Proposed positions for NGSO related WRC-23 AIs 1.16 and 1.17

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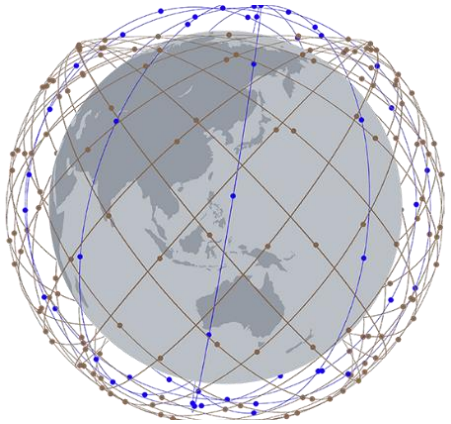
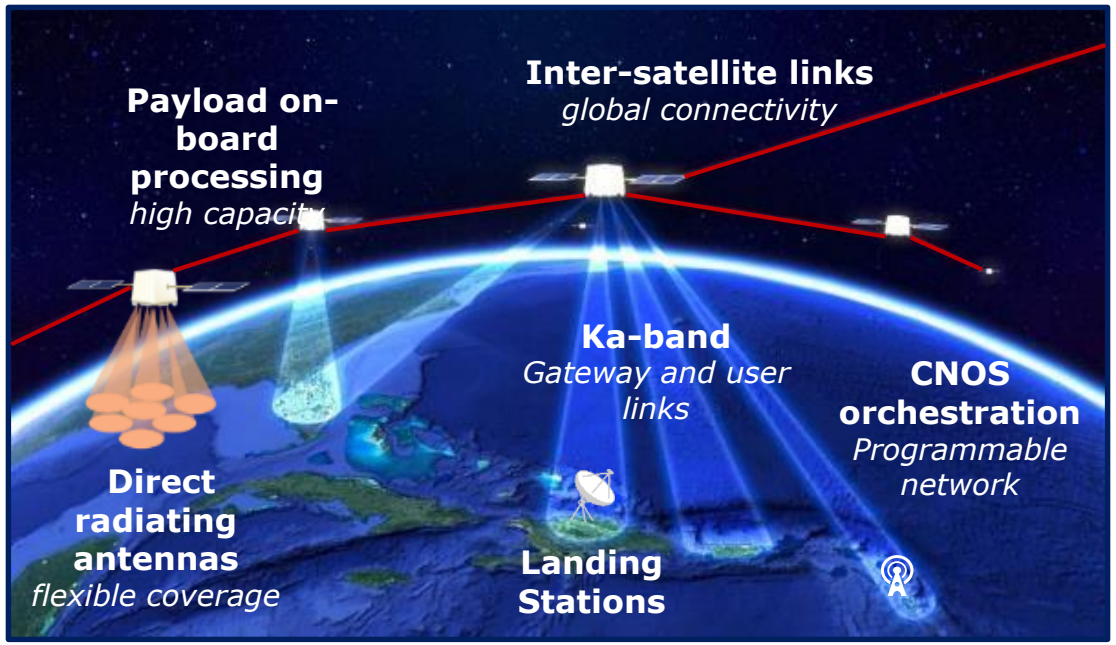
Telesat Lightspeed a highly innovative global network at Low Earth Orbit



Polar Orbit Inclined Orbit



- √ **298 satellite constellation** with optical inter-satellite links, full global coverage from pole to pole
- √ **78 polar satellites** in 6 orbit planes at 1,015 km and **220 inclined satellites** in 20 orbit planes at 1,325 km
- √ ~35 times closer to Earth than traditional satellites for **fibre-quality low latency**
- √ **~4 GHz Ka-band spectrum** and ~135,000 agile beams to flexibly connect small to very large sites (few Mbps to multiple Gbps links)
- √ Ka-band spectrum for both User Terminal (service) links and Landing Stations (feeder) links
- √ End-to-end (space + ground) network for **quick and economic** connectivity to remote sites, to be compliant with MEF standards
- √ Multiple satellites and ground nodes for **resilient, always-on** connectivity to rural and remote areas
- √ US$5B capex with **flexible, state-of-the-art design** delivers most competitive unit economics
- √ **Scalable architecture,** addition of satellites will increase capacity deliverable by the network

WRC-23 Agenda Item 1.16:

Enabling Ka-band NGSO Earth Station In Motion (ESIM)

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WRC-23 AI 1.16 – NGSO ESIM in Ka-Band

▲ *"… to facilitate the use of the frequency bands*

17.7 – 18.6 GHz and 18.8 – 19.3 GHz and 19.7 – 20.2 GHz (space-to-Earth)

27.5 – 29.1 GHz and 29.5 – 30 GHz (Earth-to-space)

by NGSO FSS ESIM, while ensuring due protection of existing services in those bands…" – **Resolution 173 (WRC-19)**

▲ GSO ESIM are already implemented in the Ka-band

▲ Technical and operational characteristic of NGSO ESIM are very similar to the GSO ESIM. Similarity should be reflected also in sharing studies.

- In the European region, NGSO ESIM have been successfully introduced since 2015 with ECC/Decision(15)04.

▲ Allowing NGSO ESIM in Ka-band will:

- allow fiber-like connectivity with low latency;
- support the need for affordable, ubiquitous, fiber-quality broadband connectivity also on the move; and
- provide a harmonized international framework for the use of ESIM, including ensuring protection of existing services

Progress of ITU-R Studies – AI 1.16

- The July WP 4A Meeting continued to work on the following documents:
  - ELEMENTS TOWARDS A WORKING DOCUMENT ON WRC-23 AGENDA ITEM 1.16 [NON-GSO_ESIM]
  - WORKING DOCUMENT TOWARDS DRAFT CPM TEXT FOR WRC-23 AGENDA ITEM 1.16
  - DRAFT NEW RESOLUTION FOR WRC-23 AGENDA ITEM 1.16
- CG 1.16 held on 28 Sep proposed additional work on the draft new Resolution
- Discussion on the need for a methodology for BR to assess compliance of NGSO ESIM complying to relevant Resolutions under this Agenda Item
  - Proposal for transitional measures to be developed until an agreed BR methodology is established

Protection of Space and Terrestrial services – AI 1.16

▲ Protection of space services

- Downlink:
  - The ESIM is receiving a signal from non-GSO satellite, no different than any non-GSO FSS
  - For protection of GSO FSS in 17.8-18.6, 19.7-20.2 GHz, NGSO ESIM shall comply with applicable epfd limit in Article 22
- Uplink
  - Non-GSO ESIM to remain within the characteristics and coordination envelope of the ITU filing (similar to GSO ESIM in Resolution **169**)
  - For protection of GSO FSS in 27.5-28.6 GHz and 29.5-30.0 GHz, non-GSO ESIM shall comply with epfd limit in Article **22** to protect GSO FSS.

▲ Protection of terrestrial services

- Downlink: The ESIM is receiving a signal from non-GSO satellite, no different than any non-GSO FSS. Non-GSO ESIM shall not claim protection from terrestrial services
- Uplink
  - 27.5-29.1 GHz: WRC-19 decided in Resolution **169** for conditions to protect Terrestrial services from GSO ESIM. The limits for A-ESIM corresponds to PFD mask on the ground and for M-ESIM corresponds to EIRP spectral density towards the horizon and distance from the low-water mark. Studies to confirm the appropriate limits to protect Terrestrial services from non-GSO ESIM.

APG23-2 Preliminary Views – AI 1.16

▲ No APG 23-2 Preliminary views under this Agenda Item

▲ Discussions during APG23-2:

- Results of on-going sharing and compatibility studies carried out between NGSO ESIMs and existing services allocated in those frequency bands and the adjacent bands should ensure protection of these services, in accordance to Res **173 (WRC-19)**
- Appropriate examination methods of any measures to be taken by the Radiocommunications Bureau (BR) for NGSO ESIM to comply with resolutions dealing with this Agenda Item should be established to ensure the protection of terrestrial services and space services

Telesat's Views:

- **Supports the development of a regulatory framework for the operation of ESIM communicating with NGSO FSS satellite systems in Ka-band similar to that already agreed at WRC-19 for GSO ESIM**
- **Supports the current positions of both CEPT and CITEL**
- **Supports the development of a BR methodology prior to the end of WRC-23, where possible.**

Proposed Preliminary Position – AI 1.16

- Supports studies to develop technical conditions and regulatory framework for the use of the frequency bands 17.7-18.6GHz and 18.8-19.3GHz and 19.7-20.2GHz (space-to-Earth) and 27.5-29.1GHz and 29.5-30GHz (Earth-to-space) by non-GSO FSS earth stations in motion, similar to that of GSO ESIM, while ensuring due protection of existing services in those frequency bands.
- Non-GSO ESIM operating in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (see No. 5.524) shall not claim protection from terrestrial services to which the frequency band is allocated and operating in accordance with the Radio Regulations
- For the protection of space services: Non-GSO ESIM characteristics shall remain within the envelope characteristics of typical earth stations associated with the non-GSO satellite system with which these ESIM communicate
- For the protection of GSO FSS networks operating in the 17.8-18.6 GHz, 19.7-20.2 GHz, 27.5-28.6 GHz and 29.5-30.0 GHz: the applicable EPFD limits in Nos. 22.5C, 22.5D and 22.5F shall apply. The methodology included in Recommendation ITU-R S.1503 for determination of compliance with EPFD limits in Article 22 applies to ESIMs communicating with non-GSO FSS systems. Depending on the outcome of ITU-R studies, additional provisions may be needed to ensure protection of other systems.
- While an appropriate examination methodology may be established for NGSO ESIM to comply with Resolutions dealing with this Agenda Item, adequate transitional measures could be developed if the methodology is not finalized by WRC-23.

Summary of other Regional Views – AI 1.16 (1 of 2)

ASMG	- **Follow and support the studies** - No additional restrictions are imposed on earth stations of GSO FSS - Ensure the protection the existing services in these band
ATU	- **Support studies towards development of regulatory framework** for the use of frequency bands by NGSO FSS ESIMs
CEPT	- **Support the development of a regulatory framework** for NGSO ESIM - Ensure the protection of GSO systems and other services - NGSO ESIM receiving in the 18 GHz band shall not claim protection from terrestrial services - Protection of GSO networks in the frequency bands 27.5 – 28.6 GHz and 29.5 – 30 GHz from NGSO ESIM can be achieved by complying with No.**22.5D.** - Protection of GSO networks and NGSO systems in the frequency band 28.6 – 29.1 GHz shall be achieved on the basis of coordination agreement between administrations and operators in accordance with No.**9.11A**

Summary of other Regional Views – AI 1.16 (2 of 2)

CITEL	- **Support studies** on the technical and operational characteristics of ESIM and sharing and compatibility studies to develop technical and regulatory provisions in accordance with Resolution 173 (WRC-19) - Studies that were conducted to support the deployment of GSO ESIM in the Ka-band have many **similarities with those that are being carried out under Resolution 173**(WRC-19). WRC-23 should aim to establish the same technical, operational and regulatory provisions.
RCC	- ESIM should **operate within the envelope of typical ES** - In the 18GHz band NGSO ESIMs shall not claim protection from terrestrial services operation - RR provisions for protection of GSO network from non-GSO FSS shall not be affected - Measures to exclude unauthorized use of ESIM in the territory of States that have not granted relevant authorizations are needed.

WRC-23 Agenda Item 1.17:

Enabling Inter-Satellite Links in portions of the Ku and Ka frequency bands

WRC-23 AI 1.17 – Inter-Satellite Links (ISLs)

- *"to determine and carry out… the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate"* - **Resolution 773 (WRC-19)**
- Frequency bands in consideration under this AI:
  - 11.7 – 12.7 GHz
  - 18.1 – 18.6 GHz
  - 18.8 – 20.2 GHz
  - 27.5 – 30 GHz
- There is a growing interest for utilizing ISLs for a variety of applications, for example
  - As a data transport layer, where there is limited access to Earth stations (e.g. over the oceans)
  - For most Earth observation and space science missions, data-download to the ground is a bottleneck as well as a key design driver. The possibility of relaying data to the ground via satellite-to-satellite links is a possible remedy to the existing limitations
  - Useful also for real or near-real time data applications, such as disaster management

Progress of ITU-R Studies - AI 1.17

- Discussed on the technical specifications and operational characteristics of different types of space stations that plan satellite-to-satellite transmissions

- Satellite-to-satellite links being considered are:
  - NGSO to GSO; and
  - NGSO to NGSO of different altitudes.

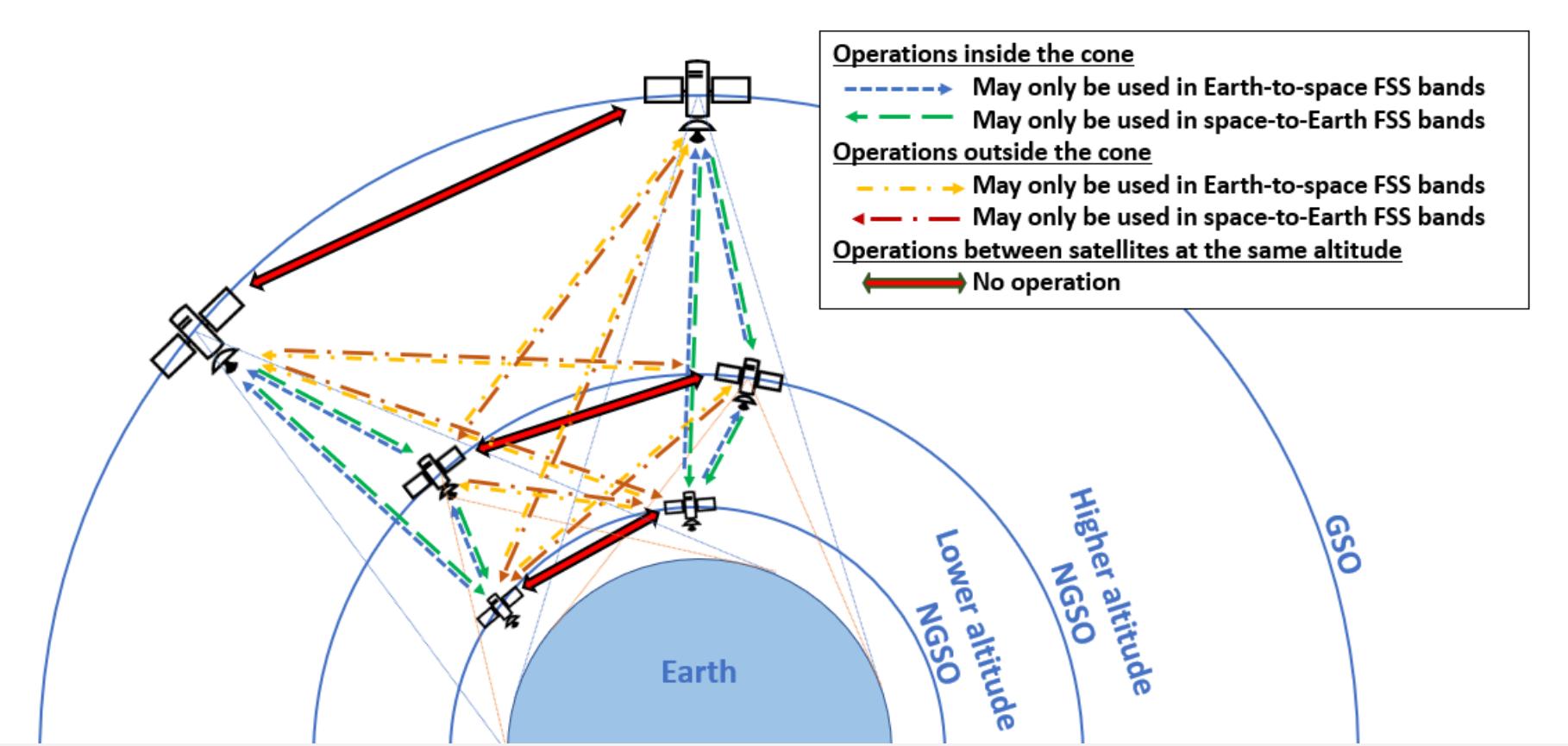
- Both Concept of Operations discussed and agreement for them to be included in Working Document (see next slide)

- Some preliminary sharing studies submitted

- Agreement that ISLs operations should be in the same transmission direction to those of the existing FSS allocation

Concept of Operations – AI 1.17

- Direction of transmission is limited to those of the existing FSS allocation
- Two Concepts of Operations have been discussed, as illustrated below



APG 23-2 Preliminary View – AI 1.17

APT Preliminary Views: **Support ITU-R studies on the sharing and compatibility as well as to develop technical and regulatory provisions in accordance to Res 773 (WRC-19)**

Discussions during APG 23-2:

- There was no contentious issue and the discussion was brief, also as all input contributions were in general agreement
- All contributions are supportive of the existing ITU-R studies under this AI

Telesat's Views:

- Views consistent to APG 23-2 Preliminary View

Proposed Preliminary Position – AI 1.17

- Support on-going studies under both concepts of operations (i.e. within the cone of coverage and expanded cone) under current FSS allocations according to the FSS directionality indicators (i.e. Earth-to-space or space-to-Earth) in accordance to Res 773 (WRC-19).

- The user shall ensure the protection of primary services allocated in the bands and the adjacent bands.

Summary of other Regional Views – AI 1.17 (1 of 2)

ASMG	- **Follow studies** - Studies should be done on real registered NGSO constellation - ISLs should not impose restrictions on GSO, NGSO satellites as well as existing services - ISLs will ensure the same protection levels for GSO, NGSO satellites and existing services as stipulated in the Radio Regulations
ATU	- **Support ongoing sharing and compatibility studies** - **Support allocation of satellite-to-satellite transmissions** within current FSS allocation, with same directional indicators as in FSS - Support the "within the cone of coverage" concept of operations - Encourage execution of sharing studies on the "expanded cone" concept of operations - Avoid a new ISS allocation in these core FSS bands
CEPT	- **Support the development of a regulatory framework** to enable ISLs - ISLs must ensure the same level of protection for terrestrial services and GSOs/NGSOs as currently provided in the RR and must not impose new constraints

Summary of other Regional Views – AI 1.17 (2 of 2)

CITEL	- **Support studies** to **consider technical and regulatory provisions** to allow ISLs - **Support confining studies to links that operate in the same direction of transmission** as provided for in the current allocations and confined to satellite located on different orbits.
RCC	- **Support the studies** of technical and operational characteristics, including spectrum requirements, off-axis e.i.r.p. values and out-of-band emission limits, for transmissions between space stations. - **Support studying sharing and compatibility** between ISLs and current and planned stations of the FSS and other existing services allocated in the same frequency bands and in adjacent bands. - **Technical conditions and regulatory provisions should be developed** for different types of space stations

Conclusion

Conclusions

AI 1.16

- GSO ESIM related agenda items have been successfully resolved in past two WRCs
- Considerable technical similarities between GSO and NGSO ESIM
- Support the development of a regulatory framework for the operation of ESIM communicating with NGSO FSS satellite systems in Ka-band similar to that already agreed at WRC-15 & WRC-19 for GSO ESIM.
- Administrations to actively participate in the studies and take a favorable position towards allowing ESIM to operate with NGSO FSS systems
- A globally harmonized regulatory framework will facilitate deployment of newer NGSO ESIM constellations in the Ka-band which provides affordable ubiquitous connectivity, while protecting incumbent services

AI 1.17

- WRC-23 AI1.17 provides opportunities for additional satellite applications
- Support on-going studies in ITU-R WP4A, under both concept of operations and with a technologically neutral approach, to determine the feasibility of ISL with the development of a Resolution

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