Your response

Question	Your response
Question 1: Do you anticipate one or more of the NGSO gateways in these applications will pose coexistence challenges to existing services? **Please provide evidence of the impact of any likely interference in terms of throughput and unavailability.**	*Is this response confidential? – N* Inmarsat is concerned about the rush of both companies and nation-states to deploy low-earth orbit "mega-constellations" (which, in many cases, consist of thousands of satellites) before issues related to competition are fully understood. In addition to the risks to competition Ofcom identifies in its Request for Comments, including that "An NGSO operator operates from all or most of the available gateway sites, potentially creating a monopoly and blocking future entrants from access the market,"[1] the large-scale use of certain orbital regions could result in a de facto exclusion of other players from those regions. This issue, and its impact on both competition and innovation, is poorly understood and needs further study. It has been noted that such orbital exclusion could violate the 1967 Outer Space Treaty.[2] It could also create space-based dominant "platforms" that restrict competition in space similar to the impact of dominant digital platforms on Earth. Such a position could have a significant impact on national broadband internet access markets and be of considerable detriment to end users.
Question 2: Do you consider that the measures to enable coexistence with future systems, as set out by the applicant, are reasonable? If not, what are your concerns and to which specific gateway sites do your concerns relate?	*Is this response confidential? – Y / N (delete as appropriate)*
Question 3: Could the granting of one or more of these licences prevent your service from operating in the UK or make it less attractive or more costly to enter the market? If yes: • **Please outline your proposed services, including gateway locations, and indicate**	*Is this response confidential? – Y / N (delete as appropriate)*

[1] Request for Comments at 6.
[2] https://www.nature.com/articles/s41598-021-89909-7.

when you are planning to start deploying your services. • **Please also explain the reasons why granting these licence applications would affect or restrict (i.e. make more costly or less attractive) your future service in the UK.** • **Please state which of the proposed gateway applications would affect your deployment (if relevant).**	
Question 4: Do you have any additional concerns or comments regarding this application?	*Is this response confidential? – N* Inmarsat is also concerned about issues related to space debris and environmental damage. Specifically: 1. Space debris The issue of space debris has been well covered in multiple studies,[3] but we have yet to see an analysis that looks at not just one constellation (such as Starlink) in isolation, but also at the aggregate impact of multiple constellations. Systems proposed or authorized by private companies and governments could increase the number of satellites operating at orbits below 2000km to well over 50,000.[4] And this number could be significantly understated given that a recent filing with the International Telecommunication Union requested 327,000 satellites for a single project. Many of those satellites could have a service life in the range of 5 years, thus requiring more launches and deliberate de-orbiting. It would be short-sighted to assume that this massive increase in activity would not lead to additional debris from failed satellites. Until this aggregate risk is fully understood, and standards and technologies to mitigate risk are in place, we believe that considerable caution should be exercised before authorizing new mega-constellations that could render parts

[3] https://www.nature.com/articles/s41598-021-89909-7.

[4] https://www.iso.org/news/ref4321.html (50k reference includes potential China constellation).

of space unusable for others (as well as potentially limit transit through that space).

2. Environmental impact

It is Inmarsat's position that mega-constellations, such as that proposed by Starlink, should be subject to the same kind of environmental impact study and assessment that is typically done for large projects on Earth (including satellite launches or Earth stations).

Credible studies have raised issues related to the impact of mega-constellations on orbital debris, the chemistry of the upper atmosphere, and light pollution. For example, a recent study in Nature declared that:

> "Damage to the orbital space environment has problematic features in common with other types of environmental issue. First, the observed and predicted damage is incremental and complex, with many contributors. Second, whether or not space is formally and legally seen as a global commons, the growing commercial exploitation of what may seem to be a 'free' resource is in fact externalizing the true costs."[5]

In terms of the impact to the chemistry of the upper atmosphere, initial studies have focused on the poorly understood impact of additional deposits of alumina. One study notes that "satellite re-entries from the Starlink mega-constellation alone could deposit more aluminum into Earth's upper atmosphere than what is done through meteoroids." One of the authors of that study comments in space.com that "alumina reflects light at certain wavelengths

[5] https://www.nature.com/articles/s41550-022-01655-6.

	and if you dump enough alumina into the atmosphere, you are going to create scattering and eventually change the albedo of the planet." Light pollution is another significant issue, with the risk that meg-constellations damage future scientific activities that use optical astronomy. Light pollution from artificial space objects (ASOs) can be billions or even trillions of times brighter than objects studied by astronomers.[6] Given these and other risks, Inmarsat's position is not that mega-constellations should never be launched, but that the sizeable potential risks need to be better understood in advance of action. We see this as similar to the widespread use of pesticides, including DDT in the 1950s. It took the publication of Silent Spring by Rachel Carson to draw attention to the harm that DDT could cause.[7] It is our view that rather than wait until after the fact, as was the case with DDT, risks should be better understood in advance and safeguards put in place to ensure space remains useful for generations to come and actions in space do not exacerbate challenges for life on our planet.

[6] *Id.*

[7] https://en.wikipedia.org/wiki/Silent_Spring.