

Consultation on Orbital Liabilities, Insurance, Charging and Space Sustainability

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Contents

Introduction

1 Legislative Historical Context

2 Other Presenting Issues

3 Case Study: Large Rocket Permissions under the Air Navigation Order 2016

4 FCC vs. DISH: A precedent for UK Regulators

5 Other Considerations

6 Recommendations

Introduction

This Written Evidence is submitted by Dr Alexander Simmonds, Lecturer in Law at Dundee University and Dr Nic Ross, Founder & CEO of Niparo Ltd.

Dr. Simmonds's two main research interests are Space Law and Employment Law having been published in both of these fields. Regarding Space Law, some of Alex's work contributed to changes made to the 2021 Space Industry Regulations in respect of the informed consent provisions. Previously, Dr. Simmonds was called to the Bar at the Honourable Society of The Inner Temple.

Dr. Ross has a background in astrophysics and cosmology research, gaining a PhD from Durham University before working in the USA, both for private research institutes and DOE National Laboratories (Lawrence Berkeley National Lab, Berkeley California). Nic held an STFC Ernest Rutherford Senior Fellowship

at the University of Edinburgh and graduate *summa cum laude* from Northumbria University in Law (Space Law). His LLM dissertation was titled: “The long-term sustainability for the fledgling U.K. Space Sector: Are current regulations and legislation fit for purpose?” Dr. Ross now runs the UKs first space sustainability consultancy, Niparo.¹

On the 01st June 2023, we held the ‘Sustainable Space: Legal and Regulatory Aspects’ summit hosted at the Higgs Centre for Innovation in Edinburgh, Scotland. The motivation for the summit was to critically examine the current paradigm and the near future of UK space sustainability. The report from this Summit is presented elsewhere² and we develop proposals made therein as well as note new issues for UK space sustainability legislation and regulation here.

In this submission, our general thesis is the Space Industry Act 2018 (SIA), and the ensuing Space Industry Regulations 2021 were a considerable and substantial initial effort. We also note there is overall scope for improvement in the primary and secondary legislation when it comes to the UK’s space sustainability efforts and we highlight below a few areas in particular where immediate progress can be made.

This submission is organised as follows. In Section 1, we present a very brief overview of the legislation in this area to date by way of context. In Section 2 we provide definitions of some of the key terms. In Section 3 we present a case study related to Large Rockets. In Section 4, we look at some other approaches to regulation from the United States and in Section 5 make notes on a couple of other issues within the legislation that have been identified since the implementation of the SI. Critically, in Section 6 we present our recommendations for legislative reform.

1. Legislative Historical Context

The Outer Space Act 1986 (OSA) is an Act of Parliament that implements the United Kingdom’s international obligations with respect to space launches and operations. The Outer Space Act received Royal Assent on 18 July 1986 and came into force three years later on the 31st July 1989.

¹ niparo.org

² <https://niparo.org/summit-2023-1>

The OSA was created in light of the UK's international space treaty obligations namely the Outer Space Treaty, the Liability Convention and the Registration Convention, and formally establish a legislative regime in this area. In particular, the OSA sets out the framework for the licensing of spaceflight activities.

Section 4 of the OSA broadly caters for the safeguarding of obligations under Article VI of the Outer Space Treaty (responsibility for national activities in outer space) while while Section 7 of the Act deals with the registration of space objects (Art VII OST; Registration Convention).

Under Section 10 of the OSA, operators must indemnify the UK Government for claims brought against the latter, other than in the circumstances set out in the section - and noting Amendments by the Deregulation Act 2015.

Importantly, as of the end of 2023, all space objects that are in the UK Space Objects Registry were registered via the OSA.

The next piece of primary legislation for space-related matters was the Space Industry Act 2018. This marked a significant expansion in the existing legal apparatus, laying down a comprehensive basis from which to provide a licensing regime for space activities within the UK³. This was followed by secondary legislation in the form of the Space Industry Regulations 2021⁴ which set out a refined and detailed licensing framework.

Presently, in order to conduct space activities or operate a spaceport, a license must be obtained under the Space Industry Act 2018, the requirements of which are laid out in a basic form in the Space Industry Regulations. Details of the requirements can be seen in Table 1 as set out below. The licensing requirements are supplemented by a comprehensive range of guidance documents which are presently hosted on the website of the UK Civil Aviation Authority⁵, designated as the Regulator of space activities within the UK under the 2021 Regulations.

A major environmental and sustainable actors part of current UK Spaceflight licensing is the requirement, for some licences, of an Assessment of Environmental Effects (AEE). The current legislation has AEEs required for Spaceport and

³ For an overview see Alex Simmonds, 'The Space Industry Act 2018: a giant leap?' 15 Jan 2020, Coventry Law Journal. 24, 2,, 95 -104.

⁴ For an overview see Alex Simmonds, 'The Space Industry Regulations 2021: another giant leap?', Coventry Law Journal 2021, 26(2), 69-89.

⁵ The UK Civil Aviation Authority, 'Guidance and Resources', <<https://www.caa.co.uk/space/guidance-and-resources/>> accessed 4 December 2023.

Launch Operator licences. For Orbital licences (as noted above, all of which are currently still issued under the OSA), although Regulation 101⁶ says that after reaching a stable orbit reasonable steps must be taken to avoid contamination there is nothing that explicitly states that it must be included in the AEE. As such, we are left in a position of licensing outlined in Table 1 (at the end of the document).

2. Other Presenting Issues

Some of the definitions in the current legislation are quite narrow in the context of the broader notion of sustainability.

Environment

Where the Act and Regulations refer to the ‘environment’ this is seemingly done with only the environment of earth in mind. Although Schedule 1 (14) of the Space Industry Act states that conditions can be imposed upon a licensee by way of preventing ‘...contamination of outer space or adverse changes in the environment of the earth’, there is no apparent requirement for the impact of any given space activity on the environment of outer space – ie. in terms of debris etc – to be included in the Assessment of Environmental Effects required under s11 of the Act. This was evident from the Assessment of Environmental Effects which was provided by Virgin Orbit.⁷

Large Rockets and Outer Space

Two definitions, in respect of sub orbital operations are also very narrow and have lead to the creation of a lacunae in the regulatory framework as regards launch activities with large rockets.

A *large rocket* is defined as a rocket with a total combined motor impulse of greater than 10,240 Newton-seconds.

⁶ 101.—(1) If necessary to ensure that an operator’s spaceflight activities are carried out safely or to secure compliance with the international obligations of the United Kingdom, the spaceflight operator must after a launch vehicle has reached a stable orbit—

(c)take reasonable steps to—

(iii)prevent contamination of outer space arising from the launch vehicle in orbit or adverse changes in the environment of the earth from that vehicle in orbit, and

⁷ Multiple Authors, ‘Assessment of Environmental Effects; Virgin Orbit, LLC LauncherOne Operations from Spaceport Cornwall, Cornwall Airport Newquay, United Kingdom; July 2022, <https://consultations.caa.co.uk/corporate-communications/aec-consultation-virgin-orbit-spaceport-cornwall/user_uploads/virgin-orbit-spaceport-cornwall-aec--13jul22--1.pdf> accessed 4 December 2023.

UK legislation gives the top of the stratosphere as the start of *outer space*. This is quantified as 47km.⁸ It should be noted this altitude, although considerably higher than aviation operation, is lower than the 80km, 100km Kármán line that has previously been used.

RF Spectrum

RF Spectrum has to be always be considered in the sustainable space discussion.

Lunar and Deep Space Actions

There is currently no disincentive for crashing (deliberately or otherwise) a satellite into the Moon or other celestial body under any existing legislation (e.g. OSA, SIA).⁹

3. Case Study: Large Rocket Permissions under the Air Navigation Order 2016

The Space Industry Act 2018 definition of ‘suborbital flight’ in the context of licensing activities is not conducive to aspects of sustainability. S1(4) states that a suborbital activity is one which involves operating a rocket above the stratosphere. The lower limits of the ‘stratosphere’ has been stipulated in the accompanying guidance as being the International Standard Atmosphere of 47km.¹⁰ Resultantly, rockets that do not cross this boundary are not subject to the usual Assessment of Environmental Effects which is required for other launch activities under the Act¹¹ as they are the subject instead of a ‘permission’ granted under Articles 96(8) and 269 of the Air Navigation Order 2016¹² (ANO) referred to as an ‘Air Navigation Order Large Rocket Permission’.¹³ Permissions granted under the ANO are also

⁸ Guidance for Launch and Return Operator Licence Applicants and Licensees, para 1.14, <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904911/guidance-for-launch-and-return-Operator-licence-applicants-and-licensees.pdf> accessed 4 December 2023.

⁹ It may be worth noting the increased attention being paid to the preservation of parts of the Moon as significant historical landmarks – see the work of Professor Michelle Hanlon and ‘For All Moonkind’ <https://www.forallmoonkind.org/>

¹⁰ The UK Civil Aviation Authority, Guidance on Applying for a License, para 1.13, <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904285/guidance-on-applying-for-a-licence.pdf> accessed 21 November 2023.

¹¹ s11.

¹² SI 2016 no. 765

¹³ UK Civil Aviation Authority, Air Navigation Order 2016, Large Rocket Permission for HyImpulse Technologies GmbH, Permission Ref: HIT/ANO/SR75Rocket, <<https://publicapps.caa.co.uk/docs/33/ANO%20Large%20Rocket%20Permission%20for%20HyImpulse%20Technologies%20GmbH%20070823.pdf>> accessed 24 November 2023.

not subject to the extensive monitoring and enforcement regime under UK Space Industry Legislation¹⁴.

Although Article 269 provides that a certificate of permission must be in writing and may even be granted subject to conditions and subject to the CAA's discretion as arises under Article 253¹⁵ giving the CAA considerable powers, there are no specific or obligatory requirements as regards rockets. The powers are more general¹⁶ with permissions being subject to revocation 'on sufficient ground being shown to its satisfaction'.¹⁷ It has also been confirmed in an email to the authors of this submission¹⁸ that such powers categorically do not extend to a requirement for an operator to provide the equivalent of the Assessment of Environmental Effects as would have been the case had the activity been licensed under the Space Industry Act.

SaxaVord Spaceport in the Shetland Island is in a unique position to offer launch capabilities to many European Stakeholders owing to its geographical location- (which makes it particularly appealing as regards the achievement of polar-synchronous orbits) and the business-friendly nature of the UK as regards space activities. It is hoped that SaxaVord will become a popular launching site over the coming years. However, this underscores the need for consideration to be given to what appears to be a large regulatory loophole as regards some of the projected launching activities. The Large Rocket proposed for launch by Hylmpulse Technologies GmbH is a 'large suborbital sounding rocket'¹⁹ using paraffin and liquid oxygen as a propellant²⁰ which may also require airspace closure.²¹ *Prima facie* this is a dangerous activity, and the exclusion of the activity from monitoring requirements – in addition to the requirement to submit an AEE – seems questionable.

Regarding sustainability, it is worth noting The Oversight and Monitoring Plan for Cornwall Airport, required information regarding the 'Operator's move towards carbon neutrality' to be provided to the Regulator on a yearly basis which is apparently absent from the SaxaVord requirements.²² This matter is notably absent

¹⁴ See, for instance, s26 -s32 of the Space Industry Act 2018 and Part 14 of the Space Industry Regulations 2021.

¹⁵ Article 269 (a) – (c)

¹⁶ Article 253(1)

¹⁷ Ibid at paragraph 2

¹⁸ Email response from the CAA, 24th October 2023

¹⁹ N4, 2.

²⁰ Hylmpulse Rocket Flight from SaxaVord Spaceport (Shetland) ACP-2021-058 Assessment Meeting, 30.09.202

²¹ See Hylmpulse Sounding Rocket Launch from Saxa Vord Spaceport – Shetland, Airspace Change Proposal documentation, <https://airspacechange.caa.co.uk/PublicProposalArea?pID=402>

²² Oversight and Monitoring Plan v.1.0 for Cornwall Airport Limited [ORS10 2022-004.pdf \(caa.co.uk\)](#), 3

from the ‘permission’ granted in respect of the Hylmpulse Large Rocket under the 2016 Air Navigation Order and regrettable as per the importance of matters of sustainability both in a legislative and real-world context. This apparent loophole becomes even more acute when the notification requirements stipulated within the Oversight and Monitoring Plan for the Launch License – arguably a more analogous instrument – are more extensive as regards the environment. Paragraph 4.6 of the OMP stipulates that:

“The Licensee must provide the following information, by way of annual report to the Regulator, no later than 31 January (or other date agreed in writing by the Regulator) each year the Licence is in force... calculation of greenhouse gas emissions, including the greenhouse gas emissions for all in-scope launch activities for the preceding calendar year, and the reduction in tonnes of greenhouse gas emissions arising from the purchase of the credits by the Licensee”.²³

This is supplemented by evidential requirements regarding the purchasing of carbon offset credits.²⁴

4. FCC vs. DISH TV: A precedent for UK regulators

In a world first, the American Federal Communications Commission (FCC) fined DISH Operating L.L.C. (DISH) \$150,000 for failing to properly remove a satellite from geostationary orbit.²⁵

The settlement includes an admission of liability from DISH for leaving the EchoStar-7 at 122 kilometres above its operational geostationary arc, less than halfway to the 300km graveyard orbit the satellite broadcaster had agreed. EchoStar-7, launched in 2002 for a 10-year mission, had a 10-year extension in 2012. Whether this extension was the cause of the lack of orbital disposal is unclear.

The \$150,000 fine was seen as a ‘band aid for a bullet wound’ by many. However, what was not noticed by the majority of commentators was that DISH’s share price fell by nearly 4% immediately following the FCC announcement, pushing the company’s \$3 billion valuation down about \$100 million; considerably more than the nominal fine itself.

²³ Ibid, 4.

²⁴ Ibid, 5.

²⁵ <https://www.fcc.gov/document/fcc-takes-first-space-debris-enforcement-action>

This action by a national regulatory body is a precedent. From the UKs perspective, will the CAA or Ofcom follow suit if required? We note the FCC-Ofcom (and FAA-CAA) regulatory parallels and that Ofcom has been known to issue multi-million pound fines.²⁶

5. Other Considerations

Secondary Effects

There are also 'secondary effects' than aren't very much discussed elsewhere.²⁷ An example here would be the extra fuel burn for (civil) aviation due to diversions caused by close of air space from rocket launches. The transatlantic routes from e.g. Denmark, Germany, Turkey etc. that fly close to the tri-point of Scottish flight information region (FIR), Norway FIR and Reykjavik RIF will be especially susceptible to e.g. launches from northern Scotland. Early calculations have suggested that the tCO2 equivalent emission could be up to *ten times larger* from the diverted aeroplanes than the rocket itself.

Orthogonality in the UK Space Sector.

There is an interesting “orthogonality” that should be realised and that is the desire for growth in the UK Space Sector and the tension to behave in a strongly responsible and sustainability manner. In particular, this can be note in the roles of the regulators. The CAA must take into consideration the ‘growth duty’²⁸ imposed under the Deregulation Act 2015.²⁹ The prevailing philosophy as regards regulation is encapsulated by s108

“A person exercising a Regulatory function to which this section applies must, in the exercise of the function, have regard to the desirability of promoting economic growth.”.

As stated in s108(2)(b), a person exercising Regulatory functions

²⁶ <https://www.ofcom.org.uk/news-centre/2023/royal-mail-fined-for-missing-delivery-targets>;
<https://www.ofcom.org.uk/news-centre/2021/ofcom-fines-o2-for-overcharging>;
<https://www.independent.co.uk/news/business/news/royal-mail-ofcom-fine-breaking-law-price-change-competition-a8490606.html> , accessed 05th December 2023.

²⁷ Though do also see e.g. <https://airspaceunlimited.com/>

²⁸ The UK Civil Aviation Authority, ‘Our Regulatory Principles’,
<[https://publicapps.caa.co.uk/docs/33/CAA%20Horizon%20Regulatory%20Principles%20\(CAP2185\).pdf](https://publicapps.caa.co.uk/docs/33/CAA%20Horizon%20Regulatory%20Principles%20(CAP2185).pdf)>
accessed 20 November 2023.

²⁹ C20.

‘must consider the importance for the promotion of economic growth of exercising the Regulatory function in a way which ensures that—
(a)Regulatory action is taken only when it is needed, and
(b)any action taken is proportionate.’

Whilst this may be an important statutory objective for the legislator, the principle of ‘proportionality’ in this context must surely fall to be judged by the potential safety implications if Regulatory action is not taken when needed. As stated in paragraph 1.5 of the statutory guidance on the ‘growth duty’:

“The purpose is to ensure that specified Regulators give appropriate consideration to the potential impact of their activities and their decisions on economic growth, both for individual businesses and more widely for sectors or groups that they regulate, alongside their consideration of their other statutory duties.”³⁰

As such, we note, if safety is not to be compromised, how does the regulator balance growth duty and true sustainability efforts?

6. Recommendations

The above is a ‘whistle-stop highlights reel’ of the current issues we see as important to the contemporary space sustainability discussion, legislation, regulation and overall efforts in the UK.

As such, our recommendations to the Consultation on Orbital Liabilities, Insurance, Charging and Space Sustainability are as follows:

- Underpinning much of the below, we recommend that the definition of ‘environment’ within the Space Industry Act 2018 and reference thereto in the accompanying 2021 Regulations should also include the ‘Environment of Outer Space’. Resultantly, Space Debris Mitigation measures, where

³⁰ Department for Business, Energy and Industrial Strategy, ‘Growth Duty: Statutory Guidance, Statutory Guidance under Section 110(6) of The Deregulation Act 2015’, <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/603743/growth-duty-statutory-guidance.pdf> accessed 20 November 2023.

relevant, should become part of the Assessment of Environmental Effects under s11 of the SIA³¹.

- Similarly, we also recommend that Orbital Operator licences and Return Operator licensees should also require an Assessment of Environmental Effects. Presently, they are exempt from this requirement (see table 1).
- That launching activities under the 2016 Air Navigation Order for ‘large rockets’ be brought within either the regulatory sphere of the Space Industry Act 2018 – i.e., within the s11 requirement for an Assessment of Environmental Effects – or that ‘permissions’ granted under the 2016 ANO are subject to an equivalent assessment. As previously outline, such activities are classified as ‘sub-orbital’ and, by any measure, have the potential of effective adverse changes to the environment of earth and there is no equivalent of an Assessment of Environmental Effects for permissions granted under the ANO 2016.³² Consideration should also be given to bringing such activities within the monitoring requirements of the Space Industry Act 2018 as, presently, they fall outside this in spite of being an inherently dangerous activity. This would also allow for closer monitoring of environmental aspects of space and launching activities.
- That the Orbital Operator Licence should include the new “5 year rule”, under which, spacecraft that end their lives in orbits at altitudes of 2,000km or below will have to deorbit as soon as practicable and no more than five years after the end of their mission.
- That in light of the FCC DISH decision, Ofcom should penalize poor behaviour and space hygiene when and where appropriate. This could be initially effected by expanding the present definition of the ‘environment’ within the SIA 2018 and SIR 2021 and legislating for more regulatory oversight of orbital – and associated – activities.
- That the SIA 2018 be updated – or other enactments be forthcoming as regards harm caused to the Moon or other Celestial Bodies. These come

³¹ This would assist in meeting / implementing the standards set out in various other international instruments the UK is party to regarding the mitigation of space debris. See Department for Transport, ‘Guidance to the regulator on environmental objectives relating to the exercise of its functions under the Space Industry Act 2018’, (2021), in particular at pages 4-5, <<https://assets.publishing.service.gov.uk/media/60d06eb88fa8f57ceec3ca03/guidance-to-the-regulator-on-environmental-objectives-relating-to-the-exercise-of-its-functions-under-the-space-industry-act-2018.pdf>> accessed 7 December 2023.

³² As also confirmed in an email in the possession of the Authors.

within the definition of “outer space” for the purposes of the Outer Space Act 1986 and SIA 2018. There is likewise nothing in place for deep space missions and activities. No liability for harm in respect of bodies and persons other than those on earth is set out under the SIA 2018- no liability would apparently be incurred for crashing a satellite, for example, either recklessly, negligently or intentionally, into the Moon or another Celestial Body. There should be consideration of updating the existing instruments as such.

Table 1. Cases studies, as noted on the CAA webpages and their licence regime. Note, licenses granted under the Space Industry Act 2018 (SIA) are given in **bold blue**; licenses granted under the Outer Space Act 1986 (OSA) are given in the *italic red*. ANO is the Air Navigation Order 2016 (Article 96).

Operation	Licences required	AEE required?
Vertically launched vehicles from a UK spaceport	Launch operator	Yes
Air-launched vehicles from a UK carrier aircraft	Launch operator	Yes
Suborbital spaceplanes launched from UK site	Launch operator	Yes
Balloons that can reach the stratosphere carrying crew or passengers	Launch operator	Yes
Operate a vehicle launched from outside the UK that will return from space and land in the UK or territorial waters.	Return operator	No
Procure the launch of a space object into orbit and carry out activities from within the UK	Orbital operator	No
Procure the launch of a space object into orbit and carry out activities from outside the UK	<i>Orbital operator</i>	No
Operate a space object in orbit and carry out activities from within the UK	Orbital operator	No
Operate a space object in orbit and carry out activities from outside the UK	<i>Orbital operator</i>	No
Conduct other activity in outer space and carry out activities from within the UK.	Orbital operator	No
Conduct other activity in outer space and carry out activities from outside the UK	<i>Orbital operator</i>	No
Launch activity of a large rocket capable of operating below the stratosphere	ANO	No
Launch activity of a rocket capable of operating above the stratosphere	Launch operator	Yes
Spaceports (for spacecraft can be vertically, horizontal launched, high-altitude balloons or spacecraft landing)	Spaceport	Yes
Provide range control services in support of licensed spaceflight activities at a designated range	Range control	No