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# Telesat LEO Inc: Decision on application for non-geostationary Earth Station Network licence

Decision

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[Welsh overview available](#)

**STATEMENT:**

Publication date: 10 November 2022

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# 1. Overview

**This document sets out our decision on an application by Telesat for a wireless telegraphy UK Earth Station Network licence.**

The licence is to allow Telesat to operate user terminals in the UK – such as a customer’s satellite dish – to connect with its Lightspeed constellation of non-geostationary orbit (NGSO) satellites.

## **What we have decided – in brief**

**We have decided to grant Telesat an NGSO Earth Station Network licence.**

We set out our original assessment of Telesat’s application in a consultation in July, in which we said we were inclined to grant the licence. We have now assessed stakeholder responses about Telesat’s ability to coexist with other current and future NGSO licence holders and considered the competition issues raised by stakeholders in their submissions.

Stakeholders also raised broader concerns regarding the protection of GSO networks and the impact of NGSO systems on the space environment, which we also address in this document.

In light of the consultation responses received we requested that Telesat provide us with additional evidence regarding its approach to coordination of ITU satellite filings and its ability to coexist with Geostationary orbit (GSO) networks. Our decision takes account of its response, which we have published alongside this decision.

On coexistence, we believe that Telesat’s Lightspeed system is capable of coexisting with both existing wireless telegraphy NGSO licence holders and future NGSO systems. Under the terms of its new licence, Telesat will have an obligation to cooperate in good faith with all other NGSO licensees.

On competition, we assess that granting the application is unlikely to prevent or restrict future NGSO systems from entering the market and that competition risks are therefore likely to be low.

**This decision will enable Telesat to provide satellite connectivity services to people and businesses in the UK. We will now proceed to issue Telesat with its new licence, subject to payment of the licence fee. A copy of the licence will also be available under the “Existing licences” section of our [website](#).**

- 1.1 NGSO satellite systems are a new way of delivering broadband services from space using a constellation of satellites in a low or medium Earth orbit. These satellite services have the potential to deliver higher speed and lower latency services than traditional Geo-stationary orbit (GSO) systems.
- 1.2 In December 2021 we set out our new [NGSO licensing process](#), which was designed to encourage greater cooperation between NGSO licence holders, enhance our ability to intervene if there is harmful interference, and ensure greater transparency by conducting short consultations.
- 1.3 Telesat submitted an application for an Earth Station Network Licence (hereafter referred to as “NGSO ESN licence”) earlier this year. In the application it set out how the licence would enable it to provide satellite broadband services to support enterprise and mobile

backhaul, maritime and offshore platforms, aviation, and government services in the UK. Telesat plans to launch satellites from 2025 and to commence initial services in the UK in the first quarter of 2026.

- 1.4 On 24 June 2022, we published a consultation (the "[Telesat consultation](#)")<sup>1</sup>, in which we set out our initial assessment of the licence application.
- 1.5 We considered the application in line with the procedures set out in our statement on non-geostationary satellite systems. We took account of all responses to the Telesat consultation in reaching our decision to grant the licence application.

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<sup>1</sup> See consultation [Telesat LEO Inc: application for non-geostationary earth station \(network\) licence](#).

## 2. Introduction and background

- 2.1 This document sets out our consideration of an application by Telesat LEO Inc (“Telesat”) for a wireless telegraphy licence to operate a UK NGSO Earth Station Network (ESN). This licence covers the use of all user terminals for a range of different services: fixed or static terminals (e.g. for a home broadband service), land mobile (e.g. on a train or a road vehicle), or on an aircraft or a drone. The licence permits uplinks from user terminals to the satellite – in the case of this application Telesat’s planned Lightspeed constellation. We also require the holder of this licence to have control of the whole satellite network so this licence is typically held by the satellite operator.
- 2.2 The application from Telesat was received on 6 June 2022. Telesat proposed to use the radio frequencies 27.5–27.8185 GHz; 28.4545–28.8265 GHz and 29.5–30 GHz to provide satellite broadband services to support enterprise and mobile backhaul, maritime and offshore platforms, aviation, and Government services in the UK.
- 2.3 We set out our preliminary view, including our initial assessment of coexistence and competition issues, in the Telesat [consultation](#).
- 2.4 We received five responses to the Telesat consultation. In response to issues raised by some respondents we requested additional information from Telesat before reaching our decision on the application.
- 2.5 After taking account of all available evidence - including the consultation responses and the further information provided by Telesat - we have decided to grant the licence. The details of how we reached this decision are presented in this document as follows:
- In **section 2** (this section) we explain the operation of NGSO satellite systems and outline Ofcom’s role in licensing NGSO earth stations and the process we follow in evaluating the NGSO applications;
  - In **section 3** we summarise our Telesat consultation and the responses received;
  - In **section 4** we consider in more detail the comments we received on NGSO coexistence;
  - In **section 5** we set out a summary of the responses related to the competition risks and benefits to consumers arising from the Telesat application and provide our assessment of these issues;
  - In **section 6** we consider concerns that were raised in consultation responses related to potential impacts on GSO networks;
  - In **section 7** we consider concerns raised regarding the potential impact of NGSOs on the space environment;
  - In **section 8** we set out our decision and next steps.

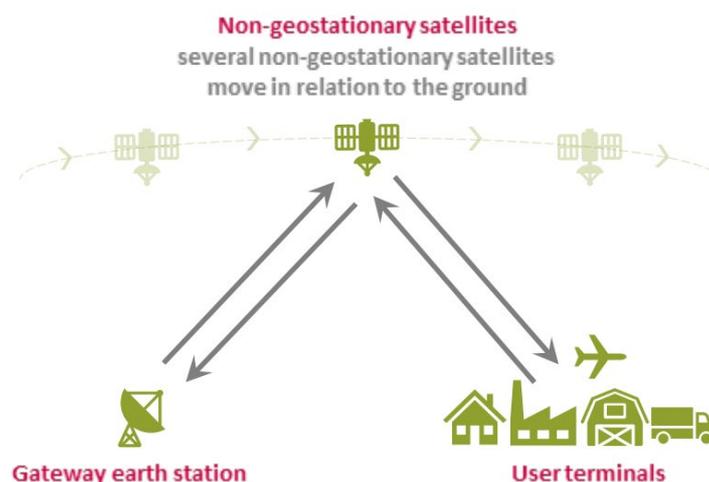
### NGSO satellite systems

- 2.6 NGSO satellite constellations can deliver broadband services at lower latency, and often at higher speeds, than traditional geostationary orbiting (GSO) systems. They generally operate in low or medium Earth orbit (i.e. in lower orbits than most GSO networks) and

connect a range of users to the internet or a private network via satellites which pass overhead.

- 2.7 The services they deliver typically have nationwide coverage and so have a vital role in connecting businesses and consumers in parts of the UK where terrestrial services are not currently available. They also provide additional choice for consumers in other parts of the UK. NGSO services can therefore play a role in delivering high quality broadband and growth across the UK.
- 2.8 An NGSO satellite broadband system is made up of three components, as illustrated in Figure 1 below:
- One or more gateway earth stations which connect the satellite broadband network to the internet or private networks. These earth stations can be located in the same country as the target users or could be located elsewhere.
  - Several satellites used to relay traffic between the gateway and user terminals.
  - User terminals to provide broadband connectivity to end users, typically comprising of an antenna and user equipment. User terminals connect with an NGSO gateway via one or more satellites, depending on the design of the constellation.
- 2.9 The Telesat application for an ESN licence relates to this final component, the earth-based user terminals in the UK that connect to its NGSO satellites.

**Figure 1: Key elements of an NGSO system**



- 2.10 Satellite broadband services tend to operate in a small number of radio frequency bands (these are known as C band, Ku band, and Ka band<sup>2</sup>). Within these bands, different services use the same radio frequencies. The signals are coordinated – under international rules laid down in International Telecommunication Union (ITU) Radio Regulations – whenever

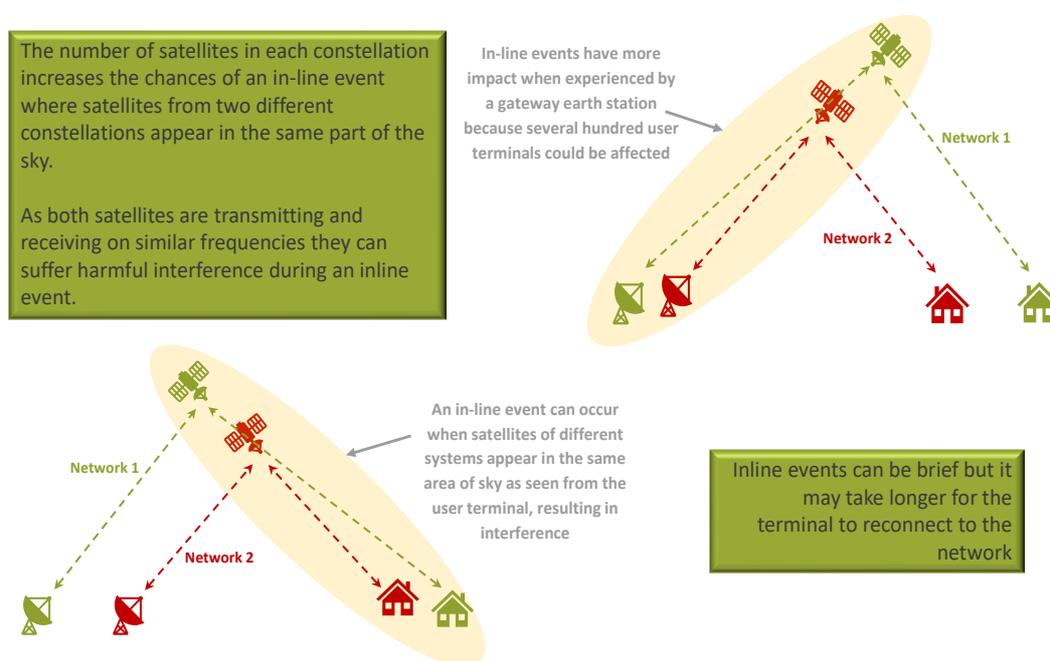
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<sup>2</sup> C band satellite services typically use 3.6 – 4.2 GHz for downlink and 5.85 – 7.075 GHz for uplink. Ku band satellite services typically use 10.7-12.7 GHz for downlink and 14.0-14.5 GHz for uplink. Ka band satellite services typically use 17.7-20.2 GHz for downlink and 27.5-30 GHz for uplink

the satellites appear close enough in the sky for their signals to be indistinguishable (typically within 2° relative to the observer on the ground).

- 2.11 Traditional GSO satellites appear static in the sky to users on the ground so the number of coordination agreements needed to operate without risk of causing or receiving harmful interference (such that one or both services are degraded) is relatively limited.
- 2.12 Proposed NGSO satellite constellations rely on large numbers of satellites that change position relative to the Earth. Earth station gateways and user terminals must track these satellites in order to maintain a continuous connection. This creates a more dynamic spectrum management environment – both in space and on the ground – and so increases the risk of interference between NGSO systems compared to GSO networks. See figure 2 below:

**Figure 2: How interference can occur between two NGSO systems**



- 2.13 As this is a new and emerging market, operators are exploring different network designs (e.g. some will deploy a few hundred satellites, others will deploy many thousands of satellites; some will deploy in relatively low earth orbits at an altitude of around 500 km, others around 1,000 km and still others in medium earth orbits around 8,000 km). In addition, operators are deploying satellites and services at different speeds as their projects mature.
- 2.14 Satellites can transmit across national borders over multiple individual states, so their use of spectrum needs to be managed globally. This management process, involving the processing of ‘satellite filings’, is administered and overseen by the International Telecommunication Union (ITU), a specialised agency of the United Nations.<sup>3</sup> International

<sup>3</sup> The rules governing the use of the electromagnetic spectrum by satellites are included in the ‘Radio Regulations’, an international treaty to which the UK is a signatory.

rules governing use of spectrum and coexistence between satellite operations are negotiated at the ITU and published in the Radio Regulations.<sup>4</sup>

- 2.15 A satellite filing enables a satellite operator to gain internationally recognised spectrum and orbital resources prior to the deployment of a planned satellite system. The ITU Radio Regulations require satellite operators to reach coordination agreements with co-frequency systems.<sup>5</sup>
- 2.16 Given the complexity and uncertainty inherent in deploying NGSO systems, it has proven much harder for NGSO operators to reach these coordination agreements to date. For this reason, we [introduced new terms in our NGSO licences](#) to encourage cooperation between parties planning to operate in the UK.
- 2.17 In addition, operators are deploying satellites and services at different speeds as their projects mature. We are keen to enable NGSO satellite services in the UK and to foster a competitive market for several operators to provide services. However, we do not want those systems that deploy first to unduly constrain or block those that might come later.
- 2.18 In relation to NGSO ESN licences, we note that competition risks could arise from the constraints that systems operating under such a licence might impose on subsequent entrants due to technical barriers to coexistence between systems.
- 2.19 For example, if there was a limited prospect of the applicant's system and future systems being able to technically coexist, this could form a barrier to future entry to the market, leading to reduced competition.

## Ofcom's role in licensing NGSO earth stations

- 2.20 All decisions taken by Ofcom are rooted in our statutory duties and obligations. These stem chiefly from the Communications Act of 2003 and the Wireless Telegraphy Act of 2006.
- 2.21 Ofcom's principal statutory duty is to further the interests of citizens in relation to communications matters, and consumers in relevant markets, where appropriate by promoting competition. In meeting this duty, we also have a number of specific duties, including to secure the optimal use of spectrum; ensure the availability throughout the UK of a wide range of electronic communication services; and to take account of the different needs and interests of all current or potential users of the spectrum frequencies.
- 2.22 The UK framework of rules for spectrum licensing is set out in section 3 of the Wireless Telegraphy Act 2006. In carrying out our spectrum functions we have a duty under that section to have regard, in particular, to:
- a) the extent to which the spectrum is available for use, or further use, for wireless telegraphy;
  - b) the demand for use of that spectrum for wireless telegraphy; and
  - c) the demand that is likely to arise in future for such use.

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<sup>4</sup> [Radio Regulations \(itu.int\)](http://itu.int)

<sup>5</sup> See Article 9.12.

- 2.23 We also have a duty to have regard, in particular, to the desirability of promoting:
- a) the efficient management and use of the spectrum for wireless telegraphy;
  - b) the economic and other benefits that may arise from the use of wireless telegraphy;
  - c) the development of innovative services; and
  - d) competition in the provision of electronic communications services.
- 2.24 As set out in our December 2021 statement on NGSO Licensing we have a specific process for considering applications for the following types of wireless telegraphy licence:
- a) **Satellite (Earth Station Network)**: this authorises an unlimited number of user terminals<sup>6</sup> in the UK to connect to the NGSO system (subject to certain conditions). It also places certain conditions on the licence holder (typically a satellite operator) to coordinate with other licence holders and prevent interference. We refer to this licence in the rest of this document as the “NGSO ESN licence”.
  - b) **Satellite (Non-Geostationary Earth Station)**: this authorises gateway earth stations<sup>7</sup> in the UK, which connect the NGSO system to the internet or to a private network. We refer to this licence in the rest of this document as the “NGSO gateway licence”.
- 2.25 In considering whether to grant NGSO spectrum licences, we follow our [published guidance](#). This includes consideration of technical coexistence with existing and future NGSO systems and any potential impacts on competition in the NGSO market. Details of existing licences can be found under the “existing licences” section of our [website](#).
- 2.26 The application by Telesat addressed in this document is for a **Satellite (Earth Station Network)** licence.

## Our licensing process for NGSO applications

- 2.27 Our [national NGSO licensing process](#), which we introduced in December 2021, is designed to encourage greater technical cooperation between NGSO operators, help us manage interference, support a competitive market for NGSOs, and enhance transparency<sup>8</sup>.
- 2.28 The main steps in the process are illustrated in figure 3 below. Guidance on the process can be found on the [NGSO licensing page](#) of our website. This page also includes the details of existing NGSO systems that new applicants should take into account when applying (existing NGSO licence holders, co-frequency earth stations and earlier applicants).

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<sup>6</sup> User terminals connect the end user (e.g. the customer) to the satellite network; for example the dish and equipment installed at a customer’s premises.

<sup>7</sup> Gateway earth stations are hubs that connect the satellite network to the internet and/or to private networks and cloud services.

<sup>8</sup> Satellite operators need to submit filings for their constellations to the ITU and coordinate with all NGSO operators who hold an older or “more senior” satellite filing. However, due to the complexity and cost of developing and launching NGSO satellite networks not all satellite filings come to fruition in the order in which they were filed. The UK process for licensing NGSO systems is not designed to circumvent the international regulatory regime as laid out by the ITU’s Radio Regulation but it encourages those who are ready to deploy to cooperate in such a way that services can coexist.

Figure 3: New NGSO licensing process



### How we assess applications

2.29 The process focuses on ensuring different NGSO services can operate alongside each other. We ask applicants to:

2.30 **Demonstrate coexistence with other NGSO systems:**

- a) We prefer for applicants to have an agreement with other relevant licence holder(s) already. This would ideally be an ITU coordination agreement, but it could also be a local cooperation agreement allowing the systems to coexist in the UK.
- b) If no such agreement exists, applicants should specify in detail how it would be possible for the different systems to coexist. They should provide evidence that reasonable measures can be put in place - by either the applicant, the existing licensee, or by both - to achieve coexistence. Specifically, applicants should provide enough evidence to demonstrate that the impact to existing licensees in terms of increased unavailability and of reduction in throughput would be modest.

2.31 **Demonstrate ability to coexist with future systems:** we do not expect licensees to foresee the characteristics or the number of future systems that will apply for a licence in the UK, or how other systems may evolve. Our intention is for licensees to:

- a) explain how their existing network design and operating model might facilitate coexistence with other NGSO satellite systems and any limits to that flexibility;
- b) outline any additional measures, which would allow improved coexistence with other systems (for example, planned roll out of ground equipment, future network designs); and
- c) be aware that they may be expected to take reasonable measures to accommodate such future applicants, in order to avoid material degradation to services in the UK.

2.32 **Identify the potential impact of their application on competition in the UK.** We expect applicants to describe:

- a) the benefits that the NGSO system can bring to UK people and businesses. Possible benefits might include:

- i) improvements to an existing NGSO service;
  - ii) greater choice and/or allowing the applicant to compete more effectively in the UK; and
  - iii) how the NGSO system may benefit its customers (e.g. a communications provider that uses the NGSO system for backhaul) as well as end consumers (e.g. the ultimate users of that communication provider's services) and possibly citizens more generally (e.g. if that communication provider's services are of wider benefit to society).
- b) any risks to competition in the UK. This may refer to how the applicant intends to mitigate any risks to competition, including, but not limited to, their ability to coexist with other non-geostationary satellite systems or giving a sense of the scale of any costs of coexistence for other operators' systems.
- 2.33 It is worth noting that a new applicant for an NGSO ESN or gateway licence may hold a senior (earlier) ITU international satellite filing than a competitor holding an existing UK NGSO licence. Under the ITU's Radio Regulations, the burden to ensure coexistence falls on the operator with the junior (later) ITU filing. In this scenario, consistent with the ITU Radio Regulations, existing UK licensees with deployed NGSOs may be reasonably expected to make changes as required to accommodate the new UK applicant. Most should have already designed their systems in such a way that this is possible.
- 2.34 We publish a short consultation on applications – along with a preliminary assessment – and invite stakeholders to comment on that and on the information supplied by the applicant. The questions we ask of stakeholders are based on the criteria above, with an option to provide comments on any additional concerns.
- 2.35 Upon receipt of these consultation responses, we may ask the applicant for additional information to help us address any outstanding concerns. For this application, we asked Telesat to provide us with additional information regarding protection of GSO services and information regarding their approach to coordination. This additional evidence has been published alongside our Decision and can be found on the [NGSO page](#) of our website.
- 2.36 We take our final decision after taking into account all of the information supplied by the applicant and all of the comments gathered from stakeholders.

## Relevant NGSO ESN licence terms and conditions

- 2.37 We expect all licence holders to meet the conditions of their licence(s) and we have a range of monitoring and enforcement powers to ensure they do so. Most of the conditions in the ESN licence apply to NGSO systems and to GSO networks. However, there are some additional conditions that are specific to NGSO operators relating to the protection of GSO services. We have also introduced some other specific licence conditions as part of the NGSO licensing process to enable us to take swift action in the event that one NGSO system causes harmful interference to another NGSO system, resulting in a material and recurring degradation of service, which in turn can cause competition risks. A full copy of the standard licence can be found in Annex A1.

### Protection of GSO services

- 2.38 The NGSO ESN licence contains provisions for the protection of GSO satellite services using the same frequencies. Specifically, condition 3.1 (c) of our NGSO ESN licence states:

*“the earth stations operating with non-geostationary satellites shall ensure compliance with the equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations”*

- 2.39 As this licence covers the transmissions from NGSO user terminals this condition ensures the user terminals don't cause interference from Earth to space transmissions (in the uplink) into GSO satellites.
- 2.40 For space to Earth transmissions (in the downlink) all satellite operators must comply with the relevant sections in the ITU Radio Regulations. The administration who holds their satellite filings is responsible for ensuring the satellite operator complies with the ITU Radio Regulations.
- 2.41 There are some bands where those protections do not apply, as indicated in No. 5.523A of the Radio Regulations, which states that for certain frequencies, GSO networks and NGSO systems have to coordinate their use of spectrum on a first-come, first-served basis, based on the date of their ITU filings. Note 1 of the NGSO ESN licence conditions states:

*“This Licence does not remove any other obligations that the Licensee may have in relation to satellite filings made under the ITU Radio Regulations”*

### Conditions related to the NGSO licensing process

- 2.42 As part of our **new NGSO licensing process**, we introduced five new conditions for holders of NGSO ESN licences under section 7 of the licence (below). These give us additional powers of enforcement should one or more NGSO system suffer material and/or recurring degradation of service.

*“1. The radio frequencies authorised by this Licence must be used in common with other non-GSO satellite systems authorised under wireless telegraphy licences granted by OFCOM. The names of these licensees shall be notified by Ofcom to the Licensee from time to time, and together with the Licensee are described as the “NGSO Licensees”.*

*2. The radio frequencies authorised by this Licence must only be used to communicate with a satellite system which has transmissions authorised under a Satellite (Earth Station Network) wireless telegraphy licence granted by Ofcom.*

*3. In the event that –*

- one (or more than one) of the NGSO Licensees suffers a material and recurring degradation of services to its users at a specific region or location in the United Kingdom; and*
- the degradation of services is resulting from radio transmissions from the earth stations, the satellite or any other part of the satellite system operated by another of the NGSO Licensees, including the Licensee; Ofcom may instruct the Licensee to cease or change the use of particular equipment or particular radio frequencies which are authorised under a wireless telegraphy licence (including but not limited to radio frequencies authorised under this Licence) and are used by any part of the satellite system.*

*4. Any such cessation or change must be for the purposes of ensuring that such interference is avoided and the degradation of services to users at the particular regions or locations is resolved.*

*5. Following receipt of such notice, for such period of time as may be specified in the notice, the Licensee may only operate in accordance with the terms and conditions of the notice.”*

## **Ofcom may take a range of monitoring and enforcement actions where licence conditions are not met**

- 2.43 Alongside the specific requirements for NGSO licence, the Wireless Telegraphy Licence Conditions Booklet (the general conditions booklet) places a number of conditions on all spectrum licence holders. It outlines some of the actions we may take in the event that conditions in our licences are not met. This includes the power to access and inspect sites (condition 5); modify, restrict and closedown (condition 6) services; and revoke a licence (condition 1).
- 2.44 In addition, we have the legal power to take enforcement action in relation to breaches of conditions in wireless telegraphy licences through criminal law prosecution. Similarly, section 42 of the Wireless Telegraphy Act 2006 gives us the power to fine companies which are in breach of the conditions in wireless telegraphy licences.
- 2.45 The type of enforcement action we would take in any circumstance would be appropriate and proportionate.

## 3. The Telesat consultation and response summary

- 3.1 In this section we summarise the key points from the Telesat consultation and provide an overview of the responses received. We consider and assess the responses received relating to specific coexistence, competition and additional issues in sections 4-7.

### Telesat consultation

- 3.2 As set out in sections 1 and 2, in June 2022 we published a consultation (the “Telesat consultation”) in which we set out our initial assessment of the licence application for a Non-geostationary ESN licence, to enable user terminals in the UK to operate using Ka band (27.5 – 27.8185 GHz, 28.4545 – 28.8265 GHz and 29.5 – 30 GHz). We noted that Telesat planned to start launching its satellites in Q3 2025 and to commence initial services in the UK in Q1 2026 and proposed to provide satellite broadband services to support enterprise and mobile backhaul, maritime and offshore platforms, aviation, and government services in the UK.
- 3.3 We said we would assess the application, including the coexistence and competition issues involved, as set out in our NGSO licence application process. We also set out our preliminary view that we proposed to grant the application.
- 3.4 We invited comments on the application and on our preliminary views and said we would take into account all comments received, and that we were open to changing those views depending on responses and evidence submitted to us as part of this process.
- 3.5 We explained that when issuing new licences, one of Ofcom’s objectives is that all authorised systems are capable of coexisting (in bands they are using in common), such that they are all able to provide services to their users without experiencing harmful interference. We outlined the coexistence criteria we asked applicants to demonstrate, and how Telesat proposed to meet these criteria. Our initial view was that the Telesat Lightspeed constellation of satellites should be able to coexist with existing, new and future NGSO gateway and terminal operators. However, we noted that at the time of writing Telesat had not reached coordination agreements with any of the existing NGSO licence holders; we encouraged all parties to continue coordinating in good faith between now and the launch of the Lightspeed constellation. We sought stakeholder views on this initial view and any potential coexistence concerns.
- 3.6 On competition, we explained that, as outlined in the Annex A3 of our statement on updates to NGSO licensing, our starting position with any competition check is to authorise applications, where possible. We outlined that we would take into account four factors: a) the extent of the likely risks to competition; b) the potential benefits from granting NGSO licence applications; c) ensuring that time and resources devoted to the licensing process are proportionate to the risks and benefits; and d) that NGSO services are currently in their infancy. Following consideration of the information provided by Telesat our preliminary assessment was that there would not be a material risk to competition associated with this

application. We sought stakeholder views on whether granting this licence would benefit or harm future competition between NGSO services in the UK.

- 3.7 We noted the potential benefits of granting the application. In our approach to competition we had said that “A network licence is necessary for an operator to deploy user terminals in the UK... Granting NGSO network licence applications is thus likely to benefit customers and consumers and supports Ofcom’s strategic priority to get everyone connected. Since issuing a new network licence allows market entry it also has the potential, if a service is deployed, to promote greater competition (assuming that it can coexist with other authorised systems).”<sup>9</sup>
- 3.8 We noted that Telesat saw growing demand for satellite connectivity supporting enterprise and telecommunications companies, the aviation industry, the UK maritime and offshore energy sector and government services. Further, they had stated that the Lightspeed network could provide multiple Gbps in each beam and can dynamically place beams in hotspot areas where demand might be greater e.g. along busy shipping routes or airports. As a consequence, our preliminary view was that Telesat’s Lightspeed had the potential to provide services that provide further connectivity options to customers in the UK, in addition to those of the existing NGSO licence holders.
- 3.9 Our preliminary assessment, taking the evidence presented by Telesat and our assessment of the risks and benefits of granting this application, was that we proposed to grant Telesat’s application for an ESN licence.
- 3.10 We set out that coexistence and competition were the two issues on which we expected to make our licensing decisions (as set out in the NGSO Licensing updates Statement) but also asked if stakeholders had any additional concerns or comments regarding this application.

## Summary of responses to Telesat consultation

- 3.11 We received five responses from satellite operators to our consultation regarding Telesat’s application for an NGSO ESN licence. Four of those respondents submitted confidential responses. We have therefore outlined the issues raised in these confidential responses in an anonymised manner.
- 3.12 The non-confidential response, from Viasat, has been published on our website alongside this document.
- 3.13 Most stakeholders assessed that Telesat had demonstrated a technical ability to coexist with existing and future NGSO operators. However, a number queried whether Telesat was showing sufficient willingness to cooperate during coordination discussions. We discuss these issues in section 4.
- 3.14 GSO satellite operators expressed a number of concerns, raising questions about the potential risks of interference to their services; the potential impact of the Telesat

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<sup>9</sup> NGSO Licensing Statement, Annex A3.12.

Lightspeed constellation on the global space environment, and potential risks to competition in the market. We consider these points further in sections 5-7.

- 3.15 We note that some stakeholders raised similar issues in their response to different questions. In addressing consultation responses, we have grouped comments together under the most relevant topic.
- 3.16 Most stakeholders assessed that Telesat had demonstrated a technical ability to coexist with existing and future NGSO operators. However, a number queried whether Telesat was showing sufficient willingness to cooperate during coordination discussions.
- 3.17 In response to some points raised by respondents, we requested Telesat to provide us with additional information regarding their approach to ITU coordination and protection of GSO services. The additional evidence has been published alongside our decision and can be found on the NGSO site on our webpages. We have referred to this material where relevant throughout the rest of this document.

## 4. Consultation responses on NGSO coexistence

- 4.1 In this section we consider and assess the responses received with respect to coexistence with existing and future NGSO systems.

### Coexistence with existing NGSO licensed systems

#### Consultation summary

- 4.2 The Telesat consultation, along with the licence application, set out how Telesat planned to coexist with existing licensed systems and co-frequency earth stations. At the time of application, the existing licensees were Starlink, OneWeb and Kepler. Telesat had not reached coordination agreements with any of these companies and so outlined in its application how it planned to coexist with existing licence operators. It stated: *“Telesat Lightspeed can dynamically assign capacity where and as required, through the selection of the satellite chosen to deliver the service, of the size and steering of satellite spot beams, and of the amount of spectrum and power allocated to them”*.
- 4.3 More detailed information regarding the likely impact of its service on existing licensed services in terms of throughput and unavailability can be found in the annex of the Telesat application.
- 4.4 Regarding specific co-frequency earth stations registered with the ITU, Telesat stated: *“With respect to the applicable specific co-frequency earth stations registered with the ITU ...Telesat is coordinating its NGSO system with the relevant operator(s) for those earth stations under the applicable provisions of Article 9 of the Radio Regulations. Telesat commits to take any necessary technical and operational measures not to cause interference into those earth stations.”*
- 4.5 Our initial view was that Telesat’s proposal to dynamically assign capacity should allow them to coexist with existing NGSO licence holders in accordance with the approach they described. However, we encouraged all parties to continue coordinating in good faith before the launch of the Telesat Lightspeed constellation.
- 4.6 As part of the consultation, we sought views and evidence from interested parties on existing coexistence challenges related to Telesat’s NGSO ESN licence application:

### Consultation question 1

Do you anticipate this satellite network will pose coexistence challenges to existing services?

## Consultation responses regarding coexistence with existing NGSO licenced systems

- 4.7 Two respondents thought that Telesat had demonstrated that the Lightspeed constellation had the technical capabilities to coexist with existing NGSO operators.
- 4.8 Another respondent pointed out that although Telesat’s application shows their service would be protected, Telesat had not indicated how they would expect licensees to protect their service given Telesat has an older filing – which might create some uncertainty for other NGSOs. The reasons for this potential uncertainty are explained in the next paragraph.

## Our assessment regarding coexistence with existing NGSO licenced systems

- 4.9 Telesat holds one of the oldest ITU satellite filings for NGSO systems operating in Ka band. As already noted, under the ITU’s Radio Regulations, NGSO operators with more recent satellite filings using the same frequencies are under obligation to make appropriate efforts to complete coordination with earlier filings. This requirement stands, even if operators choose to deploy their satellites and commence services before completing coordination.
- 4.10 The terms of coordination agreements are usually bespoke as they take into account the technical characteristics of each system, the services that each operator plans to provide, and the target market. A coordination agreement can therefore require some negotiation and compromise on both sides to enable both operators to coexist.
- 4.11 We summarised this in paragraph 3.31 of the NGSO Licensing Updates Statement where we stated that: “... operators should fulfil their obligations and coordinate with earlier filed systems as per the relevant provisions of Article 9 of the ITU Radio Regulations. At the same time, all operators (including earlier filed ones) should negotiate in good faith in order to enable the most efficient use of spectrum. This means not making unreasonable demands of other operators”.
- 4.12 Our NGSO licensing process does not require applicants to have reached a coordination agreement, as set out by the ITU, but we do want to see evidence of proactive engagement with other licensees; a plan to cooperate so that the risk of interference is minimised; and a willingness to reach coordination agreements.
- 4.13 Moreover, condition 7.2 of the NGSO ESN licence requires that:

*“The Licensee shall cooperate with all NGSO Licensees such that each satellite system (comprising the satellites, earth stations and user terminals) can co-exist and operate within the United Kingdom without causing harmful radio interference to each other, such that network services can be provided to end users.*”

- 4.14 In view of the evidence provided in the initial application - and subsequent additional information provided at our request - we assess that Telesat has provided adequate information regarding its ability to protect existing licensees. The additional confidential evidence we have seen confirms that Telesat is actively engaging in coordination discussions with a number of operators, and, in each case, is exploring a range of options in order to meet the requirements of both parties.
- 4.15 In addition, we assess the announcement in September of a coordination agreement with Amazon<sup>10</sup> as demonstrating Telesat’s willingness and ability to successfully complete such discussions. Therefore, we are satisfied that Telesat is taking the necessary steps to progress discussions with NGSO licence holders.

## Coexistence with future NGSO systems

### Consultation summary

- 4.16 The Telesat consultation set out how Telesat proposed in its licence application to manage coexistence with future systems through the use of alternative satellites and avoidance angles to avoid in-line events. It stated that the exact procedure for avoiding in-line events would be negotiated during coordination discussions. However, the impact of in-line events could be further lessened through dynamic assignment of spectrum and the power allocated to each beam.
- 4.17 Our initial view was that the application provided sufficient comfort that Telesat’s system would be capable of coexisting with existing and future NGSO gateway and terminal operators.
- 4.18 As part of the consultation, we sought views and evidence from interested parties on future coexistence challenges related to Telesat’s NGSO ESN licence application:

#### Consultation question 2

Are the measures set out by the applicant to enable coexistence with future NGSO systems reasonable?

### Consultation responses regarding coexistence with future NGSO systems

- 4.19 One respondent stated that Telesat’s proposals were very flexible. However, they claimed that Telesat was not prepared to show the same flexibility in coordination discussions, specifically that Telesat had not accepted any increase in unavailability or decrease in

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<sup>10</sup> Letter to the FCC 09 September 2022, listed [here](#) as “Kuiper-Telesat Coordination Letter”

average spectral efficiency, at similar levels as those that will occur from the Telesat system into existing services.

- 4.20 Another respondent made similar comments and went further, recommending that any award of licence should be contingent upon reciprocity, i.e. accepting coordination with future NGSO services on the same terms and conditions as Telesat is extending to the existing NGSO services.

### **Our assessment regarding coexistence with future NGSO systems**

- 4.21 With regard to future services, in the Telesat consultation we assessed that Telesat's application provided sufficient evidence to reassure us regarding the flexibility of their system. We have not seen any evidence in the consultation responses to suggest that the design of the Telesat Lightspeed constellation could not accommodate future operators. We therefore remain satisfied regarding the technical ability of their system to coexist with others.
- 4.22 In respect of coordination discussions, we recognise that a real or perceived unwillingness on the part of Telesat to coordinate might create uncertainty for other NGSO operators, given the seniority of the Telesat ITU filings and associated obligation on other NGSO operators with more junior filings to coordinate with them. In extremis, this might deter other operators from entering the UK market. We therefore requested further information from Telesat regarding its approach to coordination.
- 4.23 In response, it stated: "Telesat is conducting coordination in accordance with industry practice as developed through the relevant international expert group, which is ITU WP 4A. Notably, recent contributions have interpreted Recommendation ITU-R S.1323, that falls in the purview of ITU-R Study Group 4, responsible for all satellite matters, as promoting coordination based on (1) average degradation in spectral efficiency, (2) increase in unavailability of the lowest C/N objective. Telesat is in advanced discussions with several NGSO (coordination under No. 9.12 of the Radio Regulations) and GSO (coordination under Nos. 9.12A and 9.13 of the Radio Regulations) operators."
- 4.24 Subsequently, in September, it was announced that Telesat had reached a coordination agreement with Amazon<sup>11</sup>.
- 4.25 This, combined with additional confidential evidence regarding Telesat's approach to coordination discussions has provided the necessary reassurance regarding its approach to coordination with future licensees.
- 4.26 Regarding reciprocity, as we explained in paragraphs 4.9-4.11 above, all satellite operators (and the administrations who hold their satellite filings) have obligations under Article 9 of the ITU Radio Regulations to coordinate with those holding more senior filings. Operators with senior filings must coordinate with good faith but this is not necessarily the same as reciprocity.

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<sup>11</sup> Letter to the FCC 09 September 2022, listed here as "Kuiper-Telesat Coordination Letter" [http://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related\\_filing.hts?f\\_key=-443847&f\\_number=SATMPL2020052600053](http://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related_filing.hts?f_key=-443847&f_number=SATMPL2020052600053)

## Conclusion on NGSO coexistence

- 4.27 In conclusion, we continue to believe that Telesat has the technical ability to cooperate with existing and future NGSO licensees. We have sufficient evidence to anticipate progress on cooperation discussions, as required by the terms of our licence. We also believe the conditions in our licence will provide us with the necessary powers to intervene if required.
- 4.28 In view of the above, our overall technical assessment is that granting the application is unlikely to impact on existing licensees or restrict future NGSO systems from entering the market.

## 5. Assessment of competition issues

- 5.1 In this section we assess the competition risks, and benefits to consumers, arising from Telesat’s NGSO ESN licence application. We cover several competition risks: interference into other systems and associated barriers to entry and expansion, and a broader concern over proliferation of satellites in space.
- 5.2 We assess these competition issues using the counterfactual method. That is, we compare the competitive conditions which we expect to result from granting the application (the factual) against the conditions which would have prevailed without the application (the counterfactual). We take as our counterfactual the status quo. Specifically, we assume a situation in which Telesat does not hold the UK NGSO ESN licence it is applying for. In the factual we assume Telesat is granted the NGSO ESN licence and provides satellite broadband services to UK customers.
- 5.3 The rest of this section is structured as follows:
- A summary of Ofcom’s consultation position on competition.
  - Consultation responses related to competition.
  - Our assessment of these consultation responses.
  - Conclusion on competition risks.

### Summary of our consultation position on competition

- 5.4 In general, our starting position on new NGSO ESN licence applications is that they will not raise material competition risks.<sup>12</sup>
- 5.5 However, in our [statement](#) on NGSO licensing we also noted that “in principle competition concerns could arise from the constraints that systems operating under a network licence might impose on subsequent entrants due to the technical barriers to coexistence between systems (e.g. due to a lack of flexibility in the design of systems). If there was a limited prospect of the applicant’s system and future systems being able to technically coexist, then this could form a barrier to future entry to the market. This would be a particular concern if it results in market power. However, the magnitude of this risk is currently unclear.”<sup>13</sup>
- 5.6 Telesat, in its application, claimed there was growing demand for satellite connectivity supporting various sectors and services, such as the aviation market and the provision of mobile backhaul through satellite links for local telecommunication operators. Further details can be found in its application.

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<sup>12</sup> Statement, Annex A3.14. We also noted in the Statement that “a network licence is necessary for an operator to deploy user terminals in the UK. As set out in section 2, satellite connections can be used to support a range of consumer and business services. Granting NGSO network licence applications is thus likely to benefit customers and consumers and supports Ofcom’s strategic priority to get everyone connected (see above). Since issuing a new network licence allows market entry it also has the potential, if a service is deployed, to promote greater competition (assuming that it can coexist with other authorised systems).” See Statement, Annex A3.12.

<sup>13</sup> Statement, Annex A3.11.

- 5.7 In the Telesat consultation our preliminary view was that Telesat’s system was able to “manage coexistence with future systems”, and that “under condition 7.2 of the network licence, Telesat will be required to cooperate with other licensees”.<sup>14</sup> On this basis, our view was that there would not be a material risk to competition from granting the network licence to Telesat.
- 5.8 On consumer benefits, we noted that Telesat’s Lightspeed constellation had the potential to deliver services “that provide further connectivity options to customers in the UK, in addition to existing NGSO network licence holders.”<sup>15</sup> Telesat’s application also stated that its “Lightspeed satellite service will offer communications capabilities in areas where wired and wireless networks are absent or might not provide adequate coverage or performance compatible with the requested applications.”<sup>16</sup> In addition, the application noted that “Telesat Lightspeed will facilitate applications related to critical infrastructure, disaster communications, corporate communications, telemedicine and other remote communications that will positively affect users’ efficiency and quality of life”.<sup>17</sup>
- 5.9 As part of the consultation, we sought views and evidence from interested parties on competition concerns related to Telesat’s NGSO ESN licence application:

### Consultation question 3

Do you believe this application would benefit or harm future competition between NGSO services in the UK? Please provide details.

## Consultation responses related to competition

- 5.10 Two respondents thought this application could harm future competition between NGSO services in the UK. They each made similar points. For example, one of these respondents stated that “this application may harm future competition between NGSO services in the UK as Telesat’s track record for completing coordination agreements with other NGSO systems at the time of writing appears to be non-existing and would in effect possibly pose an obstacle for future systems to establish Ka-band based NGSO services in the UK”.
- 5.11 Viasat and another operator were concerned that Telesat's network would change after receiving a licence (in particular, with regard to the type of antenna used). They said that this would undermine the current interference-free environment for GSO operators and would deter future operators from entering the UK market. Viasat suggested that Ofcom require that Telesat “not modify the characteristics of its LEO system without filing a modification application with Ofcom that Ofcom approves (in order to maintain its authorisations in the UK)” and that “Telesat provide, every 6 months, a report showing compliance with the obligations attached to the authorisations granted.”
- 5.12 In addition, Viasat stated in its response that it considered that “the proposed Starlink system alone would consume the entire aggregate downlink EPFD ‘budget’ in both Ku and

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<sup>14</sup> See paragraph 2.17 of the Telesat consultation.

<sup>15</sup> See paragraph 2.21 of the Telesat consultation.

<sup>16</sup> See Annex to Telesat application: [TELSAT-NET-1-Annex.pdf \(ofcom.org.uk\)](#).

<sup>17</sup> See Annex to Telesat application: [TELSAT-NET-1-Annex.pdf \(ofcom.org.uk\)](#).

Ka band. Telesat’s NGSO system has the potential to worsen the aggregate EPFD exceedances created by the Starlink system, causing far more interference into GSO networks than is permitted by ITU Radio Regulations under the Res. 76 aggregate EPFD limits<sup>18</sup>. Additionally, it argued that the combined impact of these two operators would “foreclose opportunities for other parties to operate their own NGSO systems in the UK, harming competition”.

5.13 One respondent considered that the large-scale use of certain orbital regions could harm competition in space.

## Our assessment of consultation responses related to competition

5.14 Respondents to the consultation raised concerns that can be grouped into four types of competition risk:

- a) **Risk 1:** granting the NGSO ESN licence would harm competition between NGSO services in the UK, given a perception among some respondents that Telesat had a poor track record for completing coordination agreements.
- b) **Risk 2:** Telesat might change their network design after being granted a licence, which could have the effect of undermining GSO operators’ current interference-free environment, and potentially disincentivise future entrants to the market.
- c) **Risk 3:** The SpaceX system combined with authorising Telesat’s system in the UK would consume all of the aggregate EPFD “budget” allowed for under ITU regulations. This would cause interference into GSO networks and would also foreclose opportunities for other satellite operators to deploy their own NGSO systems in the UK, harming competition.
- d) **Risk 4:** Large-scale use of certain orbital regions could harm competition in space if it leads to the exclusion of other operators in those regions.

5.15 We assess each of these risks in turn below.

**Risk 1: granting the NGSO ESN licence would harm competition between NGSO services in the UK, given a perception among some respondents that Telesat had a poor track record for completing coordination agreements.**

5.16 As we have explained, we are aware that NGSO operators with more senior ITU filings have more rights than more junior ITU filings. We explained that we do not want those systems that deploy first to unduly constrain or block those that might come later. Under the terms of an ESN licence, licensees will have an obligation to cooperate in good faith with all other NGSO licensees. In the event that a licensee was found to be making unreasonable demands of other operators and was causing harmful interference we could take action using our enforcement powers. However, the announcement of a coordination agreement

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<sup>18</sup> The ITU Radio Regulations stipulate that, in most frequency bands, NGSO systems shall operate without causing harmful interference to, or claiming protection from, GSO networks (Article 22.2). The Radio Regulations also define a set of interference limits, called equivalent power-flux density (EPFD limits), used to check whether NGSO systems meet this non-interference condition in certain bands.

with Amazon demonstrates Telesat's willingness and ability to successfully complete such discussions. Accordingly, we consider this competition risk is unlikely to be significant.

**Risk 2: Telesat might change their network design after being granted a licence, which could have the effect of undermining the current interference-free environment enjoyed by GSO operators, and potentially disincentivise future entrants to the market.**

- 5.17 Operators are required to comply with Article 22 of the ITU Radio Regulations and comply with our licence conditions (which also refer to Article 22). Our licence conditions therefore require operators to comply with these interference limits irrespective of any changes to the design of their system. Further information on this can be found in section 6.
- 5.18 Respondents that commented on this risk proposed certain remedial actions that Ofcom should impose on Telesat, such as regular reporting on network design. We assess it would be unnecessarily onerous to require NGSO ESN licence holders report on network design at regular intervals as network designs tend to change infrequently.
- 5.19 However, as we outlined in section 4, we believe it is important that licence holders have sufficient certainty regarding the likely operation of Lightspeed so that they can deploy their services in a timely manner and/or to avoid a degradation of existing services when Lightspeed starts to deploy. We assess that the terms of our licence are sufficient to address this issue. If harmful interference arises, we have powers to deal with this as set out later in section 6. Accordingly, we consider this competition risk (which would arise from interference) is unlikely to be significant.

**Risk 3: The SpaceX system combined with authorising Telesat's system in the UK would consume all of the aggregate EPFD 'budget' allowed for under ITU regulations. This would cause interference into GSO networks and would also foreclose opportunities for other satellite operators to deploy their own NGSO systems in the UK, harming competition.**

- 5.20 The Radio Regulations set limits on the aggregate interference caused by all co-frequency NGSO systems into GSO networks in Article 22.5K and Resolution 76 (Rev. WRC-15).<sup>19</sup> This resolution states that, in the event that aggregate interference exceeds the prescribed limits, administrations operating NGSO systems shall take all necessary measures expeditiously to reduce the aggregate interference levels.
- 5.21 Telesat has confirmed to Ofcom in its response to our further information request that it will "operate its Lightspeed system in order to comply with all applicable provisions of the ITU Radio Regulations with respect to meeting 'single-entry' limits (i.e. Nos. 22.2, 22.5C, 22.5D and 22.5F of the Radio Regulations) and with respect to meeting the 'aggregate' limits indicated in Annex 1 to Resolution 76." Telesat and the administration that holds its filings are obliged to abide by the ITU regulations and we are satisfied that they are able to meet the relevant single-entry and aggregate EPFD limits in Article 22 based on the information they have provided. However, respondents have also raised the possibility of aggregate limits being exceeded when considering the joint contribution of Starlink and Telesat.

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<sup>19</sup> Telesat response to Telesat further information request, Q2b.

- 5.22 As explained in Resolution 76 of the Radio Regulations, existing single-entry EPFD limits were derived assuming a maximum effective number of NGSO systems of 3.5. This means that, if each system complies with the existing single-entry limits, it is reasonable to expect no exceedance of the aggregate limits until at least 4 NGSO systems are in operation. There are currently fewer than four systems licensed and only one operating in the bands Telesat wishes to use as only Starlink operates in the Ka band in the UK. Therefore, at this stage we are satisfied that there is a low risk that the licenced NGSO systems will exceed the aggregate EPFD limits in the UK. Nonetheless, we expect each satellite operator to comply with the single-entry limits regardless of the number of filings under which they operate. This is discussed in further detail in section 6.
- 5.23 On the basis of the above, we assess that the competition risk (which would stem from non-compliance) against this concern is low.

**Risk 4: Large-scale use of certain orbital regions could harm competition in space if it leads to the exclusion of other operators in those regions.**

- 5.24 We note that Telesat’s NGSO ESN licence application to provide satellite broadband services in the UK would be delivered by Telesat’s Lightspeed system. This satellite system would comprise of:

*“LEO Satellites - In the initial phase, 188 satellites plus 10 in-orbit spares will be deployed considering both polar and inclined orbits. Additional satellites will be added in a second phase, bringing the total number to 298. Polar orbits provide global coverage, with a higher concentration of satellites in the Polar Regions. Inclined orbits allow to concentrate satellites over equatorial and mid-latitude areas where demand for communications services is greater, thereby focusing most of the capacity on populated areas. By using these two complementary orbits, the system achieves true global coverage while concentrating satellite resources on the areas of greatest demand, thereby maximizing the system efficiency.”<sup>20</sup>*

- 5.25 This demonstrates that Telesat’s Lightspeed system is designed for “global coverage”, with satellites located in “polar regions” as well as over “equatorial and mid-latitude areas”. This suggests that while Telesat’s system of 298 satellites would concentrate satellite resources on the areas of greatest demand, this would not lead to a concentration of satellites in orbital paths over the UK.
- 5.26 As set out in our December 2021 statement, our competition assessment considers the potential effect on competition to supply satellite broadband to UK customers from issuing the NGSO ESN licence to Telesat. We compare this potential effect against the counterfactual (i.e. not granting the licence). For the application to raise competition concerns in the UK in the manner set out in Risk 4, it would need to be the case that:
- a) granting this UK NGSO ESN licence drives the deployment of a sufficient proportion of Telesat’s planned additional 298 global satellites in certain orbital regions; and

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<sup>20</sup> See Annex to Telesat’s application: [TELSAT-NET-1-Annex.pdf \(ofcom.org.uk\)](#).

b) this deployment leads to harm to competition in the UK.

5.27 Our assessment is that the link between granting a UK NGSO ESN licence and the global design of the Telesat Lightspeed constellation is unlikely to be strong. This is because the UK represents a small market compared to global demand for satellite broadband.

Therefore, our assessment is that granting this UK licence is unlikely to drive the deployment of a substantial proportion of Telesat's Lightspeed constellation.

5.28 Further, the planned geographic locations of Telesat's constellation – as discussed in paragraphs 5.24-5.25 above – suggests that there is unlikely to be a concentration of Telesat satellites in orbital paths over the UK designed to meet UK demand. Therefore, our assessment is that it is unlikely that the Lightspeed deployment would harm competition in the UK by preventing the use by others of orbital regions capable of being used to serve the UK.

### Conclusion on competition risks

5.29 In view of the above, our overall competition assessment is that granting the application is unlikely to create significant competition risks. We also note that there is potential for consumer benefits which could arise from the Lightspeed network following the grant of the licence, which are discussed at paragraph 5.8.

## 6. Additional concerns raised regarding potential impacts on GSO networks

### Consultation summary

- 6.1 In our Telesat consultation, as well as our statement on non-geostationary satellite systems, we explained that coexistence with existing and future NGSO systems and competition are the main issues on which we expect to make our licensing decision. However, in our consultation we also asked stakeholders if they had any additional concerns or comments.

#### Consultation question 4

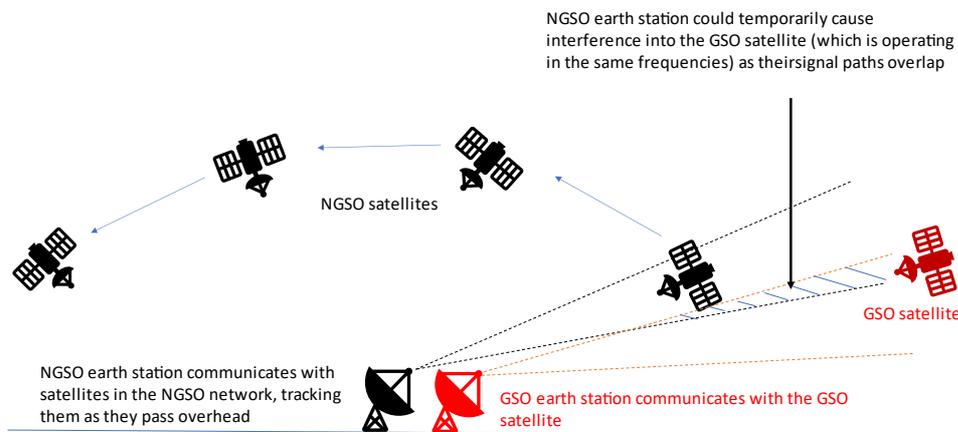
Do you have any additional concerns or comments regarding this application?

- 6.2 Stakeholders raised two additional issues:
- a) Protection of GSO networks from interference from NGSO systems – which we consider in this section; and
  - b) Environmental concerns – which we consider in section 7.

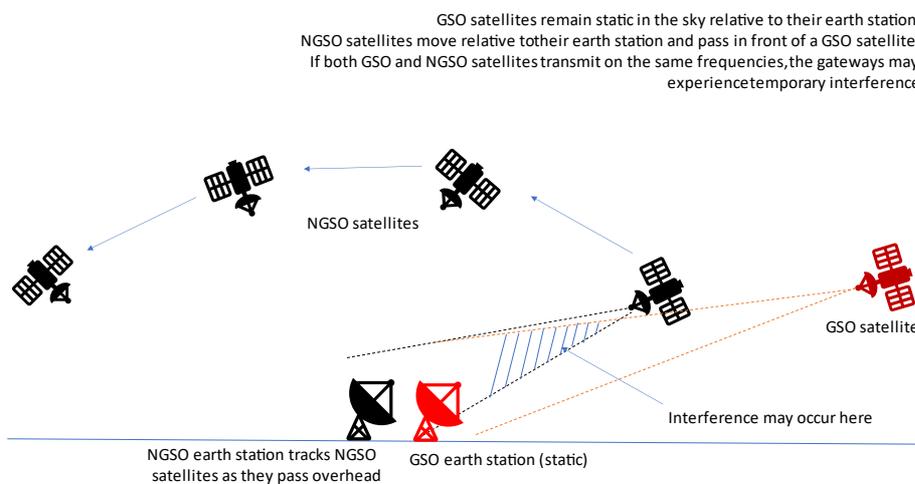
### Interference from NGSO systems into GSO networks

- 6.3 Our NGSO licensing process focuses on the mitigation of interference between two NGSO systems. This is because NGSOs are dynamic by nature, creating a complex spectrum management environment – both in space and on the ground – and thereby increasing the risk of interference. Whilst there is also the potential for interference between NGSO and GSO services which use the same frequencies, international rules and our licence conditions are intended to prevent this, and also address the management of any issues should they arise. We discussed these briefly in the annex to our Statement on NGSO Licensing Updates and will explain them in more detail here.
- 6.4 There are two potential sources of interference from NGSO systems into GSO networks: (i) interference from the NGSO earth station(s) uplink into the GSO satellite (as illustrated in figure 4); and (ii) interference from the NGSO downlink into the GSO earth station(s) (see figure 5).

**Figure 4: Potential for NGSO earth stations to cause interference into GSO Services in the uplink (Earth to space) as they communicate with NGSO satellites passing in front of the GSO arc**



**Figure 5: Potential for NGSO services to cause interference into GSO earth stations (space to Earth) as the NGSO satellites pass in front of the GSO arc**



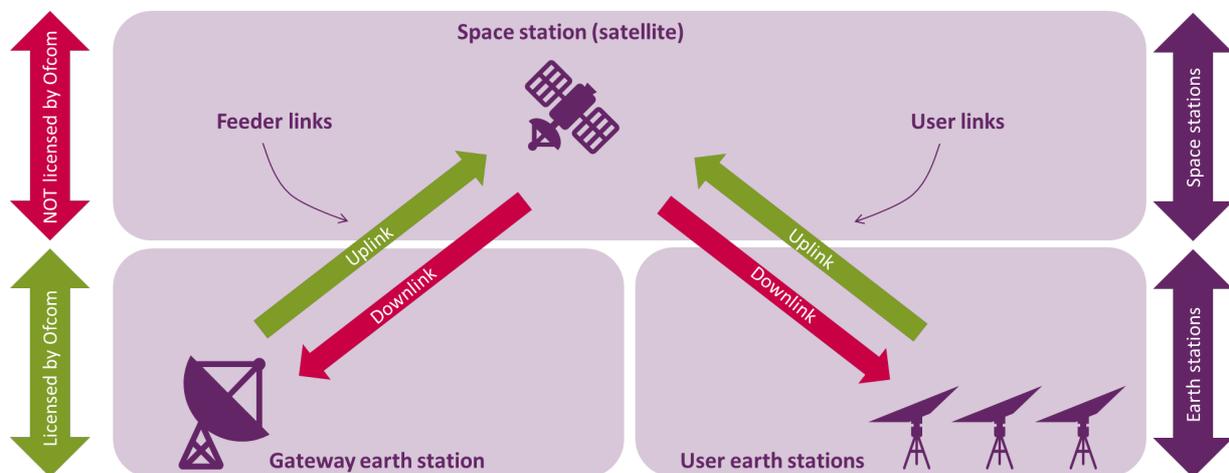
6.5 In the uplink interference scenario, Ofcom is responsible for licensing NGSO earth stations to transmit in the UK and for managing associated interference issues (see figure 6).

6.6 In the downlink interference scenario, GSO earth stations could experience two forms of interference from NGSO networks:

- a) Single entry interference, caused by satellites from one NGSO network;
- b) Aggregate interference, caused by the combined signals of satellites from multiple NGSO systems, all operating in the same frequencies as the GSO earth station.

6.7 Ofcom does not license signals transmitted by a space station (satellite) into the UK. International rules and procedures apply to these as we explain in the following paragraphs.

**Figure 6: Description of a typical satellite service and the regulations that govern their use**



### International rules on coexistence between NGSO systems and GSO networks

6.8 The way NGSO systems and GSO networks coexist is primarily managed through the ITU Radio Regulations. The Radio Regulations are part of an international treaty that is binding to ITU Member States (including the UK), who shall operate their radio stations so that they do not cause harmful interference to the radio services of other Member States operating in accordance with the provisions of this treaty.

6.9 This means that, unless there is another specific agreement in place, the UK in its authorisation and spectrum management processes will take into account (and if necessary, take steps to protect) stations of other administrations<sup>21</sup>, following the provisions of the Radio Regulations. Here, the term “station” can refer to a satellite in space or an earth station on the ground. In turn, we expect that other administrations will operate their stations in accordance with the Radio Regulations and protect UK stations accordingly. Article 15 of the ITU Radio Regulations sets out the process for resolving cases of harmful interference between member states.

6.10 The ITU Radio Regulations stipulate that, in most frequency bands, NGSO systems shall operate without causing harmful interference to, or claiming protection from, GSO networks (Article 22.2). The Radio Regulations also define a set of interference limits, called equivalent power-flux density (EPFD) limits, used to check whether NGSO systems meet this non-interference condition in certain bands.

6.11 These EPFD limits are defined in the Radio Regulations articles 22.5C (limits on Earth for emissions from NGSO satellites), 22.5D (limits on the geostationary orbit for emissions

<sup>21</sup> The ITU Radio Regulations define an administration as “any governmental department or service responsible for discharging the obligations undertaken in the Constitution of the International Telecommunications Union, in the Convention of the International Telecommunications Union and in the Administrative Regulations.”

from NGSO earth stations) and 22.5F (limits on the geostationary orbit for emissions from NGSO satellites).

- 6.12 Upon reception of a new satellite filing, the ITU Radiocommunication Bureau runs a calculation to see if the proposed new system would conform with the stated limits. Further, tables 22-4A, 22-4A1 and 22-4B in the Radio Regulations contain additional limits that have to be met when measured at any operational GSO fixed-satellite service earth station. An NGSO system that complies with all these limits is deemed to be not causing unacceptable interference to GSO networks (see Article 22.5I). In the event that the ITU Radiocommunications Bureau concludes that the limits are exceeded, the filing will receive an unfavourable finding and will not have full international recognition for the use of its orbits and frequency bands.
- 6.13 The Radio Regulations also set limits on the aggregate interference caused by all co-frequency NGSO systems into GSO networks in Article 22.5K and Resolution 76. This resolution states that, in the event that aggregate interference exceeds the prescribed limits, administrations operating NGSO systems shall take all necessary measures expeditiously to reduce the aggregate interference levels.
- 6.14 Article 22.2 does not apply in the bands at 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space), which are subject to number 5.523A of the Radio Regulations instead. This means that GSO networks and NGSO systems have to coordinate their use of this spectrum on a first-come, first-served basis, based on the date of their ITU filings, and later systems will be expected to take into account earlier systems regardless of their type.
- 6.15 It is reasonable for us to expect that NGSO satellite operators will comply with the Radio Regulations and protect GSO networks according to the relevant provisions. The national administration responsible for the NGSO system is ultimately responsible to ensure such compliance.
- 6.16 Ofcom acts as the UK notifying administration under ITU procedures in relation to international management of the radio spectrum and orbit resources. It is responsible for ensuring that these filings (and the satellite networks operating under these filings) comply with the ITU's Radio Regulations. This covers the submission of satellite filings on behalf of companies registered in the UK, British Overseas Territories, the Channel Islands and the Isle of Man.
- 6.17 However, Ofcom is not the notifying administration responsible for the satellite filings under which Telesat's Lightspeed system shall operate.

## What our licensing framework requires

- 6.18 In our licensing statement<sup>22</sup> we said that at this time we did not think that there was a material risk to GSO networks, given the existing national and international regulations we covered in paragraphs 6.9 to 6.14. Therefore, our process for considering NGSO licence

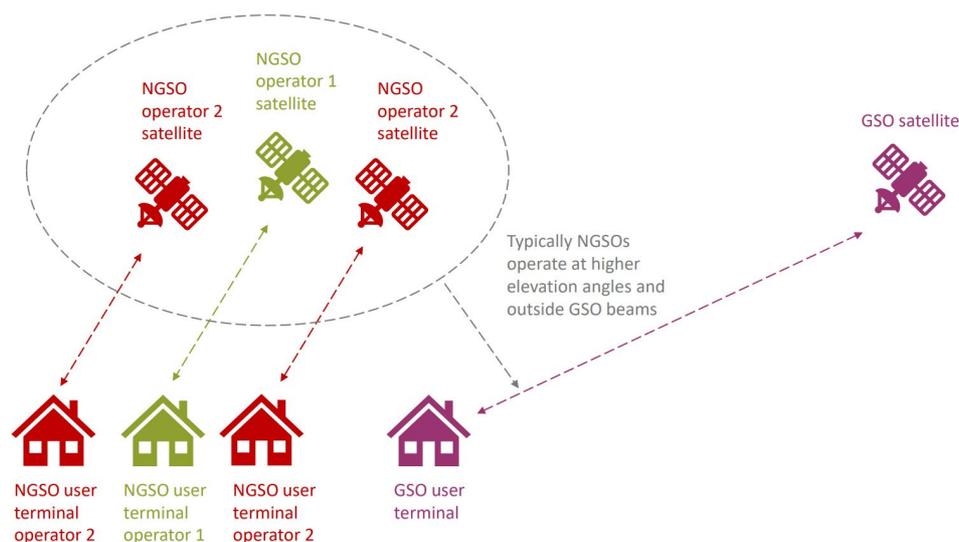
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<sup>22</sup> Paragraph A2.6 in the [annexes to our NGSO Statement](#).

applications focused on requiring applicants to demonstrate that they can coexist with other NGSO systems.

- 6.19 It is a requirement of our ESN licence conditions that all satellite operators operating in the UK under this licence must comply with the relevant sections in the ITU Radio Regulations, including the provisions relating to GSO networks as detailed above. NGSO systems can use mitigation techniques to coexist with GSO networks
- 6.20 We consider that NGSO systems have a range of mitigation techniques at their disposal that allow them to provide services while meeting the above conditions to protect GSO networks; examples are the use of a suitable GSO arc avoidance angle, or the selective reduction of transmit power at certain times.
- 6.21 Given the static positioning of GSO satellites, protecting GSO networks is typically easier than protecting another non-GSO system. For example, for a non-GSO system serving the UK, the elevation angle of earth stations will often be higher than the elevation angle of the GSO arc, as shown in Figure 6. When this is the case, NGSO earth stations will radiate most of their power away from the GSO arc.

**Figure 6: Angular avoidance between GSO and NGSO**



- 6.22 There are bands where Article 22.2 does not apply, as explained in para 6.13 above. In practice, the same technical measures used by NGSO systems to protect GSO networks in other bands would be available and could be used to support coordination in the 18.8-19.3 GHz and 28.6-29.1 GHz bands. Thus, we do not foresee major difficulties in achieving coexistence in the bands.

## Consultation responses concerning interference into GSO networks

- 6.23 While our process for considering NGSO licence applications only requires applicants to demonstrate that they can coexist with other NGSO systems, we have considered the consultation responses received on the potential risk of NGSO systems causing interference into GSO networks. We have also further reviewed Telesat’s capabilities to

coexist with GSO networks, including the capability of their satellites to protect GSO earth stations providing services to the UK.

## Consultation responses

6.24 Comments on protection of GSO were largely made by two respondents but mirror some of the responses that we saw to the consultations on updates to the NGSO Licence and our proposed Space Spectrum Strategy. Here, the comments broadly focused on:

- Compliance with single entry interference and aggregate interference limits;
- Angular separation with the GSO arc;
- Operation in bands not subject to article 22.2 of the ITU Radio Regulations;
- Monitoring and enforcement of interference from NGSO systems.

### Compliance with single entry and aggregate interference limits

6.25 Viasat stated that “the ITU’s methodology and implementing software for assessing expected EPFD levels from NGSO operations rely on an algorithm that derives a “worst-case geometry” found at one particular location on the Earth’s surface.” Viasat added that, due to ITU’s methodology and implementing software’s limitations, in its view “an ITU evaluation would not be expected to reveal the exceedances of EPFD limits in the UK.”

6.26 Viasat suggested that the Starlink system alone would consume the entire aggregate downlink EPFD “budget”. Accordingly, Viasat considered that the aggregate EPFD levels generated by both Starlink and Telesat would harm competition. It asserted that Ofcom should perform compliance analysis to ensure that the Telesat system meets the ITU RR Article 22 EPFD limits in the UK, both individually, and in the aggregate considering all other co-frequency NGSO serving the UK.

6.27 Viasat further recommended that we develop a mechanism by which we can ensure that the aggregate EPFD “budget” and the burden to resolve aggregate interference is apportioned equitably amongst all NGSO systems that serve the UK.

6.28 If we were to move ahead with granting the licence, Viasat also suggested we implement some additional conditions in the ESN licence to ensure that Telesat complied with the EPFD limits.

### Angular separation with the GSO arc

6.29 Viasat claimed that unless “Telesat’s communication links are angularly separated from the GSO arc by a sufficient amount, they could easily degrade service levels and cause capacity losses to the GSO networks with which Telesat seeks to compete, including those that serve the UK and Europe.”

6.30 Viasat added that: “If Ofcom were nonetheless to consider granting Telesat a spectrum authorisation, it should, at a minimum: (i) calculate the minimum GSO arc avoidance angle that would ensure that the Telesat NGSO system protects from interference GSO networks serving the UK and Europe; (ii) allow interested parties to evaluate the efficacy of the proposed value; and (iii) require Telesat to maintain a suitable GSO arc avoidance angle as a condition of any authorisation that ultimately may be granted in this proceeding.”

- 6.31 Another operator noted that: “Telesat’s application states that it can prevent undue interference to GSO downlinks by using a GSO exclusion angle greater than 4.5 degrees as viewed from the victim Earth Station”. However, their view was that this would be impossible to implement, given that the GSO and NGSO gateways could be in any location.

### Operation in bands not subject to Article 22.2

- 6.32 One respondent stated that: “The current guidance for NGSO licensing anticipates that modifications to networks could change the interference environment for current users of the spectrum. It states that Ofcom “would expect operators to keep us informed and to cooperate with other licensees ahead of making such changes in order to ensure they can continue to coexist”. Licensees would also be subject to an ongoing obligation to cooperate and coexist with other NGSO licensees. However, there are no such obligations with respect to the prevention of interference to GSO operators from NGSO systems in key parts of the Ka-bands.”
- 6.33 We understand this remark to refer to operations in the band 28.6 – 29.1 GHz, where GSO networks and NGSO systems have to coordinate their use of spectrum on a first-come, first-served basis, based on the date of their ITU filings, as set out above.

### Monitoring and enforcement of interference from NGSO systems

- 6.34 A respondent queried how Ofcom would monitor possible interference from NGSO systems into GSO networks. The respondent expressed a desire for Ofcom to rise to the challenge of implementing independent interference monitoring so that it can ensure that undue interference is not caused to other spectrum users in the UK.

## Our assessment of concerns about interference into GSO networks

### Compliance with single entry and aggregate interference limits

#### Protection of GSO networks from uplink interference

- 6.35 The NGSO ESN licence contains provisions for the protection of GSO satellite services using the same frequencies. Specifically, condition 3.1 (c) states:

*“earth stations operating with non-geostationary satellites shall ensure compliance with the equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations”;*

- 6.36 Additionally, we have sought further information from Telesat on their capabilities to meet the relevant limits in Article 22. Telesat has confirmed that it will “operate its Lightspeed system in order to comply with all applicable provisions of the ITU Radio Regulations with respect to meeting “single-entry” limits (i.e. Nos. 22.2, 22.5C, 22.5D and 22.5F of the Radio Regulations) and with respect to meeting the “aggregate” limits indicated in Annex 1 to [Resolution 76](#) (Rev. WRC-15).”
- 6.37 Telesat also outlined a range of mitigation techniques which it claimed would allow it to comply with the single-entry and aggregate EPFD limits. These include: the use of steerable

and shapeable narrow beams operating in a multi-colour frequency reuse scheme, dynamic modulation of the EIRP spectral density of the transmissions generated by a satellite or earth station, depending on its pointing direction with respect to the GSO arc, use of beam-hopping, use of a minimum separation angle between two or more satellite beams operating simultaneously and co-frequency.

- 6.38 Telesat noted that WRC-23 is likely to amend this Resolution under Topic J of its Agenda Item 7<sup>23</sup> and highlighted that Telesat is actively engaged in the discussions related to this topic and will comply with any provisions that may come into force following the Conference's deliberations on the matter. Telesat also noted that the COMMSTELLATION, CANSAT-LEO and TELSTAR-LEO satellite systems, for which Telesat is licensed by the administration of Canada have each received a favourable finding following the ITU Radiocommunication Bureau's examination under Resolution 85.
- 6.39 We are therefore satisfied that Telesat is capable of meeting the Article 22 limits in the Earth-to-space direction, that is when transmitting from their user earth stations towards their NGSO satellites.
- 6.40 Should we receive a report of suspected harmful interference being caused to a GSO satellite receiver by a UK licensed earth station, we would use our investigation and enforcement powers and, if needed, instruct the licensee to cease transmissions in order to remove interference<sup>24</sup>.

#### Protection of GSO networks from downlink interference

- 6.41 While we do not license Telesat's satellites as such, we recognise that the presence of terminals in the UK results in Telesat needing to place downlink beams (that is, to transmit signals from their satellites towards the Earth) in Ka band where terminals are located. As a consequence, granting an NGSO ESN licence which enables the use of user terminals in the UK would be expected to result in additional downlink emissions in the areas where user terminals are located. According to Viasat, the evaluation carried out by the ITU could fail to reveal exceedances of EPFD limits in the UK (see paragraph 6.26 above).
- 6.42 We have considered the remark made by Viasat and have sought further information on this point from Telesat. In their response, copied in paragraph 6.37 above, Telesat have confirmed they will operate in compliance with the relevant EPFD limits in the radio regulations also in the space-to-Earth direction.
- 6.43 As a consequence, we are satisfied that Telesat is capable of meeting the Article 22 limits in the space-to-Earth direction as well. If interference from any NGSO system is suspected, UK licensed operators should contact our Spectrum Monitoring Centre; upon reception of such a report we will evaluate the report and use our investigation powers if required. If we deem it necessary, we could also reach out to the filing administration in order to have the interference mitigated.

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<sup>23</sup> See section 4.3 in document 4A/856: <https://www.itu.int/md/R19-WP4A-C-0856/en>

<sup>24</sup> In considering the appropriate course of action, we would take into account a number of factors including the extent and impact of the interference and the international regulatory framework that would apply in the circumstances.

- 6.44 In the interests of proportionality, we would normally use our investigation powers in the event of material and recurring degradation to the victim's service, and that is not necessarily the same as one of the limits in Article 22 being breached.
- 6.45 It is worth reiterating that limits in the space-to-Earth direction present in the Radio Regulations apply unless administration agrees to less stringent limits in their territory. In the strictest sense, it is for Ofcom to decide whether less stringent limits are also acceptable on the ground in the UK and act accordingly.
- 6.46 In our space spectrum strategy, we state that we consider the existing approach to protecting GSO earth stations from harmful interference to be sufficient. However, we will also consider whether introducing a new licence condition (into the NGSO ESN Licence) in relation to the downlink would enable us to enforce more quickly and directly against a UK NGSO licensee (under the new licence condition) if there was harmful interference to GSO receivers in the UK. This could give Ofcom added enforcement options beyond reaching out to the filing administration responsible for the interference.

#### **Need for an independent assessment of single entry and aggregate entry**

- 6.47 As we have stated above, we have requested further information from Telesat and as a result we are satisfied that they are able to meet the relevant single-entry and aggregate EPFD limits in Article 22. However, respondents have also raised the possibility of aggregate limits being exceeded when considering the joint contribution of Starlink and Telesat.
- 6.48 As set out in Resolution 76 of the Radio Regulations, existing single-entry EPFD limits were derived assuming a maximum effective number of NGSO systems of 3.5. This means that, if each system complies with the existing single-entry limits, it is reasonable to expect no exceedance in the aggregate limits until at least four NGSO systems are in operation.
- 6.49 Therefore, at this stage we are satisfied that the risk of exceedance of the aggregate EPFD limits from emissions from all licensed NGSO systems in UK is low. There are currently fewer than four systems licensed and only one operating in the bands Telesat wishes to use as only Starlink operates Ka band in the UK; in addition we expect each of them to comply with the single-entry limits regardless of the number of filings under which they operate.
- 6.50 In the event that aggregate interference were to exceed the prescribed limits, under the current international framework it is the responsibility of administrations operating NGSO systems to take all necessary measures expeditiously to reduce the aggregate interference levels.
- 6.51 The ITU is discussing potential changes to international regulations to provide further guidance to administrations operating NGSO systems and may encourage yearly meetings between them to ensure the overall limits are met.
- 6.52 As explained above, if interference is suspected to a GSO earth stations, UK licensed operators should contact our Spectrum Monitoring Centre; upon reception of such report, we will use our investigation powers and, if needed, reach out to the responsible administrations in order to have the interference removed. In the interests of

proportionality, we would normally use our investigation powers in the event of material and recurring degradation to the victim's service.

## **Angular separation with the GSO arc**

- 6.53 As stated above, our assessment is that NGSO systems have a range of mitigation techniques at their disposal that allow them to provide services while meeting the necessary conditions to protect GSO networks, and the use of a suitable GSO arc avoidance angle is one example.
- 6.54 At this point we do not think it would be proportionate to impose a specific angle avoidance that licensees should comply with, or any other specific technical measures beyond the obligation to meet the relevant limits in Article 22. Doing so would be a significant departure from the way we usually licence space systems; for example, when licensing GSO earth stations we do not impose specific technical conditions to ensure the protection of other co-frequency satellites.
- 6.55 For the same reason, we do not propose to pursue other additional licence conditions suggested, such as requiring six-monthly reports on compliance, which we consider would be unnecessarily onerous.

## **Operation in bands not subject to Article 22.2**

- 6.56 We have already stated that that all satellite operators must comply with the relevant sections in the ITU Radio Regulations, including when it comes to engaging in coordination discussions in good faith with other operators. We have also stated that NGSO systems have a range of mitigation techniques at their disposal that allow them to provide services while coexisting with GSO networks.
- 6.57 We therefore expect Telesat to coordinate in good faith with GSO operators to achieve solutions that allow both parties to make the best possible use of the spectrum.
- 6.58 Given the deployment timelines, we do not consider that granting this licence would create additional risks. On the contrary, given that Telesat holds a senior satellite filing and that our process allows us greater scrutiny of the coordination process, we see greater benefit in granting Telesat a licence at this early stage as this will support us in monitoring that all the necessary cooperation agreements are in place in a timely manner.

## **Monitoring and enforcement of interference from NGSO systems**

- 6.59 We have explained above in paragraphs 6.40, 6.43-6.44 and 6.52 the mechanisms available should any satellite operator suspect harmful interference from an NGSO system. If interference from any NGSO system is suspected, UK licensed operators should contact our Spectrum Monitoring Centre. At that stage we would expect victim operators to provide evidence of the degradation they have experienced.
- 6.60 Our approach to handling interference will depend on the type of interference scenario:
- a) In the case of suspected interference arising from NGSO satellites to a GSO receiving earth station, we will seek evidence of harmful interference from measurements

conducted at the victim earth stations (i.e. at the user or operator's site), and we may also use our satellite monitoring facility at Baldock.

- b) In the case of suspected NGSO interference to a GSO satellite receiver we would rely on evidence of harmful interference provided by the victim satellite operator, as monitoring stations on the ground cannot measure interference to satellite receivers.

6.61 We are taking steps to further develop the UK's capabilities to detect and handle NGSO interference to GSO receiving earth stations. At our Baldock monitoring station we are developing methodologies and processes to collect evidence of harmful interference to satellite receivers, in close collaboration with NGSO and GSO operators. These methodologies will be used to support investigations when required.

## Conclusion on potential impacts on GSO networks

6.62 Whilst our process for considering NGSO licence applications only requires applicants to demonstrate that they can coexist with other NGSO systems, we have considered the consultation responses which raised concerns over the potential for NGSO interference into GSO networks and the subsequent impact on quality of service. We have further reviewed Telesat's capabilities to coexist with GSO networks, including the capability of their satellites to protect GSO earth stations providing services to the UK.

6.63 We recognise that granting a NGSO ESN licence would enable Telesat to provide services in the UK, resulting in additional emissions. Nonetheless, in view of the information provided in the initial applications, and in response to our subsequent request for further information, we are satisfied that Telesat is capable of meeting the Article 22 limits for both uplinks and downlinks. We are also satisfied that there should be no exceedance of the aggregate EIRP limits from emissions from all licensed NGSO systems in UK as a consequence of granting a NGSO ESN licence to Telesat.

6.64 There is an existing framework to protect GSO networks from harmful interference from NGSO systems. At an international level, all satellite operators must comply with the relevant sections in the ITU Radio Regulations which mandate that non-GSO systems shall not cause interference to, or claim protection from, GSO networks in the relevant frequency bands.

6.65 Further, in the UK our NGSO ESN licence explicitly requires the operator to comply with Article 22. In the event of suspected harmful interference from an NGSO system, there are a number of actions available to Ofcom and GSO operators to take action in relation to these provisions.

6.66 We will continue to support the principles of the current ITU framework for NGSO systems, including the need for later filed systems to seek agreement from earlier filed systems, and the obligation for operators to negotiate coordination in good faith. Further, we will work within international bodies to promote improvements to the international framework for NGSO systems

6.67 In view of the above our conclusion is that it is unlikely that a decision to grant a NGSO ESN licence to Telesat would result in harmful interference to GSO networks. However, in the event that this were to occur we would look to take action to address this.

## 7. Concerns regarding the potential impact of NGSOs on the space environment

- 7.1 Respondents raised a number of concerns centred on the risk of collisions in space; space debris; and the impact of releasing large amounts of vaporised aluminium into the atmosphere.
- 7.2 A stakeholder noted that “Credible studies have raised issues related to the impact of mega-constellations on orbital debris, the chemistry of the upper atmosphere, and light pollution.” They suggested that “mega-constellations should be subject to the same kind of environmental impact study and assessment that is typically done for large projects on Earth”.
- 7.3 One stakeholder raised concerns about the way NGSO systems could use orbital resources. It claimed: “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. 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. [Our] concern is about a rush to launch low earth orbit constellations that could have a meaningful impact on both the sustainability of space and of our planet without the necessary impact analysis and resulting regulatory safeguards at both a national and international level.”

### Our assessment of responses regarding the potential impact of NGSOs on the space environment

- 7.4 In the UK, policy on safe and sustainable use of space is determined by UK Space Agency and the Department for Business Energy and Industrial Strategy. Further, the UK regulator with responsibility for issues concerning the safety of space, including space launch and space debris is the Civil Aviation Authority, as outlined in the Space Industry Act 2018. As outlined in section 2, our duties and powers come from separate legislation.
- 7.5 As discussed in section 5, we assess that granting a UK NGSO ESN licence is unlikely to influence or impact the number of satellites that Telesat puts into space. The Telesat Lightspeed constellation is planned to be a global system serving a global market.
- 7.6 We recognise the role spectrum will play in enabling safe and sustainable use of space. We will consider appropriate access to spectrum for radars to track the movements of objects in space. We will also seek to understand whether changes to international spectrum allocations are needed to support in-orbit servicing and other safe space initiatives.
- 7.7 We have shared the concerns raised in the consultation with our responsible counterparts in the CAA and the UK Space Agency for their consideration.

## **Conclusion on the potential impact of NGSOs on the space environment**

- 7.8 Whilst we recognise the importance of safe and sustainable use of space and continue to discuss the spectrum issues related to space debris and space sustainability with the relevant government departments and agencies, this is not a consideration within our current NGSO ESN licence application process.

## 8. Decision

### How we decide whether to grant a licence

- 8.1 In our NGSO statement we set out how we would decide whether to grant a licence. In this, we referred to our statutory duties, with our principal duty being to further the interests of citizens and consumers in relation to communications matters. In accordance with these statutory duties, when deciding whether to grant a licence application, we said that we would be mindful that our objective is to enable citizen and consumer benefits arising from innovative satellite services, such as improved connectivity, and would take all relevant factors into account including in particular:
- (in the case of gateway licence applications) the availability of gateway sites within the UK;
  - any risks to competition for UK consumers; and
  - the ability of networks to coexist in terms of radio interference management.
- 8.2 We confirmed that in reaching our decision we would thus take account of both our technical check, our competition check, and our statutory duties and objectives. In achieving our aim, we would also take account of the available relevant evidence, including responses to the Invitation to Comment.

### Our decision

- 8.3 We have decided to grant an NGSO Earth Station Network licence to Telesat LEO Inc. in light of the evidence presented by Telesat, stakeholder responses and the reasoning set out in this document on the risks and benefits to citizens and consumers of granting this application.
- 8.4 This will authorise Telesat user terminals in the UK – such as a customer’s satellite dish- to connect with its Lightspeed constellation of non-geostationary orbit (NGSO) satellites.
- 8.5 This will authorise Telesat to provide satellite connectivity services in the UK in future, improving connectivity for UK citizens and consumers. Telesat has indicated that it plans to launch satellites from 2025 and commence initial services in the UK in 2026, such as satellite broadband services to support enterprise and mobile backhaul, maritime and offshore platforms, aviation, and government services.

### Next steps

- 8.6 We will now proceed to issue Telesat with its new licence, subject to payment of the licence fee.
- 8.7 A copy of the licence will also be made available under the “Existing licences” section of our [website](#).

# A1. Example Earth Station Network Licence

Wireless Telegraphy Act 2006

## Satellite (Earth Station Network)

Sector/class/product	<Product>
Licence number	<Lic_No>
Licensee	<Lic_Name>
Licensee address	<Address>
Trading as	<Tradenname>
Licence first issue date	<Issue_Date>
Licence version date	<Date>
Payment interval	<Year>

1. This Licence is issued by the Office of Communications ("Ofcom") on <Date> and replaces any previous authority granted in respect of the service subject to this Licence by Ofcom or by the Secretary of State.
2. This Licence authorises <Lic\_Name> ("the Licensee") to establish, install and/or use radio transmitting and/or receiving stations and/or radio apparatus as described in the schedule(s) (hereinafter together called "the radio equipment") subject to the terms set out below and subject to the terms of the General Licence Conditions booklet (Version OfW 597).

**ISSUED BY OFCOM**

**Satellite (Earth Station Network) Licence**  
**SCHEDULE 1 TO LICENCE NUMBER <Lic\_No>**  
**TERMS, PROVISIONS AND LIMITATIONS COVERED BY THIS LICENCE**

This schedule forms part of Licence <Lic\_No>, issued to <Lic\_Name>, the Licensee on <Issue\_Date>, and describes the terms and equipment specifications covered by this Licence.

**1. The Licensee may establish and use:**

1.1. Permanent, transportable or mobile sending and receiving network earth station(s) ("the station(s)") for the purpose of providing wireless telegraphy links between the station(s) and geostationary or non-geostationary satellite(s).

**2. Limitations on use**

2.1. The stations(s) operating with geostationary satellites shall:

- a) transmit within one or more of the following frequency ranges: 14.0-14.5 GHz, 27.5-27.8185 GHz, 28.4545-28.8265 GHz, 29.4625-30 GHz;
- b) for aeronautical stations, not transmit within the frequency range 14.47-14.5 GHz;
- c) transmit only to the satellite and its associated orbital longitude specified in Schedule 2.

2.2. Land station(s) operating with non-geostationary satellites shall:

- d) transmit within one or more of the following frequency ranges: 14.0-14.5 GHz, 27.5-27.8185 GHz, 28.4545-28.8265 GHz, 29.5-30 GHz;
- e) transmit only to the satellite network specified in Schedule 2.

2.3. Aeronautical station(s) operating with non-geostationary satellites shall:

- f) transmit within the frequency range 14.0-14.47 GHz;
- g) transmit only to the satellite network specified in Schedule 2.

2.4. Additionally:

- h) stations(s) that transmit with e.i.r.p. greater than 55 dBW shall operate only with prior consent from Ofcom and registration of the station(s) against the Licence;
- i) station(s) that transmit within the frequency range 14.0-14.5 GHz inclusive shall not operate at any location that is less than or equal to 5 km from the two geographical locations specified in Schedule 3 without prior consent from Ofcom and registration of the station(s) against the Licence;

- j) station(s) that transmit with e.i.r.p. greater than 50 dBW and less than 55 dBW (50 dBW < e.i.r.p. < 55 dBW) in the frequency range 14.0-14.5 GHz inclusive shall not operate at any location that is greater than 5 km and less than or equal to 7 km from the two geographical locations specified in Schedule 3 without prior consent from Ofcom and registration of the station(s) against the Licence; and
- k) station(s) shall not operate within the perimeter fence of any of the aerodromes specified in Schedule 4 without prior consent from the Civil Aviation Authority or stated Airport Authority.

## **2.5 Protection of radio astronomy and fixed links in the 14.25-14.5 GHz band**

- l) To protect radio astronomy operating between 14.47-14.5 GHz, a land or maritime station shall not transmit from a location within a 175 km radius of the national grid references below:
  - Jodrell Bank – focus point of circle is NGR SJ5739392556;
  - Cambridge – focus point of circle is NGR TL5439992385.
- m) Licensees shall protect fixed links at 14.25-14.5 GHz in accordance with the Notice issued by Ofcom.

## **3. Apparatus**

### **3.1. The Licensee shall ensure that:**

- a) The wireless telegraphy apparatus comprised in the station(s) ("the apparatus") is so designed, constructed, maintained and operated, that its use does not cause any undue interference to other users of the spectrum;
- b) The apparatus complies with (and is maintained in accordance with) the relevant performance specification(s) published by the operator(s) of the geostationary or non-geostationary satellite(s);
- c) The earth stations operating with non-geostationary satellites shall ensure compliance with the equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations; and
- d) The apparatus used for transmission complies with the Radio Equipment Directive and UK Interface Requirement 2077.

## **4. Additional conditions for mobile operation**

- a) The radio equipment shall be established or installed so that transmissions from the radio equipment may only be made when the radio equipment's operation is enabled by the crew of the vehicle, aircraft, vessel or train upon which it is mounted, and under the operational control of the network control facility. The radio equipment shall provide the crew with a means immediately to terminate transmissions;
- b) Where an aircraft or vessel is registered in the United Kingdom, Channel Islands or the Isle of Man, the Licensee shall ensure that all radio equipment on board

that aircraft is endorsed by either a separate licence or exemption under the Wireless Telegraphy Act 2006;

- c) Transmissions from the radio equipment shall automatically be terminated on loss or significant degradation of the downlink signal from the relevant satellite;
- d) For operation with geostationary satellites, the radio equipment shall employ a stabilised platform with the ability to maintain a pointing accuracy  $\pm 0.2$  degrees towards the relevant geostationary satellite throughout transmissions; and
- e) For operation with geostationary satellites, the maximum EIRP at angles greater than or equal to 2.5 degrees from the antenna main beam axis shall not exceed 20 dBW/40 kHz from any individual station.

## **5. National and international obligations**

- a) The relevant satellite data shall have been submitted to ITU in accordance with established ITU procedures; and
- b) All transmissions from the radio equipment must be terminated prior to any change of location; unless the apparatus used for transmission is designed for mobile operation and incorporates a stabilised platform or is operating under a specific exemption authorised by Ofcom.

## **6. Requirements specific to Satellite (Earth Station Network) Licences**

- a) The Licensee shall keep a record of the operational characteristics of all terminals in the network, including the locations of fixed installations or, for mobile operation, details of the vehicles, aircraft, vessels or trains on which the terminals are installed and the associated route or defined area of operation, which Ofcom may wish to have access to for enforcement purposes;
- b) The radio equipment shall implement independent local control and monitoring functions at the terminal, and be authorised, supervised and administered by a network control and monitoring centre;
- c) The Licensee shall have the facility to disable individual terminal transmission; and
- d) For satellite networks in MESH configuration, the network operator must nominate and notify Ofcom of those earth station(s) located in the UK which have independent centralised control and monitoring functionality and possess the capability to suppress transmissions from any earth station within the network. Earth stations that are capable of dynamic assignment as point-to-multipoint and point-to-point configuration may only be licensed as permanent earth stations.

## **7. Additional conditions for operation with non-geostationary satellites**

- 7.1. The radio frequencies authorised by this Licence must be used in common with other non-geostationary satellite systems authorised under wireless telegraphy licences granted by Ofcom. The names of these licensees shall be notified by Ofcom to the Licensee from time to time, and together with the Licensee are described as the “NGSO Licensees”.
- 7.2. The Licensee shall cooperate with all NGSO Licensees such that each satellite system (comprising the satellites, earth stations and user terminals) can co-exist and operate within the United Kingdom without causing harmful radio interference to each other, such that network services can be provided to end users.
- 7.3. In the event that –
- a) one (or more than one) of the NGSO Licensees suffers a material and recurring (or ongoing) degradation of services to its users at a specific region or location in the United Kingdom; and
  - b) the degradation of services is resulting from radio transmissions from the earth stations, the satellite or any other part of the satellite system operated by any of the NGSO Licensees, including the Licensee;
- Ofcom may by notice instruct the Licensee to cease or change the use of particular equipment or particular radio frequencies which are authorised under a wireless telegraphy licence (including but not limited to radio frequencies authorised under this Licence) and are used by any part of the satellite system.
- 7.4. Any such cessation or change must be for the purposes of ensuring that such interference is avoided and the degradation of services to users at the particular regions or locations is resolved.
- 7.5. Following receipt of such notice, for such period of time as may be specified in the notice, the Licensee may only operate in accordance with the terms and conditions of the notice.

## **8. Interpretation**

- 8.1. In this and subsequent schedule(s):
- l) “earth station” means a radio transmitter located on the surface of the earth or mounted on a vehicle, aircraft, vessel or train and intended for communication with one or more satellites;
  - m) “geostationary satellite” means a satellite in geostationary orbit which remains approximately in a fixed position relative to a position on the surface of the earth;
  - n) “non-geostationary satellite” means a satellite that does not remain fixed relative to a position on the surface of the earth; and
  - o) “IR” means the United Kingdom Radio Interface Requirement published by Ofcom in accordance with Article 8 of the Radio Equipment Directive (Directive

2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available of radio equipment on the market (known as the Radio Equipment Directive)).

## Notes

1. This Licence does not remove any other obligations that the Licensee may have in relation to satellite filings made under the ITU Radio Regulations.
2. This Licence does not affect the requirement, when necessary, to obtain licences or authorisations under other Acts, such as the Broadcasting Act.
3. Some terminal installations require local authority planning approval. Advice should be sought from the Department for Business, Enterprise and Industrial Strategy and the appropriate local authority planning department.
4. The Licensee must apply for a variation of the Licence from Ofcom before making any changes which may contravene the conditions of the Licence.
5. Technical terms used in clause 2 shall have the meanings assigned to them in the ITU Radio Regulations.
6. For radio equipment installed on aircraft, licensees are advised that they must comply with Civil Aviation Authority (CAA) airworthiness requirements and regulations.
7. Further information, in respect of airworthiness requirements and certification requirements before installation, can be obtained by contacting the CAA:

### **Civil Aviation Authority**

Tel: 0330 022 1500

<http://www.caa.co.uk>

### SCHEDULE 2

<b>Licence No</b>	<Lic No>	<b>Licence version date</b>	<Date>	<b>Payment interval</b>	<1 Year>
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<b>Earth Station Network Name</b>	<b>Emergency Telephone Number (24 hours)</b>
<Network_name>	<Emergency_telephone>

<b>Network Type</b>	<b>Satellite Type</b>	<b>Satellite / Satellite Network Name</b>	<b>Geostationary Orbital Longitude (degrees)</b>
<Network_type>	<Geostationary/Non-Geostationary>	<Sat_name>	<Orbit_long>

<b>Frequency band</b>
14.0 – 14.25 GHz 27.5 – 27.8185 GHz 28.4545 – 28.8265 GHz 29.4625 – 30 GHz (GSO) 29.5 – 30 GHz (NGSO)

Operations are subject to the provision of Article 4.4 of the ITU Radio Regulations (non-interference basis to users of this spectrum) prior to international coordination.

### SCHEDULE 3

Restrictions on equipment to be located within 7 km of the following National Grid References apply - see Schedule 1, Sections 2 i) and j) for further details.

SE 20900 56100

SS 20500 12600

## SCHEDULE 4

Permission to operate equipment subject to this Licence from any location within the perimeter fence of the aerodromes listed below must be obtained from either the CAA or the Airport Authority.

CAA Contact: 0330 022 1500

<b>Aerodrome name</b>	<b>Address</b>	<b>Postcode</b>	<b>Telephone</b>	<b>UK/CI/NI</b>	<b>Easting</b>	<b>Northing</b>	<b>Aerodrome POC</b>
Aberdeen / Dyce	Aberdeen Airport	AB21 7DU	01224 723714	UK	387997	812609	Duty Tels Officer
Alderney	Alderney Airport	GY9 3AJ	01481 822851	CI	556723	5506468	Senior Air Traffic Controller
Belfast Aldergrove	Belfast International Airport	BT29 4AB	028 9448 4281	NI	315195	380283	Duty Air Traffic Engineer
Belfast City	Belfast City Airport	BT3 9JH	028 9045 4871	NI	337483	376510	ATC Supervisor
Benbecula	Benbecula Aerodrome	HS7 5LA	01870 602051	UK	78483	855733	Senior Air Traffic Controller
Biggin Hill	Biggin Hill Airport	TN16 3BN	01959 574677	UK	541691	161064	ATS Manager
Birmingham	Birmingham International Airport	B26 3QJ	0121 780 0922	UK	417220	284022	Duty Engineering Officer
Blackpool	Blackpool Airport	FY4 2QY	01253 343434	UK	332307	431071	Senior Telecommunications Officer
Bournemouth	Bournemouth International Airport	BH23 6SE	01202 364150	UK	411201	97844	ATS Manager
Bristol	Bristol Airport	BS48 3DY	08701 212747	UK	350055	165098	Air Traffic Engineering Manager
Cambridge	Cambridge Airport	CB5 8RX	01223 293737	UK	548723	258544	Senior Air Traffic Controller
Cardiff	Cardiff International Airport	CF62 3BD	01446 712562	UK	306643	167265	Duty Engineering Officer
Carlisle	Carlisle Airport	CA6 4NW	01228 573629	UK	348265	560609	Senior Telecommunications Officer
Coventry	Coventry Airport	CV8 3AZ	02476 308638	UK	435519	274761	Senior Air Traffic Engineer
Cranfield	Cranfield Aerodrome	MK43 0AL	01234 754761	UK	494909	242446	Manager ATS
Dundee	Dundee Airport	DD2 1UH	01382 643242	UK	336868	729382	Senior Air Traffic Controller
Doncaster/Sheffield	Robin Hood Airport	DN9 3RH	01302 624870	UK	46603	39807	ATC Manager
East Midlands	East Midlands Airport	DE74 2SA	01332 852910	UK	445367	326168	Duty Engineering Officer

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Edinburgh	Edinburgh Airport	EH12 9DN	0131 317 7638	UK	314389	673842	Duty Air Traffic Engineer
Exeter	Exeter Airport	EX5 2BD	01392 367433	UK	300326	93702	Senior Air Traffic Controller
Farnborough	Farnborough Airport	GU14 6XA	01252 526015	UK	485452	153678	Senior Air Traffic Controller
Filton	Filton Aerodrome	BS99 7AR	0117 969 9094	UK	359103	180229	Senior Air Traffic Controller
Glasgow	NATS, Control Tower	PA3 2SG	0141 840 8029	UK	247869	666993	Manager Engineering
Gloucestershire	Gloucestershire Aerodrome	GL51 6SR	01452 857700	UK	388598	221747	Duty Aerodrome Controller
Guernsey	Guernsey Airport	GY8 0DJ	01481 237766	CI	528960	5476102	Senior Air Traffic Controller
Hawarden	Hawarden Airport	CH4 0DR	01244 522012	UK	334748	364998	Senior Air Traffic Controller
Humberside	Humberside Airport	DN39 6YH	01652 682022	UK	509295	409914	Air Traffic Manager
Inverness	Inverness Airport	IV2 7JB	01667 464293	UK	277380	851836	ATC Inverness
Isle of Man	Isle of Man Airport	IM9 2AS	01624 821600	UK	228463	468452	Senior Air Traffic Engineer
Jersey	Jersey Airport	JE1 1BW	01534 492226	CI	558699	5451100	Senior Air Traffic Controller
Kirkwall	Kirkwall Airport	KW15 1TH	01856 886205	UK	348020	1008196	Senior Air Traffic Controller
Land's End / St Just	Land's End Aerodrome	TR19 7RL	01736 788944	UK	137630	28983	Senior Air Traffic Controller
Leeds Bradford	Leeds Bradford International Airport	LS19 7TU	0113 391 3277	UK	422418	441129	Duty Air Traffic Engineer
Liverpool	Liverpool Airport Plc	L24 1YD	0151 288 4300	UK	343507	382196	Senior Air Traffic Controller
London City	London City Airport	E16 2PX	020 7646 0205	UK	542674	180487	Duty Air Traffic Engineer
London Gatwick	London (Gatwick) Airport	RH6 0NP	01293 601060	UK	526676	140318	Duty Air Traffic Engineer
London Luton	London Luton Airport	LU2 9LY	01582 395029	UK	512422	220804	Duty Air Traffic Engineer
London Stansted	London Stansted Airport	CM24 1QW	01279 669316	UK	553916	223081	Duty Air Traffic Engineer
Londonderry /Eglinton	City of Derry Airport	BT47 3PY	028 7181 1099	NI	253681	422039	Senior Air Traffic Engineer
Manchester	Manchester Airport	M90 1QX	0161 499 5025	UK	381796	384132	Duty Air Traffic Engineer
Manchester Woodford	Manchester Woodford	SK7 1QR	0161 439 3383	UK	390174	382355	Senior Air Traffic Controller
Manston	Kent International Airport	CT12 5BP	01843 825063	UK	633140	165662	Senior Air Traffic Controller

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Newcastle	Newcastle Airport	NE13 8BZ	0191 214 3244	UK	419802	571483	Senior Air Traffic Controller
Northolt	RAF Northolt	HA4 6NG	020 8833 8228	UK	509755	184987	Air Traffic Supervisor
Norwich	Norwich Airport	NR6 6JA	01603 420645	UK	622014	313753	Tels/Engineering
Oxford/ Kidlington	Oxford Airport	OX5 1RA	01865 844272	UK	446949	215594	Senior Air Traffic Controller
Pembrey	Pembrey Airport	SA16 0HZ	01554 891534	UK	240360	204220	Senior Air Traffic Controller
Plymouth	Plymouth City Airport	PL6 8BW	01752 515341	UK	250511	60229	Senior Air Traffic Controller
Prestwick	Glasgow Prestwick International Airport	KA9 2PL	01292 511107	UK	236746	626815	Senior Air Traffic Controller
Redhill	Terminal Building	RH1 5YP	01737 823377	UK	530105	147698	Senior Air Traffic Controller
Scatsta	Scatsta Aerodrome	ZE2 9QP	01806 242791	UK	438844	1172284	Senior Air Traffic Controller
Scilly Isles / St Mary's	St Mary's Airport	TR21 0NG	01720 422677	UK	92020	10300	Senior Air Traffic Controller
Shoreham	Shoreham Airport	BN4 5FJ	01273 467377	UK	519999	105406	Senior Air Traffic Controller
Southampton	Southampton Airport	SO18 2NL	023 8062 7113	UK	445278	116962	Duty Air Traffic Engineer
Southend	London Southend Airport	SS2 6YF	01702 608120	UK	586898	189290	Senior Air Traffic Controller
Stornoway	Stornoway Aerodrome	HS2 0BN	01851 707415	UK	145851	933141	Senior Air Traffic Controller
Sumburgh	Sumburgh Airport	ZE3 9JP	01950 460173	UK	439533	1110613	Senior Air Traffic Controller
Swansea	Swansea Aerodrome	SA2 7JU	01792 204063	UK	256904	191635	Senior Air Traffic Controller
Teesside	Teesside International Airport Ltd	DL2 1LU	01325 332811	UK	437041	512801	Senior Air Traffic Controller
Warton	British Aerospace	PR4 1AX	01772 852374	UK	341805	427980	Senior Air Traffic Controller
Wick	Wick Aerodrome	KW1 4QP	01955 602215	UK	336317	952799	Senior Air Traffic Controller
Wolverhampton	Wolverhampton Aerodrome	DY7 5DY	01384 221378	UK	382473	291103	Senior Air Traffic Controller
Wycombe Air Park / Booker	Wycombe Air Park	SL7 3DP	01494 529261	UK	482630	190993	Senior Air Traffic Controller
Yeovil / Westland	Yeovil Aerodrome	BA20 2YB	01935 475222	UK	353823	115831	Senior Air Traffic Controller