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Uses of Outer Space**
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Item 13 of the provisional agenda*
Long-term sustainability of outer space activities

The United Kingdom's implementation of the first set of guidelines on the Long Term Sustainability of Outer Space Activities

1. The United Kingdom welcomes the consensus that was reached, during the fifty-ninth session of the Committee on the Peaceful Uses of Outer Space, on the following twelve guidelines considered by the Working Group on the Long Term Sustainability of Outer Space Activities under the able chairmanship of Dr Peter Martinez of the Republic of South Africa. Recognizing that although these Guidelines have not yet been formally endorsed by the Committee or the General Assembly, but noting that States are encouraged to implement the agreed guidelines to the greatest extent practicable and in accordance with their national law, the United Kingdom is pleased to provide information on its current experience of implementing such guidelines. This is by no means a complete description of all that the UK is doing with respect to these guidelines.

GUIDELINE 1: Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities

2. The United Kingdom enacted the Outer Space Act (OSA)¹ in 1986. It is the legal basis for the regulation of activities in outer space (including the launch and operation of space objects) carried out by persons connected with the United Kingdom. This Act confers licensing and other powers on the Secretary of State acting through the UK Space Agency (UKSA). The Act ensures compliance with UK obligations under the international conventions covering the use of outer space to which the UK is a signatory.

3. Under the OSA, the Secretary of State shall not grant a licence unless he is satisfied that the activities authorised by the licence will not jeopardise public health or the safety of persons or property, will be consistent with the international

* A/AC.105/C.1/L.355.

¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295760/outer-space-act-1986.pdf.



obligations of the United Kingdom, and will not impair the national security of the United Kingdom. Further the Secretary of State requires the licensee to conduct his operations in such a way as to prevent the contamination of outer space or adverse changes in the environment of the Earth, and to avoid interference with activities of others in the peaceful exploration and use of outer space.

4. Noting the increase of outer space activities by non-governmental actors, the OSA regulatory framework² ensures the effective application of relevant, generally accepted international norms, standards and practices for the safe conduct of outer space activities by making reference to relevant guidelines and standards on its website in its guidance and consideration of licence applications.

5. The United Kingdom prides itself on its ability to provide a rigorous and responsive framework to consider not only existing space projects and activities but also timely regulation in order to avoid legal lacunae. A good example of this is our new traffic-light approach to cube-sat mission³, which recognizes the common technological and operational aspects of certain space systems. Rather than assess risks on a case by case basis, UK Space Agency can use pre-determined technical assessments and associated likely regulatory outcomes for a set of standard missions (green = low risk, amber = medium risk, red = high risk) thus reducing the burden on regulators and space operators while maintaining rigorous oversight. This does not preclude consideration of non-standard missions (e.g. in-orbit servicing) which are not currently established space activities, but that will require bespoke approaches reflecting the novel character of their operations.

6. The implementation of the UK's Outer Space Act is not so prescriptive as to prevent initiatives addressing the long-term sustainability of outer space activities, acknowledging that operators are often best placed to understand how best to effect overall long term sustainability objectives.

GUIDELINE 2: Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities

7. The OSA provides the UK government with the necessary regulatory oversight to:

- consider public health and safety, and the safety of property;
- evaluate the environmental impact of proposed activities;
- assess the implications for national security and foreign policy interests;
- determine financial responsibilities/liabilities and international obligations.

8. Safety evaluation within the OSA aims to determine whether an applicant can safely conduct the launch into orbit of the proposed vehicle and any payload. Because the regulator is responsible for public safety, it is important that an OSA applicant demonstrate an understanding of the hazards involved and discuss how the operations will be performed safely. There are a number of technical analyses, some quantitative and some qualitative, that the applicant must perform in order to demonstrate that their commercial launch operations will pose no unacceptable threat to the public. Risk assessments are informed by best practices and measures reflected in existing international technical standards, including those published by the International Organization for Standardization (ISO), the Consultative Committee for Space Data

² <https://www.gov.uk/guidance/apply-for-a-license-under-the-outer-space-act-1986#the-outer-space-act-1986>.

³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447284/Draft_Cubesat_regulation_recommendations.pdf.

Systems and national standardization bodies such as the British Standards Institute (BSI).

9. In addition, the UK Space Agency utilises recommended practices and voluntary guidelines proposed by the Inter-Agency Space Debris Coordination Committee and the related Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space.

10. We consult regularly with UK space industry through formal and informal mechanisms to ensure that our regulation of space activity remains responsive, fit-for-purpose and up-to-date. For example, the Space Leadership Council,⁴ established in 2010, has worked successfully as a means to incorporate industry views into the development and implementation of UK space policies.

GUIDELINE 3: Supervise national space activities

11. Recognizing that the role of the State and its regulatory authorities is not just one of authorising but also supervising the space activities of non-governmental entities, the United Kingdom seeks to ensure that entities under its jurisdiction that conduct outer space activities have the appropriate structures and procedures for planning and conducting space activities in a manner that supports the long-term sustainability of outer space activities, and that they have the means to comply with relevant national and international regulatory frameworks, requirements, policies and processes in this regard.

12. In implementing the OSA, the UK Space Agency relies upon a number of quantitative analyses and qualitative analyses during its consideration of licence applications, and follows this up with compliance monitoring and reporting activities once the system is operational. The quantitative analyses tend to focus on the reliability and functions of critical safety systems, and the hazards associated with the hardware, and the risk those hazards pose to public property and individuals near the launch site and along the flight path, to satellites and other on-orbit spacecraft. The qualitative analyses focus on the organizational attributes of the applicant such as launch safety policies and procedures, communications, qualifications of key individuals, and critical internal and external interfaces.

13. In the technical submissions for a licence under the OSA, an applicant must provide an assessment of the risk to public safety and property, covering each phase of the mission relevant to the proposed operations and licensed activity. This risk assessment is then used as a basis for the technical review conducted by assessors to determine if the applicant's proposed activities are compliant with the safety requirements of the Outer Space Act. Subsequent to licence issue, in order to ensure that licenced entities maintain all the necessary technical competencies required to conduct the outer space activities in a safe and responsible manner and comply with the relevant requirements, the UK Space Agency conducts compliance monitoring (such as uncooperative tracking from the ground) and requires operators to report annually on their space activities and to provide reports when things do not proceed according to plans submitted as part of the licence application.

14. Operators are required to designate a contact point responsible for communication with relevant authorities to facilitate efficient and timely sharing of information and coordination of activities to promote the safety and sustainability of outer space activities such as conjunction monitoring and assessment, and cooperative exchange of pertinent information such as planned manoeuvres with those potentially affected.

⁴ <https://www.gov.uk/government/groups/space-leadership-council>.

GUIDELINE 4: Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites

15. The use of the electromagnetic spectrum in the UK is regulated by OFCOM.⁵ It operates on a legal basis provided by the Communications Act (2003) and the Wireless Telegraphy Act (2006).

16. OFCOM ensures that the radio spectrum is used in the most effective way by all users, large and small in the UK. It works with the UK Space Agency to promote the sustainable use of the spectrum and to discourage hoarding of frequencies and orbital resources.

17. When authorising space activities we carry out a technical analysis to ensure that space objects that have terminated their operational phases do not pose a long-term interference in orbital regions. In Low Earth Orbit (LEO) we ensure that orbital lifetimes are compliant with the 25-year recommendation from the Inter-Agency Debris Committee (IADC) and the United Nations Committee on the Peaceful Uses of Outer Space Guidelines. In Geo-Synchronous Orbit we require space operators to boost their spacecraft at end-of-life into an orbit above the GEO region such that they will not interfere with or return to the GEO region (so-called 'graveyard' orbits). This is in line with the IADC guidelines and ITU-R S.1003.

18. We regularly check with UK operators to ensure the reliability of the re/de orbit systems and availability of fuel to conduct these manoeuvres.

GUIDELINE 12: Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects

19. The UK Space Agency has promoted the development and use of techniques and methods to improve the accuracy of orbital data for spaceflight safety and the use of common, internationally recognized standards when sharing orbital information on space objects in a number of initiatives involving government researchers at UK Defence Science and Technology Laboratory (DSTL), academia and industry.

20. The UK Space Agency and the Royal Air Force have agreed a joint strategy and letter of intent to work together in improving our national Space Situational awareness capabilities. The UK Space agency has made a significant contribution to the Space Surveillance and Tracking element of the European Space Agency Space Situational Awareness programme.

21. A good example of this was presented at the Advanced Maui Optical and Space Surveillance Technologies (AMOS) conference: in February 2014 UK and Australia carried out a joint space surveillance target tracking, cueing, and sensor data fusion experiment.⁶ Four organizations were involved, these being the UK Defence Science and Technology Laboratory (DSTL) and Science and Technology Facilities Council (STFC) with the Defence Science and Technology Organisation (DSTO) and Electro Optic Systems (EOS) of Australia. The experiment utilised the UK STFC CAMRa radar located at Chilbolton in southern England and an Australian optical camera and laser system owned and operated by EOS which is located at Mount Stromlo near Canberra, Australia.

22. The UK is home to the Space Data Association (SDA), a formal non-profit association of satellite operators that supports the controlled, reliable and efficient sharing of data critical to the safety and integrity of space flight operations. SDA is a recognition that sharing orbital information on space objects, operators and other

⁵ <https://www.ofcom.org.uk/>.

⁶ <http://www.amostech.com/TechnicalPapers/2014/SSA/DONNELLY.pdf>.

appropriate entities should be encouraged, and promotes the use of common, internationally recognized standards to enable collaboration and information exchange, thereby facilitating greater shared awareness of the current and predicted location of space objects enabling timely prediction and prevention of potential collisions.

GUIDELINE 13: Promote the collection, sharing and dissemination of space debris monitoring information

23. The UK Space Agency encourages the development and use of relevant technologies for the measurement, monitoring and characterization of the orbital and physical properties of space debris through its membership of the Inter Agency Debris Coordination Committee (IADC) and support to its regular survey programmes to characterise the orbital debris environment, including its sharing and dissemination of derived data products and methodologies in support of IADC's research and international scientific cooperation on the study of the evolution of the orbital debris population.

GUIDELINE 16: Share operational space weather data and forecasts

24. The Met Office Space Weather Operations Centre (MOSWOC) makes its operational space weather forecasts routinely available to other international centres including South Africa, United States, Belgium, Japan, Finland, Sweden and through ESA. MOSWOC also provides space weather forecaster training to developing forecast centres.

25. The Natural Environmental Research Council (NERC) British Geological Survey (BGS) makes ground based magnetometer data available and the Science and Technology Facilities Council (STFC) RAL Space make ionosonde data available in real-time.

26. The UK Space agency has made significant investments in the European Space Agency Space weather programme, €26M by 2020, one element of which supports the development expert service centres to share data and develop improved space weather forecasting models.

GUIDELINE 17: Develop space weather models and tools and collect established practices on the mitigation of space weather effects

27. The United Kingdom has identified the risk that space weather poses to modern technology that society relies upon and encourages the monitoring, forecasting, and sharing of vital space weather information. The UK has developed a space weather strategy,⁷ which we published in 2015 which outlines how we propose to mitigate this risk.

28. The UK Space Agency:

- is investing significantly in the European Space Agency Space weather programme which aims to develop the capability to forecast space weather through developing the required observational and analysis capability, networking existing European infrastructure and expertise and through developing and deploying new orbital sensors.
- is funding a study on the socio-economic costs of space weather at a global and national (UK) level.

⁷ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/449593/BIS-15-457-space-weather-preparedness-strategy.pdf.

- has worked within the EU to develop a programme of space weather research under the Horizon 2020⁸ programme.
 - is working within government to ensure critical national infrastructure is resilient to space weather
29. The UK Met Office⁹ Through the World Meteorological Organisation (WMO), participates in the Interprogramme Coordination Team on Space Weather (ICTSW), whose objectives are:
- Standardization and enhancement of Space Weather data exchange and delivery through the WMO Information System (WIS)
 - Harmonized definition of end-products and services, including e.g. quality assurance guidelines and emergency warning procedures, in interaction with aviation and other major application sectors
 - Integration of Space Weather observations, through review of space- and surface-based observation requirements, harmonization of sensor specifications, monitoring plans for Space Weather observation
 - Encouraging the dialogue between the research and operational Space Weather communities.
30. The Met Office is a member of the International Space Environment Services (ISES) association and the Met Office Space Weather Operations Centre (MOSWOC) is a Regional Warning Centre (RWC) for space weather, under ISES which:
- freely exchanges space weather forecasts and model output with other RWCs
 - encourages the adoption of standardised data formats for forecasts and leads work on verification.
 - engages in knowledge transfer activities space weather monitoring and forecasting
 - sits on the United Nations Committee on the Peaceful Uses of Outer Space Space Weather Expert Group
 - works closely with users of space weather services, to ensure services meet their needs and can be effectively used to mitigate the risks presented by space weather.
31. The Natural Environmental Research Council (NERC) British Geological Survey (BGS), hosts the World Data Centre for Geomagnetism which is a node of the World Data System. NERC and the Science and Technology Facilities Council (STFC) jointly fund RAL Space to host the UK Solar System Data Centre, which archives and makes available a number of solar terrestrial physics observational datasets.
32. The UK academic community contributes through national, European e.g. EU H2020 and ESA SSA Programme, and global fora on the development of space weather models. This has come into sharper focus with the creation of MOSWOC and a greater understanding of user's space weather forecast needs.

GUIDELINE 25: Promote and support capacity-building

33. The UK Space Agency's International Partnership Programme (IPP),¹⁰ is a five-year, £152 million programme designed to partner UK space expertise with

⁸ <https://ec.europa.eu/programmes/horizon2020/>.

⁹ <http://www.metoffice.gov.uk/>.

¹⁰ <https://www.gov.uk/government/news/uk-space-agency-funds-satellite-solutions-for-developing-countries>.

governments and organizations in emerging and developing economies around the world to deliver a sustainable, economic or societal benefit. Satellite data will be used to tackle problems such as flooding, drought, and deforestation.

34. The IPP focuses on using the UK Space sector's research and innovation strengths to deliver practical and measurable effects to end-users in developing countries. Funded from the Department for Business, Energy and Industrial Strategy's Global Challenges Research Fund (GCRF), the IPP forms part of the UK's Official Development Assistance (ODA) ring-fenced budget. Projects undergo a rigorous selection process to ensure that they meet strict requirements for ODA and UN sustainability goals. The UK Space Agency part funds IPP projects with a proportion of the cost shared by the programme applicants to ensure cost effectiveness and value for money.

35. The United Kingdom also supports capacity-building in developing countries with emerging space programmes, through measures such as improving their expertise and knowledge on spacecraft design, flight dynamics and orbits through its involvement in a range of commercial, institutional and academic collaborations (e.g. the STARDUST series on international seminars/exchanges).

36. Further, through entities such as the London Institute for Space Policy and Law, the United Kingdom supports capacity-building to help achieve efficient technical capabilities, standards, regulatory frameworks and governance methods that support the long-term sustainability of outer space activities and sustainable development on Earth.

37. The UK undertakes efforts to make relevant space-based information and data accessible to countries affected by natural disasters or other catastrophes, supporting capacity-building activities aimed at enabling the receiving countries to make optimal use of such data and information. These space-based data and information are made available through UK participation in the International Charter on Space and Major Disasters through a partnership between the UK Space Agency and DMC International Imaging Ltd. (DMCii). The UK Space Agency is the participating Member on the Charter Board while DMCii provides the UK operational contribution to the Charter.

38. The UK Space Agency is at the heart of UK efforts to explore space, exploit space-based applications and technology, while supporting UK academic and industrial communities. This includes supporting cross-governmental efforts on disaster management and recovery using satellite data. DMCii was founded in 2004 with the mission to coordinate the Disaster Monitoring Constellation (DMC). The DMC is a constellation of Earth observation satellites; each satellite is independently owned and controlled by a DMC Consortium member. The DMC was designed at concept to service many of the requirements of disaster monitoring.

GUIDELINE 26: Raise awareness of space activities

39. In its National Space Policy, published in 2015, the United Kingdom set out four guiding principles:

- Recognizes that space is of strategic importance to the UK because of the value that space programmes deliver back to public services, national security, science and innovation and the economy.
- Commits to preserving and promoting the safety and security of the unique space operating environment, free from interference.
- Supports the growth of a robust and competitive commercial space sector, underpinned by excellent academic research.

- Commits to cooperating internationally to create the legal frameworks for the responsible use of space and to collaborating with other nations to deliver maximum benefit from UK investment in space.

40. The UK Space Agency regularly supports the annual UNIDIR/Secure World Foundation Space Security meeting held in Geneva.

41. An example of the innovative use of space occurred in 2014 when the UK's Department for International Development (DFID) announced a strategic partnership with the private sector to deliver e-learning programmes in Kenya to thousands of marginalised girls. The iMlango programme is delivered around an internet learning platform, accessed via high-speed satellite broadband connectivity. The partners provide students with interactive, individualised learning tools, personalised maths tuition with a virtual online tutor, alongside digital learning content for maths, literacy and life skills, and tuition and support to teachers to use ICT in their teaching. This is enabled by UK industry, using technology developed as part of a public-private partnership with the UK Space Agency, delivered through the European Space Agency telecommunications R&D programme.

GUIDELINE 27: Promote and support research on and the development of ways to support sustainable exploration and use of outer space

42. The United Kingdom is supporting the development of novel and disruptive technologies such as the SABRE air-breathing rocket engine which has the potential to deliver low cost, low impact, reusable access to space, and is exploring those regulatory activities required to supervise such activities, including in orbit servicing missions intended to extend the life of satellites already in orbit.

GUIDELINE 28: Investigate and consider new measures to manage the space debris population in the long term

43. As a member of the IADC and recent host of its 2016 meeting in Harwell, Oxfordshire, the UK Space Agency is investigating new measures, including technological solutions to address manage the space debris population in the long term. Further, as demonstrated by its presentation to the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space in 2015 of the proposed RemoveDEBRIS mission, the UK is keen to test those enabling technologies and techniques required to implement remediation mission concepts.

44. The United Kingdom has led the development of the ISO24113 Top Level Space Debris Mitigation Standard and convenor of ISO TC20/SC14/WG7 relating to space debris.

45. The UK Space Agency reflects the need for compliance with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space via its requirements for licensing of space missions under the UK's Outer Space Act.