ITU Workshop on Efficient Use of Orbit/Spectrum Resource

SES
beyond frontiers

Bringing into use of frequency assignments for non-GSO systems

PRESENTED BY
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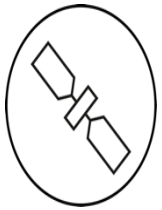
PRESENTED ON
30 August 2017 in Bangkok Thailand

SES - The World-Leading Satellite Operator

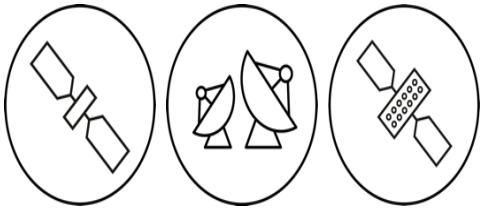


65

satellites covering

99%

of the globe and world population



Unique

GEO-MEO

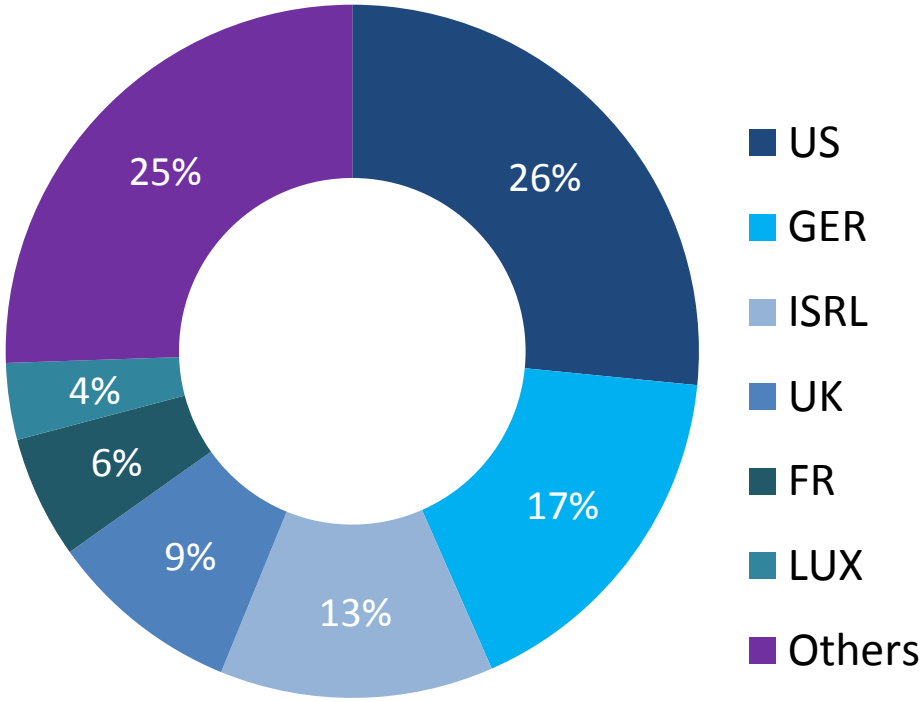
constellation complemented by a ground segment, together forming a flexible network architecture that is globally scalable

Driver of

INNOVATION

in next generation satellite development

Global Presence, International Team



2,000

employees of more than

65

nationalities in over

20

locations worldwide

EUR 2

billion annual revenue

*SES employees with a permanent SES employment contract, excl. externals and students/trainees

Leading Satellite Operator & Dynamic Market Leader

PARTNER OF CHOICE

serving over
700 broadcasters,
telcos, enterprises,
governments and
institutions in over
130 countries

Outline of Presentation

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Increased number of NGSO submissions to the ITU

NGSO systems – Current and Future

Lack of clarity in Radio Regulations

2 Studies within ITU-R

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Milestones for SES Option

3 Conclusion

INTRODUCTION

Increased number of NGSO submissions to the ITU

- Renewed interest for deploying space systems with global coverage and ubiquitous reach
- It is envisaged that this could be achieved by deploying NGSO satellite constellations with often large number of satellites
- Upward trend in the submission of NGSO (non-geostationary satellite orbit) filings to the ITU
  - Various frequency bands
  - Different types of orbits – LEO, MEO, HEO
  - Variation in number of orbital planes, inclination, number of satellites etc.
- This surge in NGSO filings at the ITU was captured in the BR Director's Report to WRC-15

Increased number of NGSO submissions to the ITU

Adm	Satellite Name	No. of Sats	LEO	MEO	HEO	Ku	Ka	Others	Max DBIU
CAN	102	774	LEO				Ka		27.05.2022
	CANPOL-2	51	LEO		HEO		Ka		19.04.2020
	COMMSTELLATION	891	LEO				Ka		06.05.2018
CHN	TXIN	60	LEO				Ka	Other	30.12.2021
CYP	ANDROMEDA-A	48	LEO				Ka		04.06.2021
D	COURIER-3	72	LEO				Ka	Other	13.06.2021
F	AST-NG-C-1	797	LEO	MEO			Ka	Other	08.04.2021
	AST-NG-C-2	4672	LEO				Ka	Other	04.12.2021
	ES-SAT-2	1428	LEO	MEO		Ku	Ka	Other	27.06.2021
	MCSAT LEO	774	LEO				Ka		18.12.2019
	MCSAT-2 HEO	312		MEO			Ka		29.01.2021
	MCSAT-2 HEO-1	36			HEO	Ku	Ka		29.01.2021
	MCSAT-2 LEO-1	72576	LEO			Ku			29.01.2021
	MCSAT-2 LEO-2	2772	LEO				Ka		29.01.2021
	MCSAT-2 MEO-1	1104		MEO		Ku			29.01.2021
	MCSAT-2 MEO-2	744		MEO		Ku	Ka		29.01.2021
G	L5	2692	LEO			Ku	Ka		27.11.2019 14.03.2020 18.07.2021
	O3B-C	840	LEO	MEO		Ku	Ka		02.09.2021
LIE	3ECOM-1	288	LEO			Ku	Ka		10.06.2021
	3ECOM-3	288	LEO			Ku	Ka		18.09.2021
LUX	CLEOSAT	60	LEO				Ka	Other	12.05.2022
NOR	ASK-1	7			HEO	Ku	Ka	Other	28.06.2020
	NORSAT-H1	4			HEO	Ku	Ka	Other	11.11.2021
	STEAM-1	3993	LEO			Ku			27.06.2021
	STEAM-2	3993	LEO				Ka		27.06.2021
RUS	SKY-F	24		MEO			Ka		05.10.2022
USA	HIBLEO-2FL2	66	LEO				Ka		09.06.2018 29.07.2021

Source: ITU Workshop on the Efficient Use of the Orbit/Spectrum Resource, 6 Sep 2016 in Bali Indonesia

NGSO systems – Current and Future

- Example of operational NGSO systems:
  - O3b – MEO, 1 equatorial plane, 12 satellites, Ka band
  - Iridium – LEO, 6 orbital planes, 66 satellites, L/Ka bands
  - Globalstar – LEO, 8 orbital planes, 32 satellites, C/L/S bands

- Upcoming NGSO systems:
  - OneWeb – LEO, 648 satellites, Ku band, 2018
  - LeoSat – LEO, 108 satellites, Ka band, 2019
  - SpaceX – LEO, 4425 satellites, Ku/Ka bands, 2019

Lack of clarity in the Radio Regulations

- WRC-15:
  - examined issue of BIU of frequency assignments for NGSO systems
  - unable to conclude on the issue
  - but recognised lack of specific provisions in the Radio Regulations
  - Plenary Minutes recognized as important issue for study
  - Invited ITU-R to study the matter under Agenda item 7 – develop regulatory provisions with milestones

- Why are the current provisions unclear?

BR considers that a frequency assignment to any NGSO system has been brought into use when:

- there is at least one satellite at one of the notified orbital planes
- deployed for continuous 90 days
- Capable of transmitting & receiving in notified frequency assignments

- Lack of clarity in the RR may lead to possible spectrum warehousing

Lack of clarity in the Radio Regulations

11.44 (MOD RRB12/61)

1 The information concerning the date of bringing into use is to be provided in the following occasions:

– in AP4 notice forms when submitted under No. **11.15**; and

– in the confirmation of the date of bringing into use under Nos. **11.44.2**, **11.47** and **11.44B**.

It should be noted that the information concerning the date of bringing into use shall be provided for each assignment or group of assignments. (See also the Rules of Procedure concerning No.**11.44B**).

2 The Board considered the information to be provided for the bringing into use of any frequency assignment to space stations of a non-geostationary satellite system in the FSS or MSS prior to the adoption of regulatory provisions by a future world radiocommunication conference and concluded as follows:

In order to consider any frequency assignment to a space station of a non-geostationary satellite system as having been brought into use, the notifying administration has to inform the Bureau that at least one space station with the confirmed capability of transmitting or receiving that frequency assignment has been deployed for a continuous period of ninety days on one of the notified orbital planes of the non-geostationary satellite system, irrespective of the notified number of orbital planes and satellites per orbital plane in the system. The notifying administration shall so inform the Bureau within thirty days from the end of the ninety day period. A frequency assignment to a space station of a non-geostationary satellite system with a notified date of bringing into use more than 120 days prior to the date of receipt of the notification information shall also be considered as having being brought into use if the notifying administration confirms, when submitting the notification information for this assignment, that at least one space station with the capability of transmitting or receiving that frequency assignment has been deployed on one of the notified orbital planes of the non-geostationary satellite system and maintained for a continuous period of time from the notified date of bringing into use until the date of receipt of the notification information for this frequency assignment. The date of deployment of the first satellite at its intended orbit shall be within the seven-year time limit for bringing frequency assignments to a space station into use under No. **11.44**. (MOD RRB16/58)

Rules of Procedure (ROP) on No. 11.44 was modified and approved at the 73rd meeting of the Radio Regulations Board (RRB)

Purpose of modification of ROP: to clarify the treatment by the Bureau of information on the BIU of NGSO satellite networks received between WRC-15 and WRC-19

STUDIES WITHIN ITU-R

Issue A of Agenda item 7

- Agenda item 7: standing Agenda item (AI) to consider possible changes to satellite coordination, notification and recording procedures
- This issue concerning the BIU of frequency assignments to NGSO systems is known as Issue A of Agenda item 7
- Working Party 4A (WP 4A):
  - responsible for conducting studies for AI 7
  - tasked to develop regulatory provisions with milestones for Issue A
  - the 3rd meeting was from 3-12 May 2017 in Geneva
- Currently there are 6 methods to resolve Issue A
- The aim of the next WP 4A meeting in October 2017 is to reduce these options

Current Options for Issue A

Options	Short description
1	Incorporate the existing ROP for No.11.44 into the RR • Reflects the current practice of the BR. Could challenge filing under No. 13.6
2	Milestone-based approach • Contains multiple options for each milestone ie Initial, Intermediate and Final. If conditions in each milestone are not met, there are regulatory consequences such as the reduction of filing parameters
3	Incorporate the existing ROP for BIU; add milestones for notification and recording of frequency assignments • Milestone-based approach contained in new WRC Resolution. 3 configuration deployment milestones ie Minimum, Interim and Final. If deployment of configuration not met, BR will align the system parameters recorded in the MIFR to match the actual system deployed
4	Adjust satellite network filing based on real satellite conditions • Same BIU principles as GSO networks. If BR finds discrepancies between operational parameters and filing, BR shall published the new notification of the satellite network based on the actual parameters.
5	BIU based on Minimum satellite constellation criteria (MSCC) • Phased approach with milestones. Completion of BIU based on specified number of NGSO space stations in all orbital planes means full NGSO BIU, else it is partial NGSO BIU. Failure to comply with MSCC (either full or partial) results in cancellation of filing
6	Milestone approach with BIU factor • Allows constellation to be scaled up based on number of satellites already launched. Subject to penalties if milestones are not met

Principles for SES Option

- Proponent of Option 6, but is updating method based on the following principles:
  - Have 3 stage milestone methodology of different periods ie 7 years; 7+2 years; 7+2+3 years
  - Have tests at each milestone, where a certain percentage of the satellites in the filing are launched 1% at 7 years; 20% at 7+2 years; 75% at 7+5 years
  - Have penalties for failing to meet milestones: reduction of the number of satellites in filing based on number of satellites launched x BIUF
  - A BIU Factor (BIUF): parameter to scale up the constellation deployment based on the number of satellites that have been launched
  - Scaling up never allows more satellites than original number filed

  Example:

  If an operator launched 10 NGSO satellites within 7+5 year period

  Assuming BIUF of 5, Operator is allowed to launch 10*5 satellites by the end of the overall 7+5 year period

Milestones for SES Option

Milestone	Description
1	Regulatory period: within 7 years from coordination request information or API submission Criteria: • Minimum 1% of satellites in filing are launched. Fail to meet this, entire filing cancelled
2	Regulatory period: 7+2 =9 years Criteria: - if number of satellites launched ≥ 20% of number of satellites originally filed then PASS. - if number of satellites launched < 20% of number of satellites originally filed then FAIL. • the MIFR will be amended and number of satellites filed will be capped at the Maximum Number of Satellites (MNS): MNS = number of satellites launched at this milestone * BIUF of 5 The BIUF of 5 is used to allow future expansion of the constellation but at the same time limits this maximum number of satellites based on that the number of satellites already launched.
3	Regulatory period: 7+2+3 =12 years Criteria: - if the number of satellites launched ≥ 75% of the number of satellites originally filed (NSF) then PASS - if the number of satellites launched < 75% of the number of satellites originally filed (NSF), then FAIL • the MIFR will be amended; the number of satellites filed will be capped at minimum of (MNS and MNS 2), where: MNS 2 = number of satellites launched at this milestone * BIUF of 1.34 - If the number of satellites that can be brought into use has been capped at milestone 2, the number of satellites that can be brought into use at milestone 3 cannot exceed the milestone 2 capped value.

Milestones for SES Option

Assumption: number of satellites filed originally recorded in the MIFR is 100

Milestone 1	
Minimum 1% of NSF launched	
PASS	FAIL
If 1 satellite launched 1% of 100 MIFR:100	Filling cancelled

Milestone 2	
≥ 20% of NSF launched	
PASS	FAIL
If 20 satellites launched 20% of 100 MIFR:100	If 15 satellites launched BIUF of 5 MNS: 15x 5=75 MIFR: ~~100~~75

Milestone 3			
≥ 75% of NSF launched			
Passed Milestone 2		Failed Milestone 2	
PASS	FAIL	PASS	FAIL
If 75 satellites launched 75% of 100 MIFR:100 Remaining 25 satellites can be launched at anytime	If 50 satellites launched BIUF of 1.34 MNS2: 50*1.34=67 MIFR: ~~100~~67 Remaining 17 satellites can be launched at anytime	If 75 satellites launched 75% of 100 MIFR:75 Number of satellites already capped by milestone 2 to 75	If 40 satellites launched BIUF of 1.34 MNS2: 40*1.34=54 MIFR: min(75,54)= 54

NSF: Number of satellites filed originally recorded in the MIFR
MIFR: number of satellites in filing recorded in Master Register
Maximum number of satellites in Milestone 2: MNS
Maximum number of satellites in Milestone 3: MNS2

CONCLUSION

Conclusion

- SES position:
  - Support a BIU procedure which minimises abuse by speculative players and provides regulatory certainty to real NGSO systems.
  - Prevent filings with 100’s of satellites from being brought into use with only one satellite
  - Extend period of BIU to recognize NGSO systems take longer to deploy
  - Extension period should not be longer than 12 years to allow other later priority and GSO systems to develop
  - Milestones developed to ensure satellite deployment is progressing over the extension period
- It is beneficial to have more clarity in the provisions relating to the BIU of NGSO frequency assignments
- This leads to more efficient use of the limited orbit/spectrum resource

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