Your response

Question	Your response
Question 1: Are there other trends in the space sector (or the broader spectrum environment) that we should monitor and/or	Telesat applauds Ofcom for acknowledging that the demand of satellite spectrum is increasing as a result of the significant changes and rapid expansion of the satellite sector. Telesat strongly supports Ofcom's efforts to update the spectrum strategy to enable NGSO satellite systems to grow and compete, offering a wide range of services to UK consumers and citizens. Telesat notes Ofcom's statements that in the UK "96% of residential premises have access to a superfast broadband connection and that the market for future communications services delivered via NGSOs may

take account of in our strategy?	well come in other countries than the UK where broadband coverage is not of the same level or in situations where terrestrial networks are disrupted by conflict or natural disasters." Indeed, Telesat agrees that one of the main roles of satellites is to "connect the unconnected" by providing broadband connectivity and backhaul for mobile communications in rural/remote locations thereby extending and accelerating the deployment of high capacity fibre-like networks. Telesat, in collaboration with Vodafone Group and University of Surrey has already successfully demonstrated that LEO satellites can provide effective backhaul transport for mobile network operators (MNO) including advanced backhaul solutions for 5G (https://www.telesat.com/press/press-releases/worlds-first-5g-backhaul-demo-over-leo-satellite/) However, Telesat is of the view that satellite communications services are not going to be confined only to remote areas where terrestrial infrastructure is not yet deployed: in fact, satellite services are key to enabling communications on the move, also for the energy and governmental sectors, in addition to commercial and private maritime and aeronautical applications. **ESIM** Ofcom correctly identifies that satellites are increasingly used to provide connectivity for maritime and air passengers. Indeed there is an increasing demand of people to stay connected regardless of their location, and in places that are unreachable through terrestrial networks including airplanes and vessels. Earth Station in Motion (ESIM) use satellite antennas mounted on aircraft/ships/trains/vehicles and enable high speed broadband services to consumers on the move. ESIM are one of the fundamental parts of current and next generation networks connecting, for instance, travellers, commercial shipping, energy industry sites (e.g. oil rigs). There are also non- commercial applications in which satellite can play an important role. Innovative LEO systems such as Telesat Lightspeed ™ [1] can support bandwidth-intensive applications in several areas such as defence, humanitarian aid and disaster relief efforts, offering outstanding security, quality, global coverage and seamless mobility. Within the defence industry, command and control is of paramount importance for coordination between ground, air and sea units as one integrated entity. High system availability, global footprint and low-latency are some of the key characteristics of innovative LEO systems (including Telesat Lightspeed) which can confidently provide wide area communications across the government's defence network for its operations domestically and internationally. Apart from the operational use,

[1] https://www.telesat.com/leo-satellites/

these systems could also be leveraged upon to provide cloud connectivity, and recreational-related applications as part of the welfare for duty-personnel.

For humanitarian aid and disaster relief, real-time data-intensive applications including the provision of high-resolution videos, critical to the success of such operations, can be supported by LEO networks in areas where communications are non-existent or unreliable.

Satellite and 5G/6G

Satellite is already an integral part of the 5G ecosystem through the satellite industry's active participation in research, development and standardisation activities, with virtualised and cloud-centric network capabilities becoming commercially available. In addition, specific further standardisation work is being undertaken in dedicated bodies such as for instance 3GPP (System Aspects SA and Radio Access Network RAN groups), ETSI and ATIS (NTN group).[2] This evolution has led to a much-increased ability of satellite and terrestrial systems to operate seamlessly within the 5G ecosystem and thus accelerate the deployment of 5G services to end-users in all geographical areas, whether urban, sub-urban or rural.

Future networks will be based on a network of networks in order to ensure that a maximum number of citizens can access 5G and 6G. Satellite networks constitute an essential but often invisible overlay for terrestrial networks to help realise the Gigabit society in which millions of connections between people, devices and things will require inter-connectivity and stability at unprecedented levels that terrestrial networks alone cannot deliver for citizens of modern societies.

6G is building on the important work that is being done to bring 5G to the world. While it remains to be seen which use cases for 6G will become widely deployed, 6G will need to incorporate the full range of terrestrial and non-terrestrial technologies that are under development, if its benefits are to be enjoyed by all. As all previous generations of wireless networks have demonstrated, the use of non-terrestrial technologies is essential for maximizing coverage and bridging the digital divide. Specifically, 6G needs will be best addressed if the capabilities of satellite in terms of coverage, reach, energy efficiency, reliability, resilience and capacity are fully integrated.

The use of satellite networks in 5G and 6G will indeed reinforce service reliability of terrestrial networks by providing service continuity to users.

Satellite and Cloud

Another important evolution is the association of Cloud technology with satellites. The use of satellites extend the reach of direct access to the Core or the Edge using the cloud , allowing users to connect and have great performance for the applications they need and to capitalize on

[2] www.atis.org

	the productivity, scalability and operational agility that cloud computing enables, regardless of geographical barriers. Satellite communications platforms also benefit from much enhanced network agility and security coming out of the cloud functionalities. In particular, cloud technology combined with software designed networks are creating new ways of increasing cyber-security by using space technology, without deploying dedicated and expensive physical infrastructure. Operators are deepening their partnership with cloud players to this end. As an example, Telesat will build Telesat Lightspeed Cloud to offer the versatility and the flexibility required for the next generation space based community for enterprise customers by leveraging best in class technologies across multiple cloud vendors (https://www.telesat.com/press/press-releases/telesat-selects-cloudops-to-develop-cloud-infrastructure-for-telesat-lightspeed-leo-network/). **Real time download of Earth Exploration Satellite Service data** Ofcom identifies a trend of growing capacity demand of Earth Exploration Satellite Service (EESS) for remote sensing data collection, which operators will need to downlink to the ground and distribute to users. Telesat would like to raise another equally important trend, which is the demand of real time download of EESS data including high-resolution videos or photographs during exceptional circumstances (disasters, wars etc). Recent geopolitical events provide the necessary evidence to deem this application as strategic for UK citizens and consumers. In order to cope with the demand for high bandwidth and time sensitive data, operators are looking to employ inter-satellite links in the Ka-band or optical links in their satellite systems to transfer data between non-GSO EESS and relay satellites that are then able to transmit the data to the required point in Earth.
Question 2: Do you agree with the broad areas we have prioritised for our work?	Telesat applauds Ofcom's decision to prioritize the Communications area since it is an area currently undergoing several major innovations. In particular, the size of the satellite communication sector is increasing with a number of NGSO constellations already operating, in the process of being deployed or planned. These state-of-the-art systems are capable of providing unprecedented amount of capacity, including for very high-throughput (Gpbs links), low-latency applications and have been optimized to serve the fast-growing broadband connectivity requirements of fixed and mobile network operators, aeronautical and maritime users, enterprise customers and governments. Telesat understands that new NGSO systems may create new challenges in terms of managing interference in the UK and agrees with Ofcom's initiative to develop a strategy that addresses these challenges, for the

	benefit of UK customers and citizens. However, Telesat is of the view that this strategy, including methodologies to assess the potential for interference among NGSO systems should be consistent with the ITU framework. Noting that these methodologies are still being finalized at the ITU level, Telesat urges Ofcom to actively engage, as a matter of priority and in cooperation with UK stakeholders, to the current work in progress within Working Party 4A.
Question 3: Are there other issues and actions that are likely to be important over the next 2 – 4 years?	Telesat has no additional comment
Question 4: Do you have any evidence on whether specific actions should be a high priority?	Telesat has no additional comment
Question 5: Do you have any other issues you wish to comment on?	Telesat most welcomes Ofcom's proposal to authorise the guard-bands of 28 MHz located in the 28.0- 29.5 GHz band for satellite earth station use. Telesat understands that this proposal applies both for NGSO and GSO specific earth station sites on the condition that adjacent bands are both being used for satellite uplinks. Telesat is of the view that in this case, indeed there is no technical reason to maintain any guard band. In fact authorizing this spectrum for satellite uplinks will facilitate the deployment of specific earth station sites by ensuring continuity of spectrum that can be used. Telesat agrees with Ofcom that it may be appropriate to review ITU-R Recommendations that have not been updated in decades, in particular those that characterise the time-variant nature of interference caused to and received from non-GSO systems with respect to other applications of FSS or to other services operating co-frequency. In doing so, Telesat urges Ofcom to use a consistent approach among the different topics being considered at the ITU-R. For example, during a recent meeting of WP 4A, with respect to discussions carried out under WRC-23 Agenda Item 1.17, there have been proposals to protect non-GSO receivers operating in the Ka-band so as to avoid high values of I/N that are exceeded for very short periods of time. Telesat notes that the same approach may be appropriate to be used in the preliminary draft new Recommendation ITU-R S.[INTERFERENCE-NGSO], whose aim is to determine the sharing conditions between NGSO systems. Therefore, with respect to these two issues, Ofcom may wish to update Recommendation ITU-R S.1323 using such a consistent approach, noting that that Recommendation was last updated in 2002.

	Telesat concurs with Ofcom's view that the use of inter-satellite links could make connectivity easier for NGSO systems, allowing for new applications to flourish as already mentioned in the reply to Question 1. Telesat encourages Ofcom to follow and support the developments on WRC-23 Agenda Item 1.17, which if successfully resolved, will extend the use of frequency bands for inter-satellite links.
Question 6: Are there other issues and actions specifically relating to NGSO communication systems that are likely to be important over the next 2 – 4 years?	Telesat has no additional comment
Question 7: Do you have any evidence on whether specific actions relating to NGSO communication systems should be a high priority?	NGSO satellite services using the Ka-band have already been deployed or planned to be deployed in various regions of the world including Europe. While Telesat appreciates Ofcom's efforts towards establishing a NGSO licensing framework, Telesat is of the view that high priority should be also be given to updating the NGSO Earth Station Network license in order to include aeronautical and maritime ESIM. In addition, as mentioned in Question 8, similarly to GSO aeronautical and maritime ESIM, NGSO aeronautical and maritime ESIM authorization could be extended to include larger frequency ranges within the 27.5-30GHz. Updated NGSO Earth Station Network license conditions including all types of ESIM and their operating frequency ranges will provide operators with the regulatory certainty to deploy their NGSO satellite services in the UK.
Question 8: Do you have any other comments relating to NGSO systems?	***Spectrum access and national authorization for NGSO systems*** Telesat notes that as a result of NGSO licensing updated regime, the NGSO earth station network license recently introduced covers two types of terminals: land stations (operating in 14.0 – 14.25 GHz, 27.5 – 27.8185 GHz, 28.4545 – 28.8265 GHz and 29.5 – 30 GHz frequency bands) and aeronautical stations operating in the 14.0-14.25 GHz frequency band. Telesat understands that before these licensing updates, land NGSO ESIM were licensed exempt while NGSO ESIM mounted on ships were licensed[3]. Ofcom already recognises in its NGSO licensing statement that their decision to update NGSO licensing regime creates a potential gap in the licensing framework for NGSO systems using Ka-band user terminals. Ofcom also states that this 'gap' will be resolved so that

[3] https://www.ofcom.org.uk/__data/assets/pdf_file/0030/84684/ir_2093.pdf

aeronautical and maritime ESIMs/ESOMPs are captured in network licences in 2022/23. Therefore, Telesat expects that NGSO earth station network licenses, similarly to GSO earth station network licenses, will also include maritime and aeronautical ESIM/ESOMP in the Ka-band. Telesat also agrees with Ofcom's approach to update ship and aircraft radio licenses to allow the installation and operation of NGSO earth stations on board ships and aircraft in the UK.
Telesat notes the Ofcom statement: "NGSO ship and aircraft earth stations can broadly use the same parts of Ku and Ka band spectrum that are already available for GSO use". While Telesat understands that Ofcom intends to extend the authorization of ship and aircraft GSO ESIM to a larger range of frequencies within the 27.5-30 GHz frequency range (5.16 of the Consultation Document), Telesat is of the view that NGSO ESIM should also have access to this larger amount of spectrum. This is in line with technology neutral principles and with Ofcom's approach that when considering providing greater spectrum access for satellite systems, this should include both GSO and NGSO systems, also as NGSO systems can efficiently share spectrum with GSO systems. Finally, it is important to note that there is no substantive difference between NGSO and GSO in terms of coexistence with other services. In fact CEPT has already adopted decisions ECC/DEC/(13)01 and ECC/DEC/(15)04 in which the sharing conditions between ESIM and terrestrial services are identical. Therefore, Telesat strongly supports Ofcom's proposal of extending the authorization of ship and aircraft ESIM to a larger range of frequencies within the 27.5-30 GHz frequency band, provided that this extension will be applied to NGSO aircraft and maritime ESIM as well. The conditions provided in the Annex 2 of the aforementioned ECC/DEC/(15)04 decision are sufficient to protect the spectrum allocated to Spectrum Access Licensees.

International work

As already mentioned above, ESIM are being used around the world by airlines and private planes, by the maritime sector on cargo, tanker, ferry, cruise ships and for public and private transportation on trains, buses, emergency response vehicles and other motor vehicles, beside governmental and energy applications. The next World Radiocommunication Conference (WRC-23) will consider establishing a globally harmonised framework in the Ka-band for ESIM communicating with non-geostationary orbit (NGSO) satellites under agenda item 1.16, as it did in 2015 and 2019 for Ka-band geostationary orbit (GSO) satellites. This will encourage more competition and lower latency for broadband services enabled by NGSO ESIM.

The work under this topic is progressing and studies have demonstrated that by complying with some technical and operational conditions (e.g. a pfd mask to protect terrestrial services), NGSO ESIM can coexist with existing services. Therefore, Ofcom is encouraged to support the development of a regulatory framework for the operations of NGSO ESIM and actively engage in all relevant meetings.

Extension to additional bands

Telesat applauds Ofcom's decision to consider NGSO access to Q/V bands. Q and V bands will in fact become important for additional satellite capacity for both NGSO systems and GSO networks in the near future. These bands are currently under a lot of discussion and many operators are developing projects planning to use this spectrum. Telesat has also submitted ITU filings and has plans to use Q/V band for its future generation of LEO constellation. It is important to note that as per RR. No.5.516B, a number of bands have been identified for High Density Fixed Satellite Services (HD-FSS) in Region 1 including the 39.5-40.5 GHz, 47.5-47.9 GHz, 48.2-48.54 GHz, 49.44-50.2 GHz frequency bands (space-to-Earth). At regional level, the CEPT-ECC most recently adopted ECC/DEC/(21)01 decision on the use of the bands 47.2-50.2 GHz and 50.4-52.4 GHz by the fixed-satellite service (Earth-to-space). In particular, according to this decision, the 48.2-50.2 GHz frequency band is expected to be used by ubiquitous user terminals operating with GSO and NGSO FSS networks and systems. In fact, the development of satellite communication terminals, using new reconfigurable antenna technologies, will drive the demand for access in Q/V bands, allowing for the deployment of small low profile user terminals. However, Telesat notes that as referenced in section 5 of the Consultation Document, Ofcom intends to consider licensing of Gateway earth stations *only* in Q/V bands and in higher frequencies including E band. Also, section 6.42 of the Consultation document does not clarify if both NGSO user terminals and Gateways could access the Q/V bands. In any case, Telesat encourages Ofcom to consider developing an approach for authorizing also NGSO user terminals in Q/V bands in accordance with ECC/DEC/ (21)01.

Pricing

Telesat notes Ofcom's intention to review the pricing of NGSO satellite earth station licenses in order to reflect the "opportunity cost" that issuing a license might have on the ability to issue other licenses. While Telesat understands that currently GSO licenses reflect the opportunity cost of issuing fixed links in the shared band, the impact of NGSO gateways may be less as they can operate at relatively high elevation angles and with lower eirp values (typically the antennas are smaller than for GSO gateways in the same frequency band). Telesat also notes Ofcom's concern that NGSO gateways are likely to require large minimum separation distances from the gateways of other NGSO systems in order to avoid harmful interference and this could have an opportunity cost in relation to the deployment of other NGSO gateways in the UK. Telesat does not share this concern as, in Telesat's experience, the distance between NGSO gateways is entirely dependent on the NGSO systems parameters, as well as the methodology and protection criteria used to assess inter-system interference; therefore, it cannot be determined *a priori as "large"*. Furthermore, taking into account the fact that an increasing number of NGSO systems will implement Optical Inter-Satellite Links – a feature already implemented by Telesat Lightspeed and which allows constellations to make the most efficient use of Gateway

earth stations by limiting their numbers – Telesat is of the view that there is a relatively low risk of scarcity of sites in the UK.

Introducing license terms to put conditions on NGSO downlinks

Telesat agrees with Ofcom on a licence condition according to which the satellite system to which the earth station belongs should comply with the limits in Article 22 of the Radio Regulations. In this respect, Telesat proposes that, in order to prove this, the satellite system in question shall receive a favourable finding by the Bureau following the examination carried out under Resolution 85 (WRC-03).

International regulations on NGSO-GSO sharing

Telesat agrees with Ofcom's approach that a globally harmonized approach to handling NGSO to GSO interference should be developed. In fact, the methodology used by the ITU is contained in Recommendation ITU-R S.1503, but some of its aspects may result in unnecessary constraints to NGSO systems. In particular, Telesat notes that the methodology described in Recommendation ITU-R S.1503-3 i) does not model adequately complex systems and (ii) it makes several worst-case assumptions. Telesat applauds Ofcom's efforts in relevant international forums to update this Recommendation ITU-R S.1503-3 and invited Ofcom to further pursue these efforts.

Overall, Telesat appreciates this opportunity to provide comments on the important matters raised in this Consultation, remains available for possible additional clarifications and looks forward to continuing the discussion and collaboration with Ofcom.