29 January 2021

Secretary
Standing Committee on Industry, Innovation, Science and Resources
House of Representatives
PO Box 6021
Canberra ACT 2600
Email: iisr.reps@aph.gov.au

Dear Committee Secretary,

RE: Inquiry into Developing Australia's Space Industry

Introduction

Viasat welcomes the opportunity to comment on the House Standing Committee on Industry, Innovation, Science and Resources' inquiry into and report on developing Australia's space industry.

Viasat commends the Committee's inquiry into Australia's emerging space sector and notes its importance as a part of Australia's economic future, and, moreover, its importance in supporting our national and security interests.

In this submission, we outline Viasat's growth in Australia in the commercial and Defence sectors and its interest in working with Australia to promote new capabilities across these platforms. Viasat also brings to the Committee's attention matters of *critical near-term concern*:

- growing barriers to equitable access to spectrum and orbits for Australia caused by the actions of a few;
- growing environmental concerns caused by the actions of a few; and
- the major implications for further development of Australia's burgeoning space industry

About Viasat

Viasat is a global communications company with 5,900 employees and 45 offices worldwide working to connect the entire globe with high quality, secure, affordable, fast broadband connections anywhere in the world—on the ground, in the air or at sea. For more than 30 years, Viasat has helped shape how consumers, businesses, governments and militaries around the world communicate.

Viasat has an extended history deploying satellite-based networks in both U.S. domestic and international settings. Worldwide, Viasat networks support over 850,000 subscribers using its Surfbeam platform in Europe, Saudi Arabia, Canada, and Australia. In the U.S., Viasat's network currently serves around 600,000 subscribers on its own satellites.

Viasat is building a highly advanced global constellation known as ViaSat-3. This constellation is a first-of-its-kind: an ultra-high capacity satellite platform comprised initially of three geostationary ViaSat-3 class satellites and complementary ground network infrastructure. The first ViaSat-3 class satellite will serve the Americas, the second will serve Europe, Middle East and Africa (EMEA), and the third will serve the Asia-Pacific (APAC) region, including Australia.

Each of the individual ViaSat-3 satellites is expected to offer over 1 Terabit per second (Tbps)—or 1,000 Gbps—of total throughput. Together, they form a global broadband network with enough bandwidth to deliver affordable, high-speed, high-quality internet and video streaming services virtually anywhere around the world. Each ViaSat-3 satellite will have approximately 14 times the capacity of each Sky Muster satellite that currently serves Australia.

The ViaSat-3 APAC satellite is expected to launch in the second half of calendar year 2022—which enables the offering of ViaSat-3 satellite services to commercial and Defence markets in the region beginning in 2023. This satellite will offer high-speed internet to people no matter where they live, work or travel. It will also offer secure, reliable and truly global Defence communication capabilities in tandem with complementary regional satellites. We discuss more about the services that Viasat provides to customers in Australia and around the world in the attached Annex.

Australia's Access to Finite Resources: Physical Orbits and Spectrum

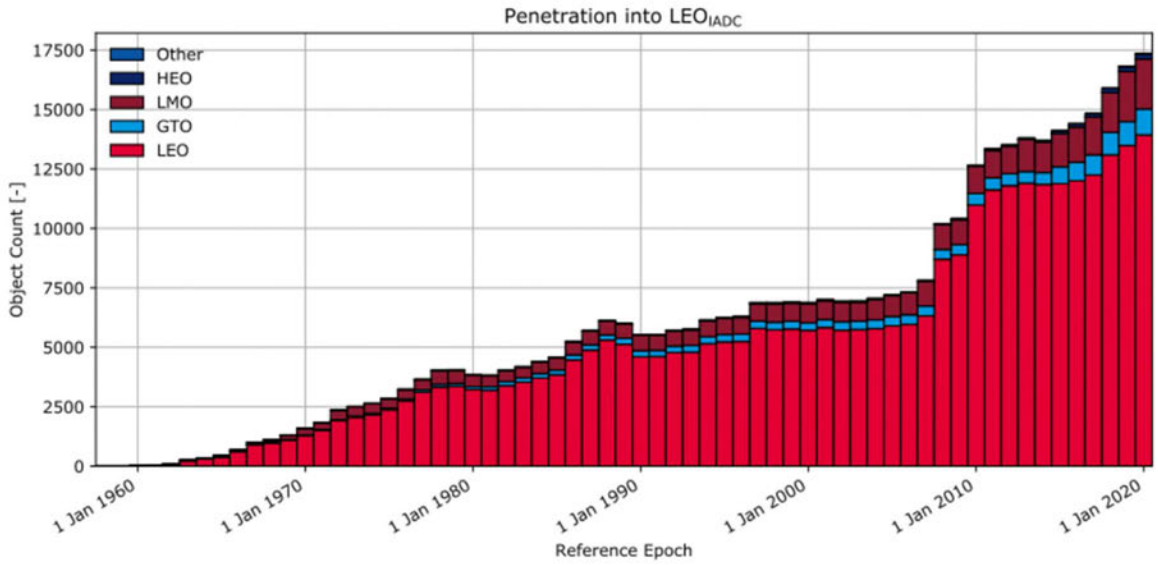
Recently launched (and proposed) Low Earth Orbit (LEO) mega-constellations consisting of many thousands of satellites threaten to preclude continued access to both finite orbits and spectrum for many types of satellite networks - even those in the geostationary orbit (GSO).

Space Debris

Much like the climate crisis today on Earth, we face a mounting level of space junk that, unlike pollution on land, could become all but impossible to repair resulting in dramatic consequences for all space-faring nations limiting continued access to space for government, commercial, and human exploration purposes.

The concerns over space debris are growing rapidly with the plans of mega-constellation operators to launch over 100,000 thousand more satellites into LEO orbits. Over 1,000 satellites were launched into LEO in the past year and this pace is expected to increase. The European Space Agency estimates that there are over 900,000 pieces of orbital debris greater than 1 cm in diameter hurtling through space. As the number of satellites in these orbits increases so too does the risk of catastrophic collisions that, if history is any indication, will send what amounts to large clouds of high-speed shrapnel into orbits hundreds of kilometres above and below that threaten many different uses of space.

Dr. Donald Kessler, renowned NASA scientist, theorised that with the increased density in these orbits each collision could create a cascading effect in which each collision begets additional self-perpetuating collisions. This is now known now as the Kessler Syndrome. We can already see this happening today as existing orbital debris in LEO continues to grow from such collisions with itself. As ESA has stated, "As a consequence of the rising debris object count, the probability of catastrophic collisions will also grow progressively." The chart below from ESA shows the rapid increase in debris as of one year prior to the massive increase in launches in 2020.



The Australian government, if it acts now, can help prevent this pollution of space. We know that if satellites can properly manoeuvre to avoid debris the probability of primary and subsequent collisions, as projected by Dr. Kessler, decreases significantly. Rules requiring effective and reliable manoeuvrability for all that apply for market access to Australia will help ensure that the risks posed by some of these constellations do not exceed manageable levels. Australia can and should be a leader in driving the industry toward designing constellations that, in the aggregate, pose a low risk of collision over their constellation lifetime.

Spectrum Access

Spectrum is a scarce resource that can be beneficially shared among many different satellite systems and this can continue to be the case *if* appropriate rules are put in place.

Geostationary (GSO)/Non-geostationary (NGSO) Sharing

The massive increase in the number of NGSO satellite constellations and their associated ground systems is creating a dangerous amount of interference into GSO co-frequency operations. The International Telecommunications Union (ITU) created rules 20 years ago that were based on the existence of only 3.5 NGSO systems and were based on very different technology than is being employed today. These rules are critically out of date and the associated rules on the national level are not in place to protect against this NGSO interference threat.

These “EPFD” limits must be strengthened. Otherwise, the operation of NGSOs threatens to unduly constrain the capacity and throughput of the GSO systems that provide critical commercial and Defence capabilities throughout Australia. In contrast, strong EPFD limits pose virtually no constraint on NGSO capacity.

Protection of existing and planned GSO networks, such as the Sky Muster satellites Australian Defence systems, and the ViaSat-3 constellation, is critical. ITU Article 22.2 makes it clear that NGSO systems “shall not cause unacceptable interference to and, unless otherwise specified in these Regulations, shall not claim protection from geostationary satellite networks in the fixed-satellite service.”

Australian can ensure this protection is achieved by imposing strong limits on the aggregate EPFD (interference) generated by NGSO systems into GSO satellites at the market access application stage.

NGSO-NGSO Sharing

In addition to polluting space by creating physical hazards that make orbital access too expensive and risky for others, mega-constellations threaten to monopolise spectrum access by effectively filling the sky with radio transmissions from all directions, leaving no room for shared use by other satellite systems. These planned constellations will "blanket the sky," causing many in-line interference events (when one system blocks the communications path used by another system) and precluding other systems from sharing the same spectrum. Mega-constellations will rarely experience this problem themselves because their far greater number of satellites that block spectrum for smaller NGSO constellations provides them with alternative communications paths where spectrum remains available.

The preclusive effect of these mega-constellations is depicted in the following table, which shows the probability of satellites in NGSO System B blocking all of the satellites in NGSO System A. Three constellation sizes are considered for each system: 300, 3,000, and 30,000 satellites. Typical orbital parameters were used, and the user terminal was modelled at a representative location of 25.3° S, 133.8°E (centre of Australia). Several observations can be made:

- A 30,000 satellite NGSO system will blanket the sky, blocking all other constellations, including other similarly sized constellations.
- Even 3,000-satellite NGSO systems have a significant blocking effect on many other constellations.
- Conversely, 300-satellite NGSO systems never block 3,000 or 30,000-satellite NGSO systems.

	NGSO System B		
NGSO System A	300 Satellites	3,000 Satellites	30,000 Satellites
300 Satellites	3.4%	34.8%	100%
3,000 Satellites	0%	18.4%	100%
30,000 Satellites	0%	0%	100%

Probability that NGSO System B blocks a location from service by NGSO System A

This dynamic has the perverse effect of incentivising companies to deploy many more satellites than actually needed, utilising large numbers of spectrally inefficient and unreliable satellites and rejecting more reasonable approaches to spectrum sharing and coordination with smaller NGSO satellites – satellites even at other altitudes. And, as discussed above, this could have disastrous effects on the environment. Tragically, we are seeing this dynamic at work today, with NGSO constellation size continuing to escalate.

Australia can be a leader in encouraging companies to launch fewer, more spectrally efficient systems that can share these finite spectrum resources and still deliver fast, reliable, and cost-effective broadband service, while also providing the benefit of limiting debris creation and the deleterious effects on the environment in space and on Earth.

Environmental issues

In recent months, a number of third-party organisations have sounded the alarm about the potential for a variety of significant environmental harms caused by on mega-constellations that have not been fully examined:

- Depleting ozone, contributing to climate change, causing unpredictable changes in atmospheric chemistry, and potentially creating dangerous falling debris from satellites that do not fully burn up on reentry;
- Creating excessive light pollution that would interfere with the ability of astrophotographers, astronomers, and ordinary stargazers to study and enjoy space, and tarnish the beauty of the night sky; and
- Increasing the risk of collisions in orbit and generating excessive space debris that would pollute the orbital environment.

These issues should be carefully examined before granting market access to any NGSO constellation. In particular, all potentially significant impacts of granting market access to a mega-constellation, and all relevant alternatives, including denial of the application and a reduction in the total number of satellites, should be considered.

Conclusion

We appreciate the Committee's inquiry into "developing Australia's space industry" and we look forward to being a part of the growth of the Australian space industry as well as assisting in developing policy to protect Australia's future access to the finite orbital and spectrum resources that are required for such growth, and to the environment as well.

We encourage the Committee, the ACMA, and the Australian Space Agency to swiftly implement rules surrounding these critical and time sensitive matters. Viasat believes that if not handled correctly swiftly and correctly, Australia may find its ability to implement or authorise satellite systems restricted by the actions of other jurisdictions and administrations, and its ability to control its own natural environment compromised.

My Viasat colleagues and I can be available to appear before the Committee to talk further about this submission.

Sincerely,

Peter Girvan
Vice President – Asia Pacific
Space and Commercial Networks

Annex

Viasat in Australia

Viasat Australia provides several offerings in the commercial space including:

- nbn Skymuster satellite ground infrastructure - Viasat built and supports (via a local team) the nbn™ Skymuster ground infrastructure, which includes ten Gateways and two Data Processing Centres. Viasat also supplies the terminal/customer premise equipment and antennas for at-home use. The Skymuster service provides nbn internet service to over 100,000 remote and rural Australians. Viasat works continually with nbn on transferring world leading technology and techniques into this network.

- USO Voice Satcom Terminals - Viasat supplies home satellite terminals that provide voice services to remote and rural Australians helping meet the Australian Universal Service Obligation.

- Qantas Inflight Connectivity - Since 2017, Viasat has supplied the in-flight connectivity service on the Qantas domestic fleet of B737 and A330 aircraft. The Viasat in-flight Wi-Fi service connects Qantas passengers, crew and pilots to fast, high-quality internet, including streaming media services, gate-to-gate.

In the National Security space, Viasat provides the Defence Narrowband Satellite Capability and the JP 2008 Ph 5A UHF Milsatcom project and also is the major provider of the Broadband Satellite Ground Station East as a primary subcontractor to Northrop Grumman under Project JP 2008 Ph 5B2.

In addition to delivering major segments of the Beyond Line of Site national security communications capabilities through phases of the 2008 Joint Project, Viasat also provides a range of products and services to the Australian Defence Force (ADF) including Information Assurance and cybersecurity, network encryption, and information assurance capabilities; next-generation satellite ground infrastructure and military satellite communications; and a wide range of Link 16 Tactical Data Link and deployment and sustainment services.

Viasat is actively working to participate in the Australian Defence Joint Project 9102 – Future Satellite Capabilities aiming to provide next generation future-proofed resilient Satellite Communications services for the ADF. In addition to leveraging the capability currently being delivered for the Satellite Ground Station – East under Defence Joint Project 2008 Phase 5B2 and the prime contractor for Channel Control and systems integrator for Defence Joint Project 2008 Phase 5A, Viasat has been building the Australian based business to increase local capability and transfer IP. Sustaining all Viasat product and systems in country is a key aim of Viasat's contribution to Defence Industry capability growth and improved sovereign Defence self-reliance. Viasat has demonstrated this commitment by establishing two state of the art Maintenance, Test and Integration Facilities (MTIF) in Canberra and Newcastle staffed and run by the Viasat Australian team to continue to grow the sovereign support capabilities.

Viasat continues to develop and provide new technology leadership that addresses resilience, assured connectivity, space protection and is seeking innovative ways to deliver these future capabilities through the growing Australian workforce.

Viasat believes there are tremendous opportunities and is looking to grow its relationship, presence and collaborative efforts with the Australian Space Industry and ADF with advanced technologies that provide assured communications for all citizens, including remote users by using advanced

network bonding, intelligent systems, and dynamic accessibility options which will improve National Security and also quality of life offering significant opportunities for sizeable growth of the Australian space sector. Viasat is working to enable reliable connectivity at home and abroad for the most challenging military operations by leveraging resilient space capabilities through innovative network layer connectivity that will enable diversity of access to data from multiple satellites constellations in various orbits. Viasat is supporting efforts to ensure space safety of flight, assured command and control, and persistent space domain awareness by leveraging Viasat's tactical space systems and advanced analytics.

Viasat understands the importance of growing the capabilities and capacity of the Australian workforce to meet future demands of the space economy and contribute to National resilience and self-reliance. Viasat is committed to growing its Australian workforce and is already implementing plans to more than double its current Australia workforce of 45 in the next two-plus years. The growth is predominantly in the highly technical satellite Engineering areas such as RF, Fibre, Site, Network and Systems Engineering. This growth will support Viasat's intentions to be the first global internet service provider—where Australia will take a leading role in Viasat's ability to bring high-speed broadband communications to the greater Asia-Pacific region. It will also help bring additional interoperability technology capabilities and sovereign resources to the Five Eyes (FVEY) nations, of which Australia is a member. Viasat believes that by establishing multiple sovereign MTIF locations in Australia and, undertaking strategic teaming with Australian owned Small to Medium Enterprise (SME) companies such as WA based Blacktree, it will be able to more effectively and efficiently serve the satellite communications, cybersecurity, tactical networking and information assurance needs of the ADF, and any FVEY partner they may fight alongside.

Viasat recognises the importance of growing the capabilities and capacity of the Australian workforce to meet future space, broadband and Defence demands. Viasat has an extensive intern and graduate programme in the US. Viasat has already engaged with a number of ANU STEM initiatives and intends to extend that US Graduate programme to Australia with the expectations that the new graduates will be employed as part of the doubling of the Australian workforce.