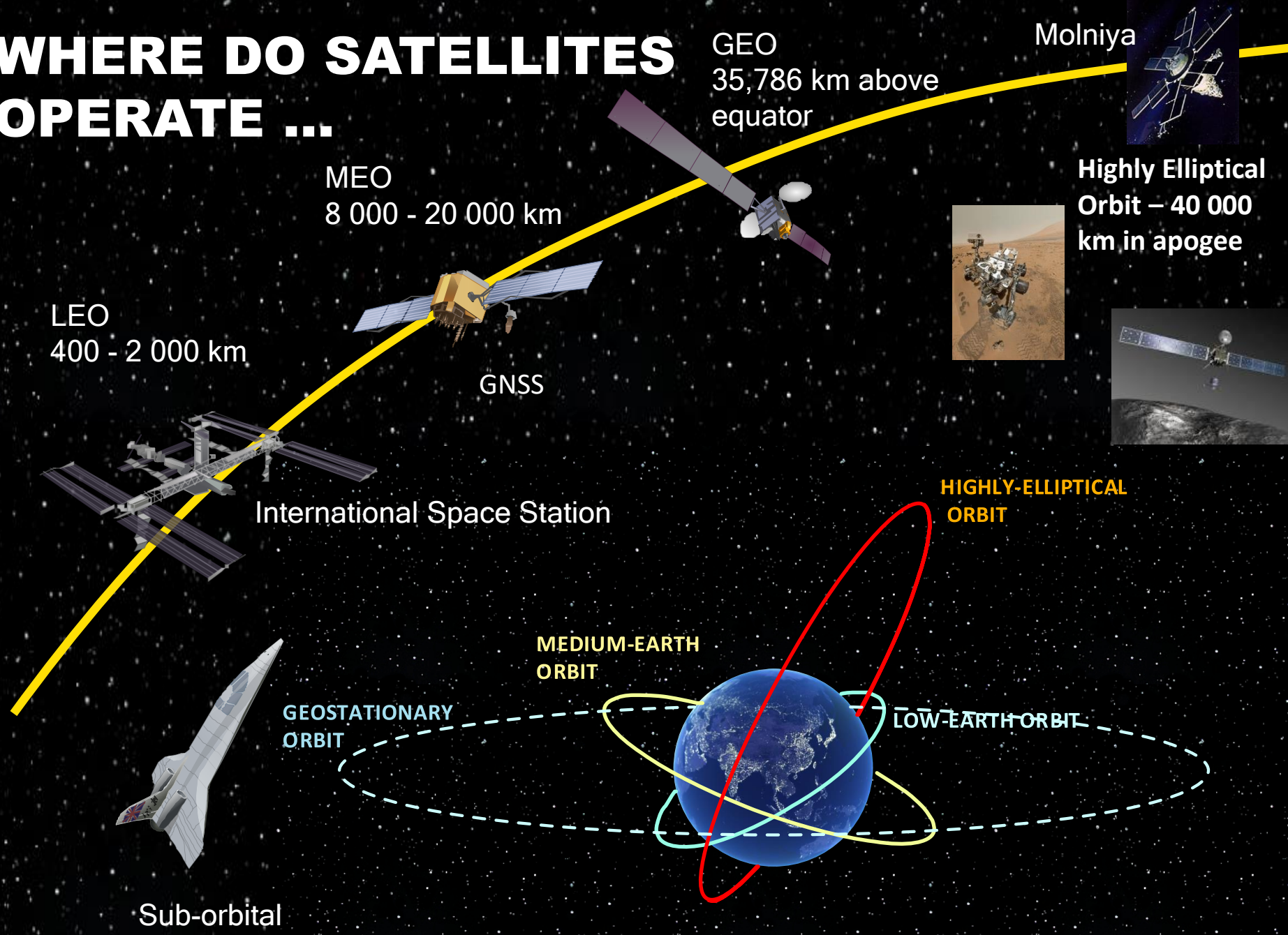
will consider the needs in high capacity bands for **HAPS** evolution, with candidates at 21 GHz, 26 GHz and 38 GHz



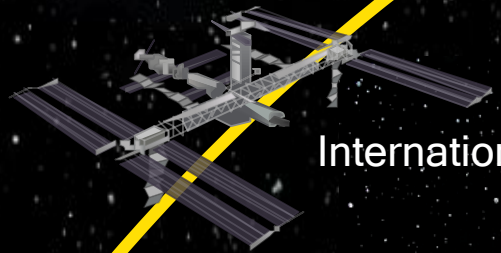
Studies on Stations on board sub-orbital vehicles



WHERE DO SATELLITES OPERATE ...



LEO
400 - 2 000 km



International Space Station

MEO
8 000 - 20 000 km



GNSS

GEO
35,786 km above equator



Molniya



Highly Elliptical Orbit – 40 000 km in apogee



HIGHLY-ELLIPTICAL ORBIT

MEDIUM-EARTH ORBIT

GEOSTATIONARY ORBIT

LOW-EARTH ORBIT

Sub-orbital



RA- QUESTION ITU-R 259/5

Operational and radio regulatory aspects for planes operating in the upper level of the atmosphere

decides that the following Questions should be studied

- 1 How will planes be operated including a description of the various phases of flight?
- 2 During which phases of flight described in *decides 1*, will, if at all, need to be supported by air traffic control systems and what sort of systems are expected?
- 2 What radio links will be required to support planes operations and under what radiocommunication service definition will they fall?

Studies should be completed by 2019



Resolution 763 (WRC-15) Stations on board sub-orbital vehicles (WRC-19 agenda item 9.1.4)

resolves to invite the ITU Radiocommunication Sector

1. to conduct studies to identify any required technical and operational measures, in relation to stations on board sub-orbital vehicles, that could assist in avoiding harmful interference between radiocommunication services;
2. to conduct studies to determine spectrum requirements and, based on the outcome of those studies, to consider a possible future agenda item for WRC-23;
3. to complete the studies within the next ITU Radiocommunication Sector (ITU-R) study cycle,



ITU-R WP 5B

Stations on board sub-orbital vehicles (WRC-19 agenda item 9.1.4)

ITU-R Working party 5B is responsible for the studies

- Working on a preliminary draft new report;
 - Definitions of stations
 - Existing definitions – satellite, spacecraft
 - New – suborbital vehicle, space plane, reusable launch vehicle, expendable launch vehicle?
 - Phases of flight
 - Spectrum management
 - Which service, existing services or a new category of service?
 - Requires dedicated frequency band?
- Next meeting: 6-17 November 2017, Geneva