TELESAT

COMMENTS OF TELESAT

In response to the consultation
24 – 30 GHz use in New Zealand Discussion Document - April 2021

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Telesat is grateful for the opportunity to respond to the "24 – 30 GHz use in New Zealand Discussion Document" and applauds the RSM on its transparent process in industry engagement to solicit views for the future use in this frequency range. Information in the document covers RSM's preliminary proposal on band planning, licensing options and technical considerations across the two main frequency bands – the 26 GHz band (24.25 – 27.5 GHz) as well as the 28 GHz band (27.5 – 29.5 GHz).

In general, Telesat is aligned to some of RSM's preliminary views in the discussion document, particularly on the allocation of the 28 GHz for Fixed Satellite Services ("FSS") for both geostationary and non-geostationary satellite constellations, with IMT allocation in the 26 GHz band.

Prior to the provision of responses, Telesat would like to provide an introduction of the satellite services provided, particularly on Telesat's Low Earth Orbit ("LEO") satellite constellation, also known as Telesat Lightspeed. Further background information on Telesat may be found at the last page of this document.

On this note, Telesat understands that the current Gazette notices[1] for the relevant Satellite Services General User Radio Licences ("GURL") are also applicable to non-geostationary satellite systems, although licence conditions that support NGSO operation may need to be reviewed after the outcome of Agenda Item 1.16[2] of WRC-23. For the purpose of clarity, Telesat would appreciate confirmation of this understanding.

For this consultation, Telesat would respond to 14 questions which are relevant to the market access and imminent deployment of Telesat Lightspeed in New Zealand.

[1] The relevant satellite services GURL include the Satellite Services GURL (https://gazette.govt.nz/notice/id/2017-go2843), GURL for Maritime Purposes (https://www.gazette.govt.nz/notice/id/2016-go6223) and GURL for Aeronautical Purposes (https://gazette.govt.nz/notice/id/2016-go5553).

[2] WRC-23 Agenda Item 1.16 aims to study and develop technical, operational and regulatory measures, as appropriate, 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) and 27.5 – 29.1 GHz and 29.5 – 30 GHz (Earth-to-space) by non-GSO FSS earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with **Resolution 173 (WRC-19)**. (https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000D0016PDFE.pdf)

Telesat Lightspeed

In Feb 2021, Telesat announced Thales Alenia Space to be the prime contractor for Telesat's LEO constellation, now known as Telesat Lightspeed[3]. Telesat Lightspeed satellites will begin launching in approximately two years, with customer trials completed by end 2023 and commercial services commencing in 2024.

Telesat Lightspeed is a highly innovative global network consisting initially of 298 state-of-the-art Low Earth Orbit satellites, in polar and inclined orbits, seamlessly integrated with on-ground advanced data networks, which will facilitate low latency and a fibre-equivalent experience globally at any time.

A variety of fixed and mobile user terminals across different industry verticals would access Telesat Lightspeed constellations via the user links. Feeder link connectivity to all satellites will be ensured via approximately fifty "landing stations" worldwide consisting of sites with multiple full motion antennas accessing the satellites within the landing stations' field of view. Each of these landing stations would be connected to a Point of Presence which would meet the customers' point of interconnect.

Telesat Lightspeed will be compliant with Metro Ethernet Forum standards, allowing Telesat Lightspeed services to be integrated seamlessly into existing telecommunications networks. This standards-based approach will make it easy for Telesat's potential customers to implement Telesat Lightspeed as a core component in their broadband infrastructure and operations.

This is also a future-proof solution for backhaul cellular/5G traffic and will provide high-speed broadband access to rural and remote communities, planes, ships, enterprise and government users. Furthermore, as a highly advanced and efficient system with unparalleled economies of scale (multiple Tbps of usable capacity with global coverage), Telesat Lightspeed will deliver to target markets at significantly lower cost vs traditional alternatives.

In terms of frequency bands, Telesat Lightspeed uses the 17.8 – 18.6 GHz and 18.8 – 20.2 GHz bands in the space-to-Earth direction, and the 27.5 – 29.1 GHz and 29.5 – 30.0 GHz bands in the Earth-to-space direction for user terminals such as Earth Stations in Motion ("ESIM"), VSATs and the landing stations.

To maximise system efficiency, Telesat Lightspeed is also designed as a highly flexible system that will dynamically allocate capacity based on demand. In terms of coverage, each satellite in the constellation will be designed with steerable beams

[3] More information detailing our vendor selection and the next-generation technology that is incorporated into the Lightspeed satellites may be found under Telesat's Press Release "Telesat to redefine Global Broadband Connectivity with Telesat Lightspeed, the World's Most Advanced Low Earth Orbit (LEO) Satellite Network" (https://www.telesat.com/press/press-releases/manufacturer-announcement/, 9 Feb 2021).

and inter-satellite links, and in terms of bandwidth and power assignment, by means of onboard processing.

Specifically:

• Direct Radiating Array – Provide independent agile beams, each with steering and forming capabilities, allowing beams to be generated where and when required based on traffic demand;

• On-board Processing – Perform signal regeneration (i.e. demodulation and re-modulation), routing of traffic;

• Optical Inter-Satellite Links ("ISL") – Multiple ISL beams on each satellite will connect to other satellites in the Telesat Lightspeed Constellation enabling a highly resilient mesh network.

Satellite user beams will be formed using active array antennas with state-of-the-art beam-forming capability. Each Telesat Lightspeed satellite will have several independently steerable beams that allow frequency reuse.

In order to serve user terminals, which may be randomly scattered across the entire field of view of the satellite, each satellite beam may hop to different beam locations at a rate fast enough that all user terminals share full access to the satellite. Beam hopping is a powerful capability that will allow the Telesat Lightspeed to efficiently serve both highly distributed and highly concentrated demand.

For maximum flexibility, each beam can be assigned variable spectrum and power, in order to adjust for the local demand and spectrum regulatory constraints.

Responses to selected questions from Discussion Document

Q2 What are the likely use cases for Ka band satellite services in New Zealand in the short and long term?

As the RSM has correctly pointed out on page 10 of the document, "the Ka band has become an increasingly popular choice for newer satellite systems". There is also a heightened interest within the satellite industry to move towards NGSO networks, in view of the lower latencies, which would further increase the number of satellite use cases.

As a satellite operator planning to launch the most advanced and capable LEO constellation, Telesat's response on the use cases in New Zealand is based on the vast applications which Telesat Lightspeed can support.

In general, satellite services can provide connectivity in regions where terrestrial services are limited and can be utilised as redundancies (or alternatives) in areas where terrestrial solutions are in place. The emphasis on high quality connectivity has been further amplified during the COVID-19 pandemic, where everyone has been highly encouraged to telecommute.

Furthermore, Telesat agrees with the RSM that satellite services can be used to complement the existing mobile service coverage to the remote communities in New Zealand through their use as a mobile network backhaul. In a similar manner, they can also be used as a fixed wireless backhaul. Specifically, Telesat Lightspeed will offer high-speed, high-capacity broadband connectivity, with performance equivalent or superior to terrestrial networks with respect to security, resiliency and latency up to 50ms return.

At the enterprise level, Telesat has observed an increasing number of companies with global site offices that are heavily reliant on connectivity for their perpetual access to a centralised corporate network. The use of satellite services serves as an alternate form of redundancy and acts as a possible means of data-offloading through a dedicated private network. Telesat expects such demand to also come from multinational corporations headquartered in New Zealand.

Within the aeronautical industry, there is an increasing interest towards in-flight connectivity and a focus on gate-to-gate passenger experience. Satellite services can offer global coverage across the entire flight path for passengers, including the polar regions. The global coverage means that New Zealand passengers would be provided with a consistent in-flight fibre-like connectivity experience throughout their journey. In regions where there is a huge demand for high capacity (such as airport hubs and high traffic airspace), some satellite systems, including Telesat Lightspeed, can dynamically place multiple beams within the hotspots to meet these demands.

With true global coverage designed to serve all sea routes including emerging polar routes, satellite services will meet the unique remote-to-shore connectivity

requirements critical to the modern maritime industry. From the "moving city" nature of cruise ships to unique operational needs of merchant shipping, innovative satellite services could offer multiple Gbps link speeds and Tbps of capacity to meet passenger demands for seamless Virtual Private Network ("VPN"), encrypted web pages, e-commerce and entertainment applications, as well as real-time internet streaming for crew morale and welfare.

Moreover, with increased reliance on technology towards the development of autonomous and semi-autonomous ships[4], there is a higher dependency on real-time operational information exchange with shore stations for any decision making and any optimisation of the vessel's performance. This low latency and high throughput for the required dedicated communications link can be achieved with LEO satellite solutions.

On a governmental level, the use of satellite solutions would benefit governmental applications such as humanitarian disaster aid relief, which would allow the quick deployment of user terminals. Usage of satellite connectivity in such instances can aid rescue efforts by easing coordination and harmonization between disaster relief agencies and government agencies.

The importance of such command and control is equally as important to the New Zealand defence industry with the need to coordinate between ground, air and sea units as one integrated entity. A novel satellite system, like Telesat Lightspeed, with high system availability/security, global footprint and low latency can confidently provide such wide area communications across the New Zealand defence network for its operations internationally, including areas where terrestrial connectivity may not be readily available. Apart from operational use, satellite services can also be leveraged upon to provide cloud connectivity, and recreational-related applications as part of the welfare for duty-personnel.

In addition, oil and gas industries could also leverage on Telesat Lightspeed to provide high speed, low latency connection to their offshore platforms (such as oil rigs) for the purposes of enterprise traffic for operations and overall control as well as a means of telecommunications and connectivity for crew on board.

Q3 What are the spectrum requirements for ESIM use in New Zealand?

With the increasing number of applications which require a high throughput and low latency for real-time transmission of data (such as live video streaming services), there is a need for ESIM terminals to have access to the full 27.5 – 30

[4] https://www.forbes.com/sites/bernardmarr/2019/06/05/the-incredible-autonomous-ships-of-the-future-run-by-artificial-intelligence-rather-than-a-crew/?sh=1f609d0e6fbf

GHz of spectrum. Telesat would encourage RSM to open up the entire 28 GHz of spectrum band for ESIM use in New Zealand.

Specifically, Telesat Lightspeed is planned for operations within the 27.5 – 29.1 GHz and 29.5 – 30 GHz in the earth-to-Space direction and 17.8 – 18.6 GHz and 18.8 – 20.2 GHz in the Space-to-earth direction.

Overall, the possible limitation of ESIM operation to the upper portion of the 28 GHz band is even more constraining for NGSO systems than for GSO networks.

Q6 Do you agree New Zealand should allocate 24.25 – 27.5 GHz primarily for IMT use?

Telesat is of the view that the 26 GHz (24.25 – 27.5 GHz) should be allocated primarily for IMT use (including private IMT networks).

This is consistent to the two outcomes of the WRC-19 highlighted by the RSM on page 2 relating to the:

1. Identification of the 24.25 – 27.5 GHz frequency band for IMT systems; and
2. Operations of ESIMs in the 27.5 – 29.5 GHz.

The 3.25 GHz of bandwidth will be more than sufficient to provide 800 MHz of spectrum to each of the three major Mobile Network Operators[5] with 850 MHz of remaining spectrum to accommodate the private IMT networks and the Fixed Wireless Access (if required). In addition, the RSM could also consider allocating other millimetre wave bands identified in WRC-19 (37 – 43.5 GHz and 66-71 GHz) to meet additional spectrum demand for mobile services. Availability of equipment within these frequency ranges will also be assured as the frequency bands have been globally harmonised for IMT.

This is in addition to the existing low and mid-range spectrum which RSM would have allocated, or planned for mobile allocation, in New Zealand.

Aligned to the endorsement by New Zealand during WRC-19 for the two agenda items on IMT identification and ESIMs use in the 26 and 28 GHz band respectively together with the sufficiency of spectrum for New Zealand MNOs in the 26 GHz band, Telesat would highly encourage the RSM to allocate the full 28 GHz band exclusively for satellite usage.

[5] https://www.globenewswire.com/news-release/2020/03/06/1996440/0/en/New-Zealand-Telecoms-Market-Outlook-to-2025-Operator-Profiles-Mobile-Broadband-Subscribers-Revenue-IoT-Market-Thematics-Opportunities.html#:~:text=New%20Zealand%20is%20a%20stable,underpinned%20by%20strong%20economic%20fundamentals

Q8 How do you see our proposal of the 28 GHz band allocation?

Telesat is in agreement with the RSM for the full allocation of the entire 28 GHz band for satellite use, including ESIM and NGSO satellite constellations providing broadband services.

As per Telesat's reply for Q6 and as the RSM has rightfully mentioned on page 17 of the Discussion Document, there is indeed sufficient spectrum for MNOs in the 26 GHz band. Also, with a clear decision of allocating 26 GHz for IMT and 28 GHz for satellite services, the RSM would enable New Zealand to reap the benefits of both mobile equipment availability in the 26 GHz band while still supporting the heavy investments made by satellite operators in the 28 GHz worldwide.

Hence, Telesat is strongly supportive of the **exclusive allocation** for satellite use in the 28 GHz band.

Q9 – Q12 Which option do you prefer for allocating the 28 GHz band? Or is there any other option for managing the shared use of IMT, ESIMs and FSS in the 28 GHz band?

If you prefer option 1, do you agree with the proposed sharing mechanism (defining satellite coordination zones) between IMT use and FSS ground stations?

If you prefer option 2, how much spectrum do you think RSM should allocate to ESIM, IMT private network/FWA? And what's the preferred spectrum placement?

Are there any other issues of sharing use between earth stations and ESIMs that you would like to bring to our attention?

Consistent to replies in Q6 and Q8, Telesat's preference is for the FSS gateway earth stations and all ESIMs to have full flexibility in the access to the frequency range 27.5 – 29.5 GHz throughout New Zealand.

As such, Telesat would like to propose for an "Alternate Option" as per below:

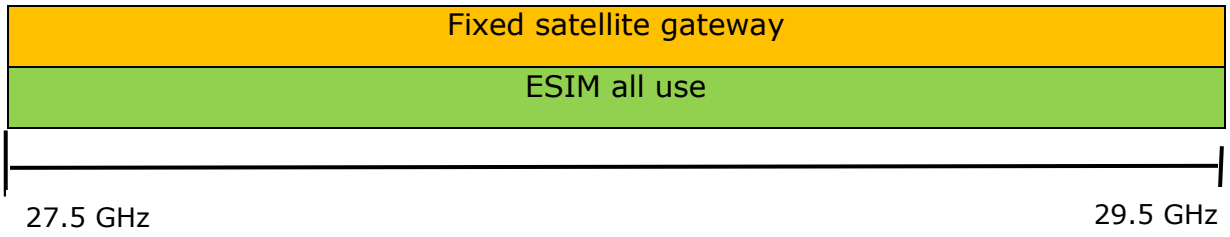

Figure 1: 28 GHz Alternate Option Allocation

The proposed new allocation is aligned to what Telesat has advocated in the previous replies. IMT private networks and FWA shall be accommodated in the

other frequency bands, such as the 26 GHz, with the reasons mentioned on the sufficiency of spectrum in the 26 GHz for IMT and FWA.

However, in the situation where the "Alternate Option" is not considered by the RSM, Telesat prefers Allocation Option 1 between the two options presented in the Discussion Document with a modification to the frequency boundary from the proposed 28.35 GHz to 28.1 GHz (or a frequency lower than 28.1 GHz). For illustration of the "Modified Allocation Option 1", please refer to diagram below:

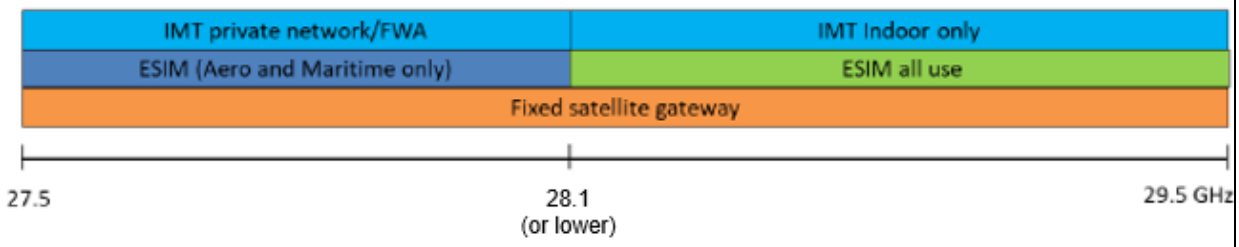

Figure 2: Modified 28 GHz allocation option 1

While this new boundary could be a compromised solution, Telesat still has concerns over the choice of geographic areas where FSS has priority over IMT private networks and FWA in the 27.5 – 28.1 GHz. As the RSM is aware, fibre connectivity from the earth station gateways would still be required for connection to the point of interconnect. As such, the selection of the areas for satellite coordination zones is of paramount importance to satellite operators.

For further details relating to Telesat's comments on the spectrum sharing approach, please refer to the reply for Question 33.

In any case, the "Modified Allocation Option 1" would permit the continued FSS gateway and unrestricted ESIM usage in the frequency bands 28.1 – 29.5 GHz in any parts of New Zealand. This is in view that the IMT in this part of the frequency band is solely for indoor usage and a coordination zone in this part of the frequency band is not necessary.

For allocation option 2, there is no assurance on the amount of spectrum for allocation to all ESIM at this stage despite the rising demand and use cases as highlighted by Telesat in Q2. In addition, since IMT and ESIM would not share the spectrum, a portion of the 28 GHz band would then be allocated to earth station gateways and ESIM while another portion of this band would be allocated to IMT and the earth station gateways. In Telesat's view, such an arrangement will limit the amount of spectrum for Aeronautical and Maritime ESIM usage and would not make optimal use of the spectrum. With these considerations, Option 2 is undesired until further details on the spectrum placement is provided.

Q13 Do you agree that the current satellite allocation and licensing regime for 29.5 – 30 GHz should remain?

Yes, the 29.5 – 30 GHz satellite allocation and licensing regime should remain as per page 19 of the Discussion Document for any new and existing satellite use cases. This licensing regime has been well-established, straightforward and Telesat does not foresee any issues in the continuation of this regime.

However, Telesat would like to highlight to the RSM the need for a separate review of the technical conditions associated to the satellite licences to facilitate the newer satellite systems such as Telesat Lightspeed. This is because the current licensing conditions are based on legacy satellite systems, which are not necessarily relevant in the most recent designs.

For further details, please refer to Telesat's response in Q16.

Q14 What's your preferred licensing option in the 26/28 GHz spectrum?

In general, Telesat is of the view that the licensing option in the 28 GHz should follow that in the 29.5 – 30 GHz frequency range. Specifically, Telesat is supportive of the RSM's proposal for the continued General User Radio Licence for ESIM and ubiquitous VSATs in the 28 GHz band.

FSS gateway earth stations in the 28 GHz would still need to be individually licensed by RSM.

Telesat does not have any comments relating to the licensing option in the 26 GHz spectrum.

Q 16 If there is a need for general use spectrum for IMT and ESIM, how much spectrum should we set aside for it? Should RSM mandate technical conditions on the general use licence?

ESIM should be allocated the full 28 GHz band under a general use spectrum regime. Telesat propose an exclusive allocation to satellite services as per the "Alternate Option" in Figure 1 in Telesat's response to Q9-Q12.

RSM should not mandate any onerous technical conditions on the general use licence. Rather, a review on the technical conditions is required to meet the operational capability of evolving modern satellite technology.

The technical conditions which require an update include, but are not limited to, the "maximum permitted emission bandwidth per channel", which is currently 20 MHz.

In view of the possible extensive discussion which could arise, Telesat would highly encourage the RSM to convene a separate consultation with the industry to review and update the relevant satellite licensing conditions.

Q33 Do you have any comments regarding the spectrum sharing approach proposed by RSM between FSS and IMT FWA in the 28 GHz band?

In the document, the RSM has proposed for a coordination zone for FSS gateway earth stations and IMT FWA.

If the RSM were to allocate the 28 GHz based on Telesat's proposal of exclusive Satellite Service allocation (refer to "Figure 1: 28 GHz Alternate Option Allocation"), then the spectrum sharing approach is not required and this eliminates any onerous studies on the details for spectrum sharing approach.

However, should the RSM decide to proceed with the co-sharing of FSS and IMT FWA in the 28 GHz ,Telesat is of the view that these coordination zones should only be applied to different services operating in the same or overlapping frequency band. Based on Telesat's "Modified 28 GHz allocation option 1", coordination zones would only be required in the 27.5 – 28.1 GHz and no coordination zones will be required for indoor IMT and satellite usage in the 28.1 – 29.5 GHz.

As part of the spectrum sharing approach, the RSM has mentioned for FSS to be licensed with a primary status in sparsely populated rural areas. However, as highlighted in Telesat's response to Q9-12, the satellite gateway earth stations would require access to fibre ports for connection to an interconnection point. Hence, Telesat would respectfully request the RSM to also reconsider this point in the identification of geographical areas.

In the worst case where the RSM chooses to allocate other services such as the FWA and private IMT networks and indoor enhanced Mobile Broadband in the 28 GHz, Telesat is of the view that Fixed Satellite Services should be accorded primary status in the entire 28 GHz band for the whole territory of New Zealand. IMT and FWA could then be given a secondary allocation and operate on a non-protection and non-interference basis. This is especially so since IMT is already allocated to the 26 GHz band and Telesat does not foresee any strong impetus to further allocate any portion of the 28 GHz band to IMT on a primary basis.

Overall, Telesat would still strongly urge the RSM to allocate the entire 28 GHz exclusively for Fixed Satellite Services or, as an alternative, solely allocate the entire 28 GHz band to Fixed Satellite Service on a primary basis.

Q34 If RSM were to apply an EIRP limit on horizon plane for FSS, what is the maximum EIRP value we should assume?

Should the RSM select the exclusive allocation of the 28 GHz to satellite service ("28 GHz Alternate Option Allocation"), there is no need on the deliberation of the EIRP/PFD limit for FSS.

Alternatively, the proposal of having a limit should only be applicable in coordination regions where there is co-sharing between different services in the

same frequency band (e.g. 27.5 – 28.1 GHz in the "Modified 28 GHz allocation option 1").

Instead of an EIRP limit on horizon plane for FSS, Telesat would like to respectfully suggest for the RSM to consider a similar PFD limit that was proposed and implemented by the ACMA after an extensive engagement with the industry (pfd limit of -91 dBW/m²/MHz measured at a height of 5 metres above the ground at the coordination boundary of the two regions where FSS and IMT FWA are both primary services).

Q36 Do you think RSM should mandate the regulatory requirements as laid out in Resolution 169 (WRC-19) for ESIM use if a shared use between 27.5 – 28.35 GHz?

Instead of the regulatory requirements laid out in Resolution 169 (WRC-19), Telesat would like to propose the RSM to consider using the conditions in Annex 2 of either ECC Decision (13)01 or ECC Decision 15 (04)[6] which were carefully reviewed and implemented in the European region since 2013 and 2015 respectively.

It is of Telesat's view that the implementation of the ECC Decision would result in the most efficient use of spectrum.

Conclusion

Telesat urges RSM to adopt a balanced spectrum policy that benefits the existing and emerging satellite services in the Ka-band, while still meeting the spectrum requirements of terrestrial services. It is Telesat's view that the 26 GHz is solely allocated to IMT services, while retaining the 28 GHz exclusively for both the GSO and NGSO Fixed Satellite Services, including ESIM terminals in this band. Apart from the ease of implementation without the need to define coordination zones and power limitations, this arrangement will also enable RSM to provide a thriving ecosystem with added investment certainty, for both IMT and satellite industries in New Zealand.

This is particularly helpful and encouraging for satellite operators, such as Telesat, with huge investments being planned for the space and terrestrial stations.

Telesat is optimistic that the eventual decisions undertaken by the RSM will further promote a viable and sustainable business case for satellite operators to provide affordable access within New Zealand in the long run, for the general benefit of all involved. These measures together with a GURL licensing framework (adapted to the

[6] ECC/DEC/(13)01 https://docdb.cept.org/download/1513 and ECC/DEC/(15)04 https://docdb.cept.org/download/47f8be60-b651/ECC%20Decision%20(15)04.pdf

new satellite technical conditions) in the Ka-band will also catalyse the eventual rollout of Telesat Lightspeed deployment in New Zealand.

Should there be any additional queries or discussions, Telesat remains at the RSM's disposal and looks forward to our continued engagement and cooperation.

Background of Telesat

Telesat is headquartered in Ottawa, Canada, and was established in 1969. It launched the world's first domestic commercial geostationary ("GEO") satellite in 1972 with an initial mandate to provide satellite services to all parts of Canada, especially to remote areas where terrestrial alternatives were unavailable or prohibitively expensive.

Since then, Telesat has been providing reliable and secure communications solutions to hundreds of broadcast, telecom, corporate and government customers with the operation of 17 GEO satellites, a robust teleport and terrestrial infrastructure that is seamlessly integrated within the system.

In the late 1990s, Telesat began serving the Asia-Pacific ("APAC") region with Telstar 10 satellite. Subsequently, the Telstar 18 was launched in 2004 before its replacement by the Telstar 18 Vantage[7] ("T18V") in late 2018. The launch of T18V has brought High Throughput Satellite ("HTS") spot beam capacity and expanded coverage areas, including New Zealand, with transponders operating in the C-band and Ku-band.

To find out more about Telesat and its history, please visit https://www.telesat.com/

[7] https://app.telesat.com/satellites/t18v/summary_eirp