BR DIRECTOR'S REPORT TO WRC-15

NGSO Issues

Yvon HENRI

Chief of Space Services Department

International Telecommunication Union

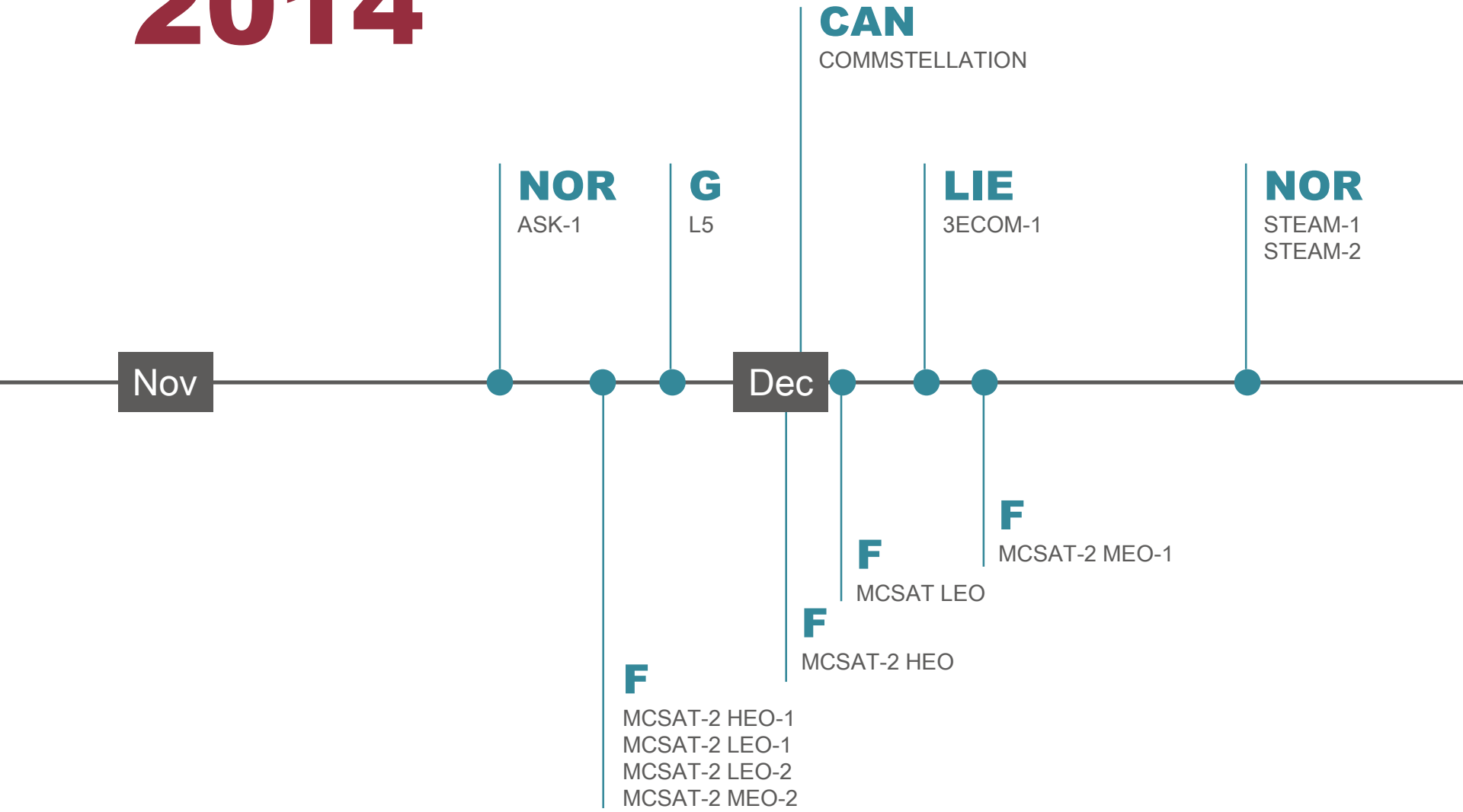
Workshop on the Efficient Use of the Orbit/Spectrum Resource 2015

RECENT NON-GEOSTATIONARY (NGSO) SYSTEMS

From Nov 2014, BR received many coordination request submissions for NGSOs with large number of frequency assignments and orbits

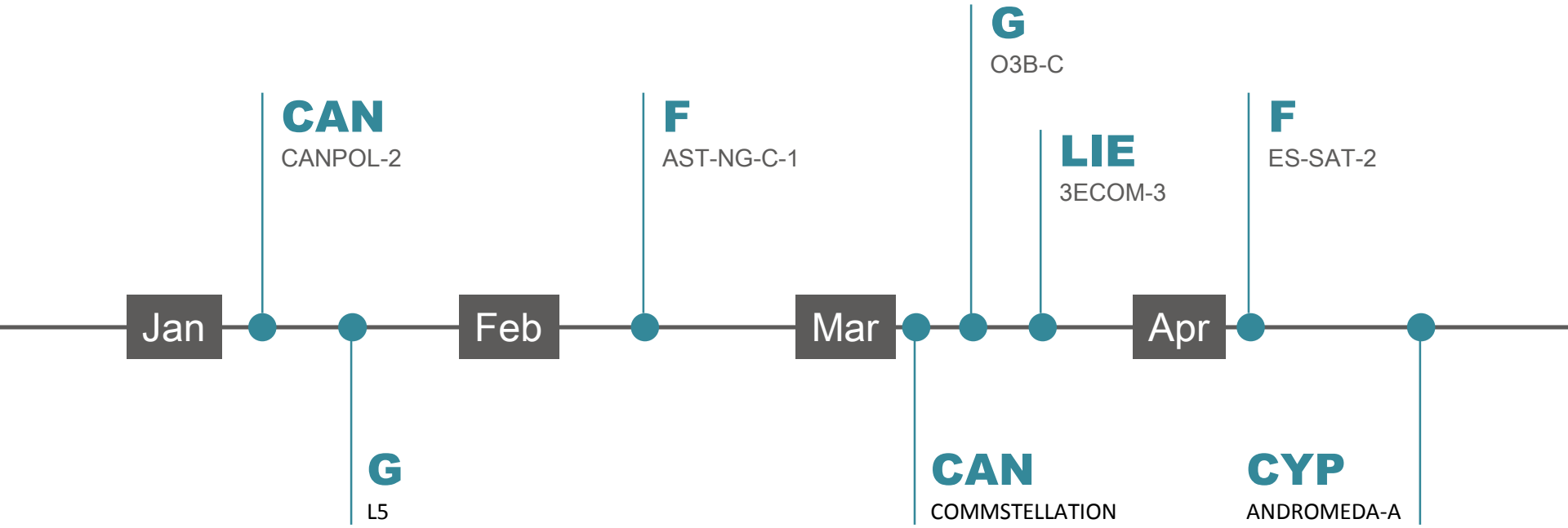
Source: Doc. CMR15/4(Add.1,2)

2014



Source: SRS database

2015



Source: SRS database

Adm	Satellite Network	Total No. of Sat.	LEO	MEO	HEO	Ku	Ka	Other
CAN	CANPOL-2	51	LEO		HEO		Ka	Other
	COMMSTELLATION	891	LEO				Ka	
CYP	ANDROMEDA-A	48	LEO				Ka	
F	AST-NG-C-1	797	LEO	MEO			Ka	Other
	ES-SAT-2	1428	LEO	MEO		Ku	Ka	Other
	MCSAT LEO	774	LEO				Ka	
	MCSAT-2 HEO	237600		MEO			Ka	
	MCSAT-2 HEO-1	36			HEO	Ku	Ka	
	MCSAT-2 LEO-1	72576	LEO			Ku		
	MCSAT-2 LEO-2	72576	LEO				Ka	
	MCSAT-2 MEO-1	216000		MEO		Ku		
	MCSAT-2 MEO-2	72000		MEO		Ku	Ka	
G	L5	2692	LEO			Ku	Ka	
	O3B-C	840	LEO	MEO		Ku	Ka	
LIE	3ECOM-1	288	LEO			Ku	Ka	
	3ECOM-3	288	LEO			Ku	Ka	
NOR	ASK-1	7			HEO	Ku	Ka	Other
	NORSAT-H1	4			HEO	Ku	Ka	Other
	STEAM-1	3993	LEO			Ku		
	STEAM-2	3993	LEO				Ka	

Source: SRS database

CHARACTERISTICS

LEO, MEO, HEO
Ku, Ka-bands etc. (Art. 22 EPFD limits + No. 9.7B applies)
Fixed-Satellite Services
Large no. of assignments / orbits
Various configurations of operation

Source: Doc. CMR15/4(Add.1,2), LEO 680-1425km, MEO 7000-23500 km, HEO including TAP, Tundra, Molniya

Source: Spacenews

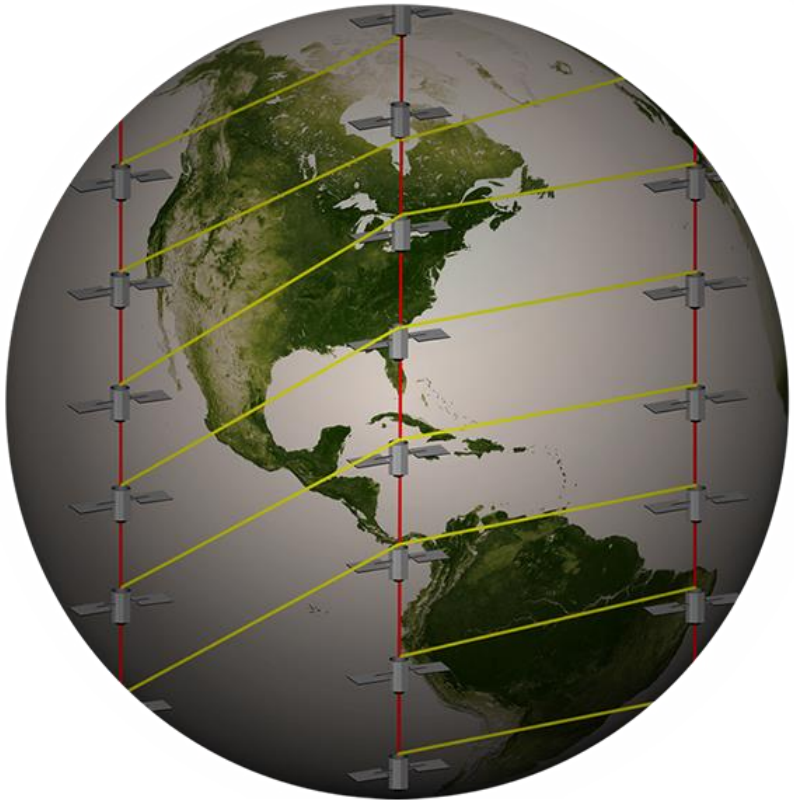
“Enable affordable internet access for everyone”

Greg Wyler, CEO/Founder OneWeb

648 LEOs | Ku-band | 1200km | 2018
Virgin, Qualcomm, Airbus, Bharti

Source: Oneweb

Source: SpaceNews, SatelliteToday, Flickr/movie05



“Very high speed secured network delivery system”

Cliff Anders, Founder LeoSat, Corp

78-108 LEOs | Ka-band | 1400km | 2019
Business and government customers
Thales Alenia Space

Source: Leosat

“Our proposal is to deploy thousands of low-cost micro-satellites capable of providing Terabit/s data rates”

Farooq Khan, President, Samsung Research America

4600 small satellites | millimeter wave bands

Source: arxiv.org

NGSO ISSUES

Extract from BR Director's Report To WRC-15

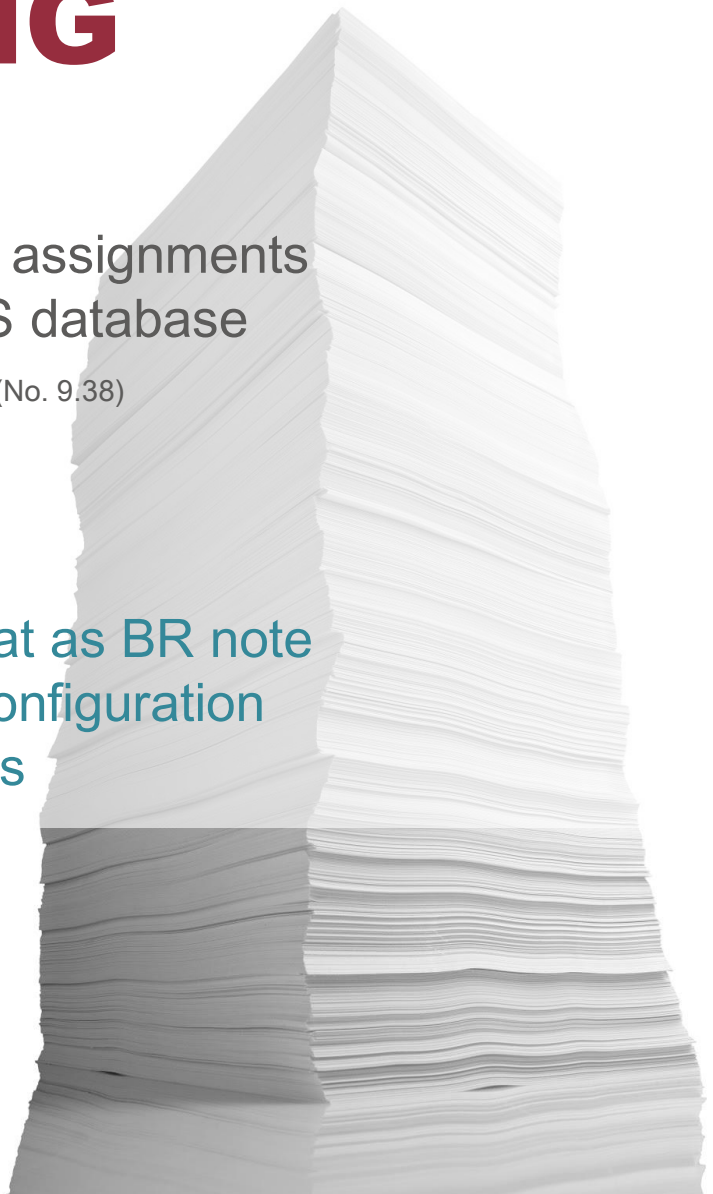
1. PROCESSING

PROBLEM

- Unable to process large amount of assignments
- Unable to establish findings in SRS database
- Unable to meet 4-month time limit (No. 9.38)

SOLUTION

- BR software being upgraded
- Findings presented in tabular format as BR note
- Requesting Adm to clarify actual configuration
- Processing GSOs ahead of NGSOs



Source: Doc. CMR15/4(Add.1,2)

2. CONSTELLATIONS

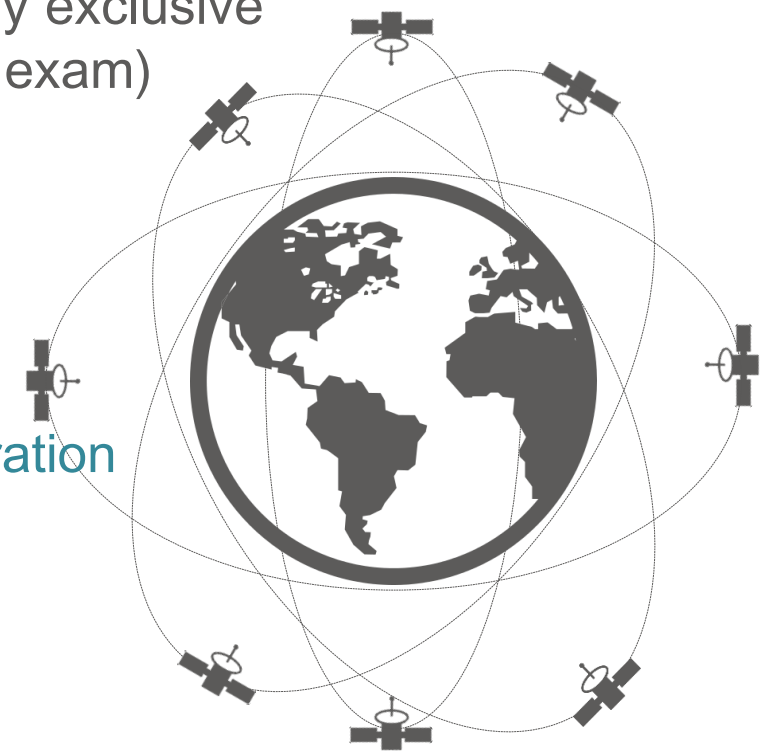
PROBLEM

Various operational configuration or flexibility at coordination stage

- Simultaneous operation of all satellites
- Different configuration but mutually exclusive
- Unknown (uncertainty with EPFD exam)

SUGGESTION

WRC-15 to limit extent of flexibility to simultaneous or mutually exclusive operation at the coordination stage, with one configuration to be determined at notification

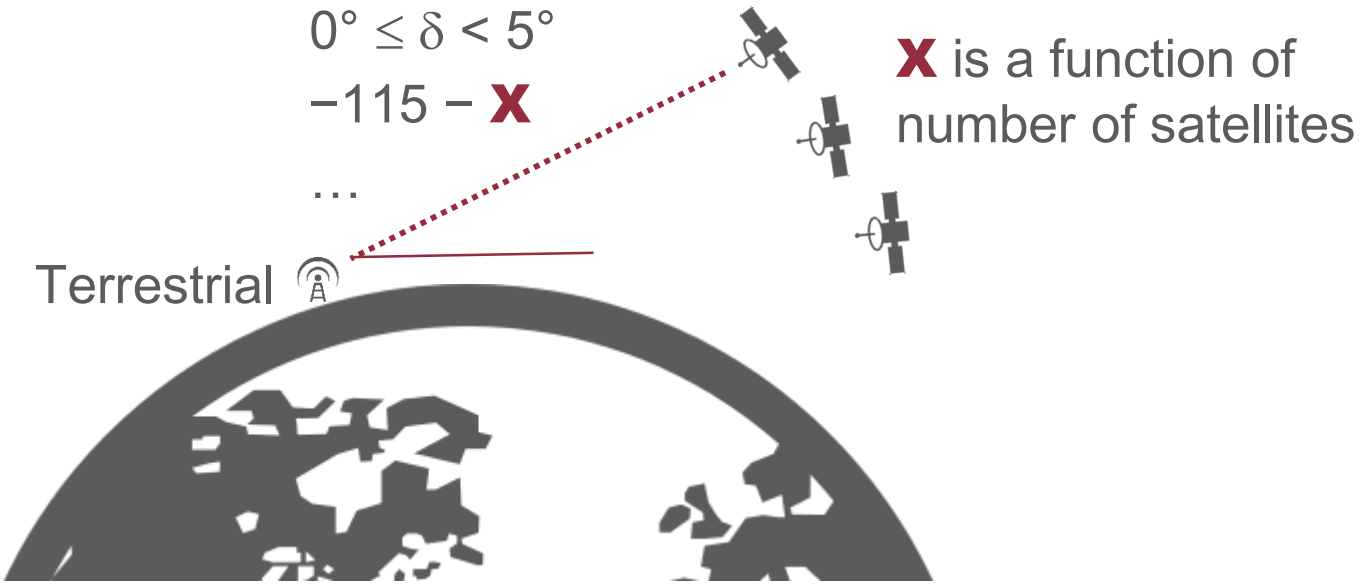


Source: Doc. CMR15/4(Add.2)

3. PFD HARD LIMITS

PROBLEM

- PFD limits in 17.7-19.3 GHz
- Limits depend on number of satellites
- Based on NGSO FSS with 96, 288, 840 satellites
- Large no. of satellites lead to low (stringent) limits



Source: Doc. CMR15/4(Add.2), Art. 21 Table 21-4, Rec. ITU-R SF.1483, Rec. ITU-R SF.1482

3. PFD HARD LIMITS

PROBLEM

- PFD limits in 17.7-19.3 GHz
- Limits depend on no. of satellites
- Based on NGSO FSS with 96, 288, 840 satellites
- Large number of satellites lead to low (stringent) limits

SUGGESTION

WRC-15 may review to ensure all existing services protected considering growing interest in operating non-GSO FSS systems

Source: Doc. CMR15/4(Add.2), Art. 21 Table 21-4, Rec. ITU-R SF.1483, Rec. ITU-R SF.1482

4. EPFD TOOL

UPDATES

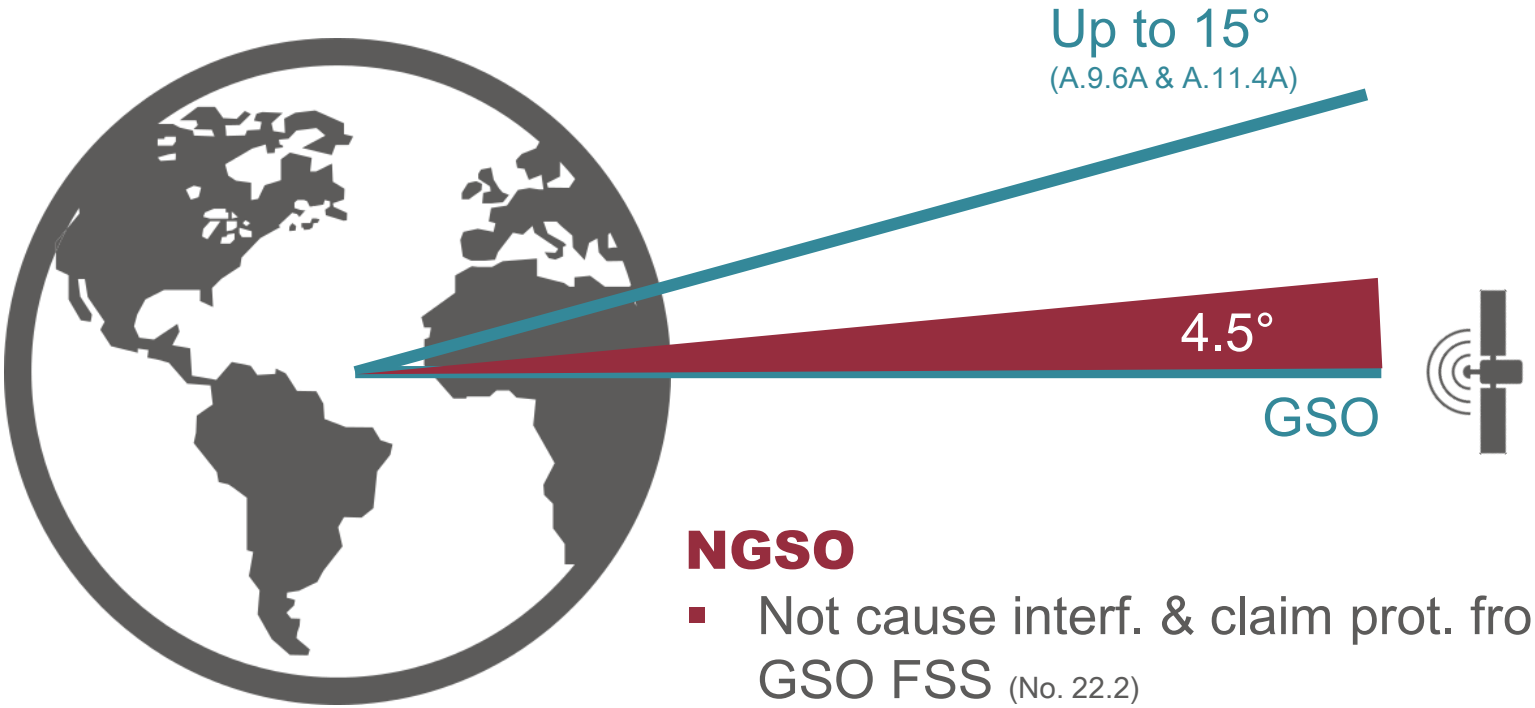
- Tool upgraded to take into account equatorial and elliptical orbits (Rec ITU-R 1503-2)
- Final stages of testing; BR requesting Administrations for PFD/EIRP masks in XML format
- When ready, BR to
  - Review findings with respect to EPFD limits
  - Reestablish coordination requirements under No. 9.7B (NGSO FSS vs GSO E/S)

SUGGESTION

WRC-15 to review or confirm the pertinence of some assumptions related to Rec.ITU-R S. 1503-2, and review Res 85 (WRC-03) which allows BR to process NGSO without tool (qualified favourable based on commitment & coordination requirements based on frequency overlap) accordingly

Source: Doc. CMR15/4(Add.1,2), Res85, Rec ITU-R S.1503-2

5. PROTECTION OF GSO

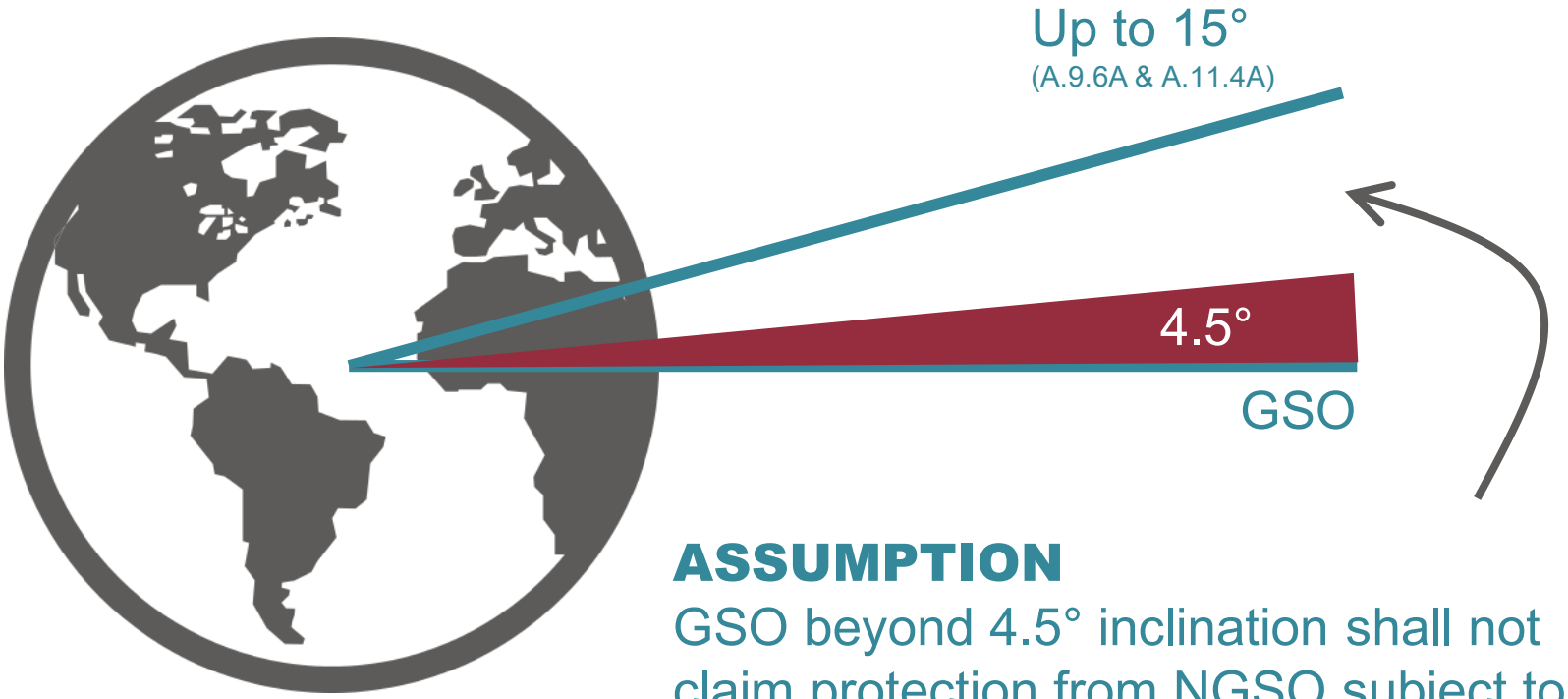


NGSO

- Not cause interf. & claim prot. from GSO FSS (No. 22.2)
- EPFD limits compliance considered fulfilled No. 22.2 (No. 22.5I)
- EPFD protects GSO up to 4.5° inclination (Tables 22-4A, -4B)

Source: Doc. CMR15/4(Add.2), Articles 9, 11, 22, Res76 (WRC-2000)

5. PROTECTION OF GSO



ASSUMPTION

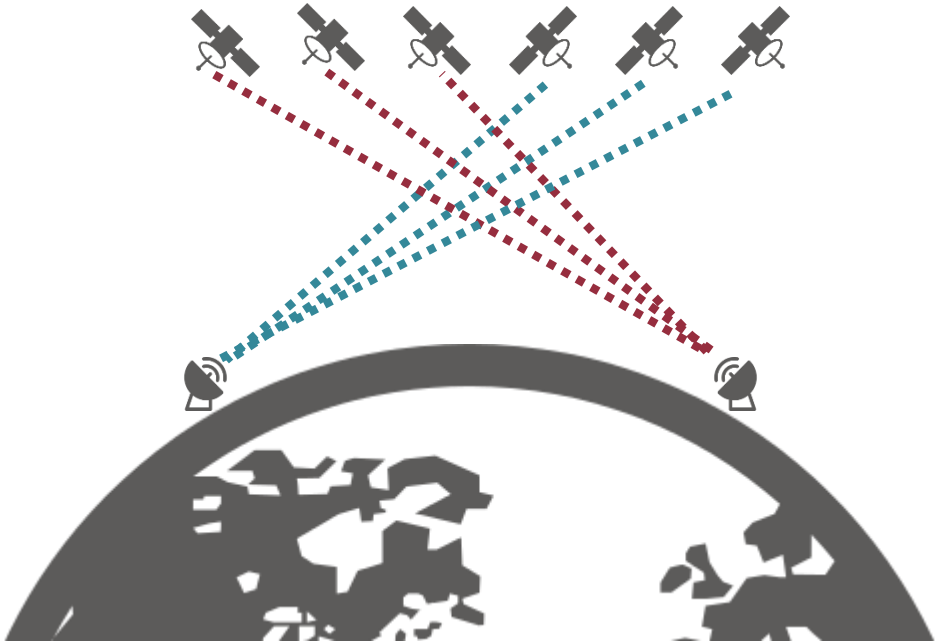
GSO beyond 4.5° inclination shall not claim protection from NGSO subject to EPFD limits

Source: Doc. CMR15/4(Add.2), Articles 9, 11, 22, Res76 (WRC-2000)

6. NGSO COORDINATION

General coordination procedures

- CR is not an order of priority (RoP9.6 1b)
- Coordination is a two-way process (RoP9.6 1c)
- No particular priority for being first to start (RoP9.6 1d)



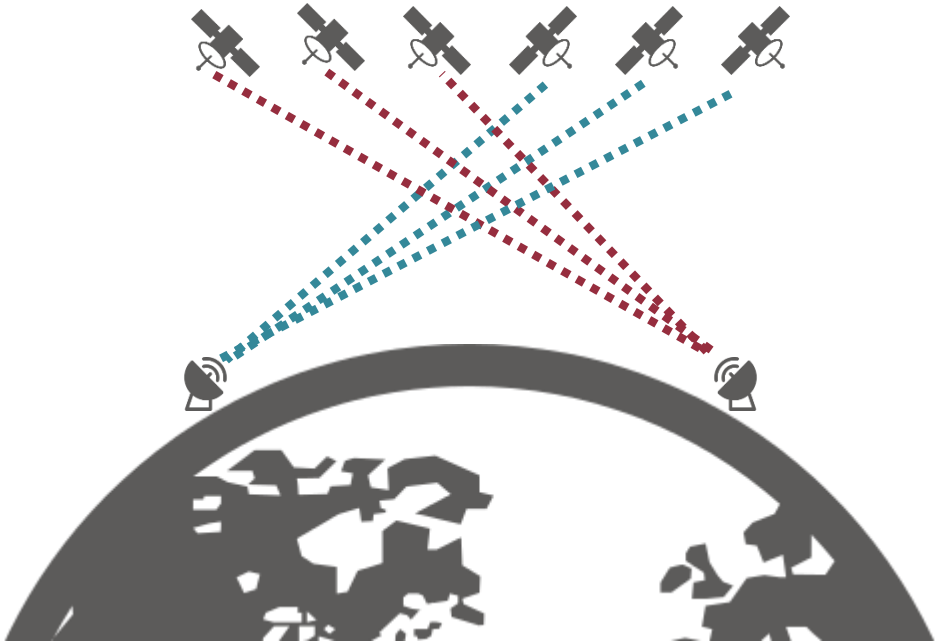
Source: Doc. CMR15/4(Add.2), RoP No. 9.6, Article 9

6. NGSO COORDINATION

PROBLEM

Coordination between NGSO FSS systems

- Identified based on frequency overlap (No. 9.12)
- No methodology to assess compatibility

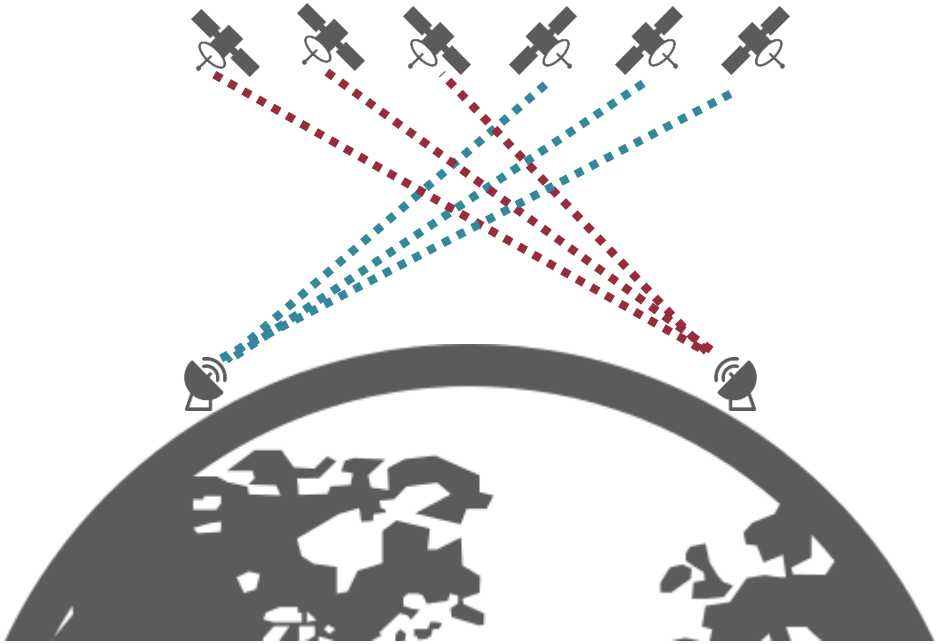


Source: Doc. CMR15/4(Add.2), RoP No. 9.6, Article 9

6. NGSO COORDINATION

SUGGESTION

- Agreed bilateral methodology could be used e.g. dynamic coordination, regular multilateral meetings etc.
- To consider status of changes in e.g. AP4 orbital characteristics, resulting from coordination agreement on the coordination date of receipt.
- WRC-15 may wish to study this issue further



Source: Doc. CMR15/4(Add.2), RoP No. 9.6, Article 9

7. BRINGING INTO USE

Current bringing into use practice

- One NGSO satellite at one orbital plane
- Capable to transmit or receive frequency assignment
- 90 days of operation

PROBLEM

Spectrum warehousing / “fictitious frequency assignments”

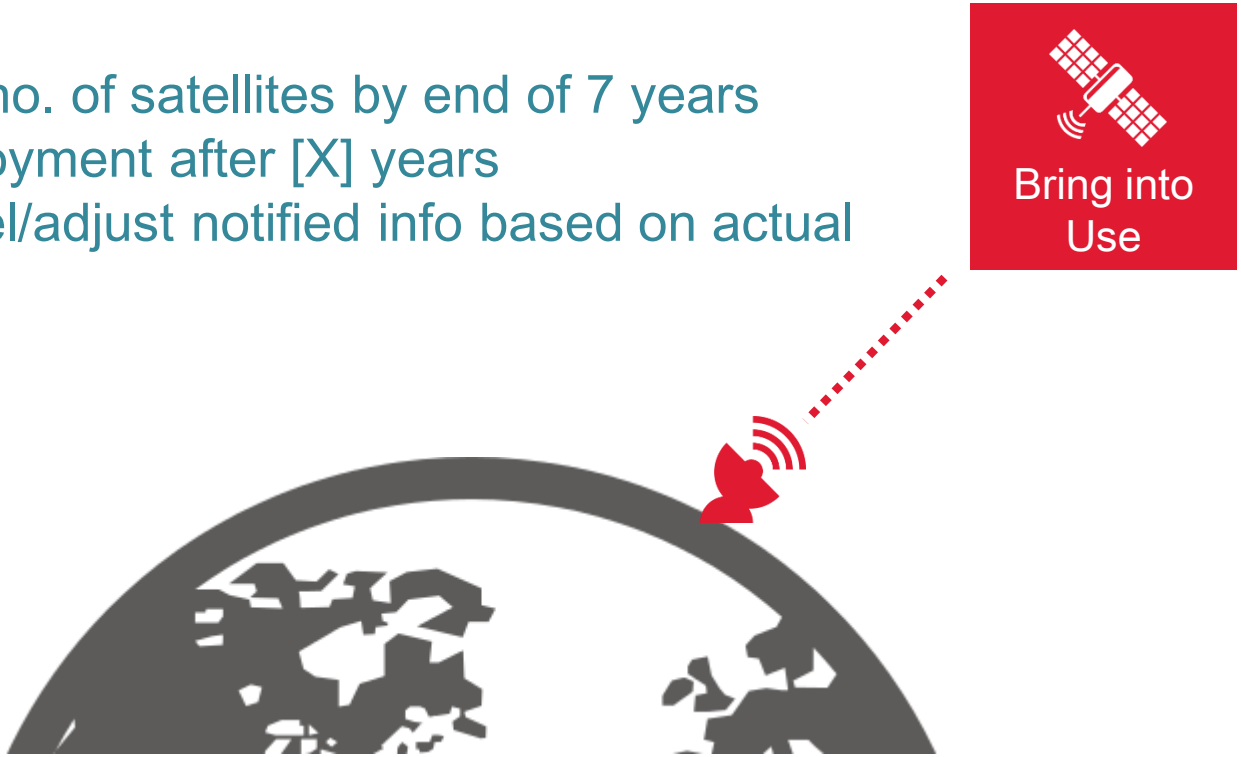
Source: Doc. CMR15/4(Add.2), Article 11

7. BRINGING INTO USE

SUGGESTION

Redefine BIU

- % of total no. of satellites by end of 7 years
- Total deployment after [X] years
- Else cancel/adjust notified info based on actual use



Source: Doc. CMR15/4(Add.2), Article 11

8. SMALL SATELLITES

ISSUE

- Secondary payloads
- No propulsion
- Unknown altitude

SUGGESTION

- Submit best estimate for apogee, perigee, inclination, min. transmitting altitude during API
- Update during notification

Source: Doc. CMR15/4(Add.2), Articles 9, 11, Appendix 4, image: cnes.fr

KEY POINTS

- WRC-15 should ensure all existing services protected considering growing interest in operating non-GSO FSS systems
- WRC-15 should prevent problem of spectrum warehousing / “fictitious frequency assignments” and provide real opportunity to use spectrum/orbit resource more efficiently
- More details on NGSO issues in BR Director's Report To WRC-15
  http://www.itu.int/md/R15-WRC15-C-0004/en

BR DIRECTOR'S REPORT TO WRC-15

Non-GSO Issues

Yvon HENRI

Chief of Space Services Department

International Telecommunication Union

Workshop on the Efficient Use of the Orbit/Spectrum Resource 2015