

Space Launch and Orbit Group

Orbit Session

November 2022



Welcome

Agenda

Welcome

July meeting follow up

- Kitemark initiative update – Joanne Wheeler & Hugh Lewis
- Space spectrum update – Ofcom

Orbit session 12 month review

Hot topics

- Reduced lifetime requirements
- Regulator's Licensing Rules

Current challenges

- Applications update
- Safety Case for orbital
- Satellite orbital safety best practices – OneWeb

Future opportunities

- Engagement/outreach plan

AOB



Welcome

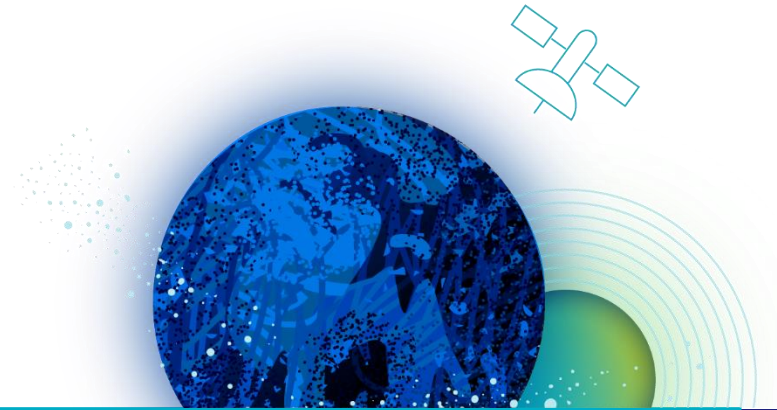


Housekeeping

- Please mute microphones
- Please use chat or raise Teams hand to ask any questions, or raise your hand in the room
- We will publish the slides and actions from this meeting, not verbatim minutes, on our website at caa.co.uk




July follow up





The Earth ∞ Space Sustainability Initiative



The Earth & Space Sustainability Initiative brings together industry, academia, government stakeholders and international bodies to ensure that space continues to support the environmental, economic and scientific interests of future generations

The Earth & Space Sustainability Initiative will facilitate the establishment of the industry-led Kitemark – the global transparent ESG space sustainability standard, recognised by the finance and insurance communities

Earth & Space Sustainability — a strategy for global leadership and access to finance

UK can lead the establishment of global transparent ESG space sustainability standard.

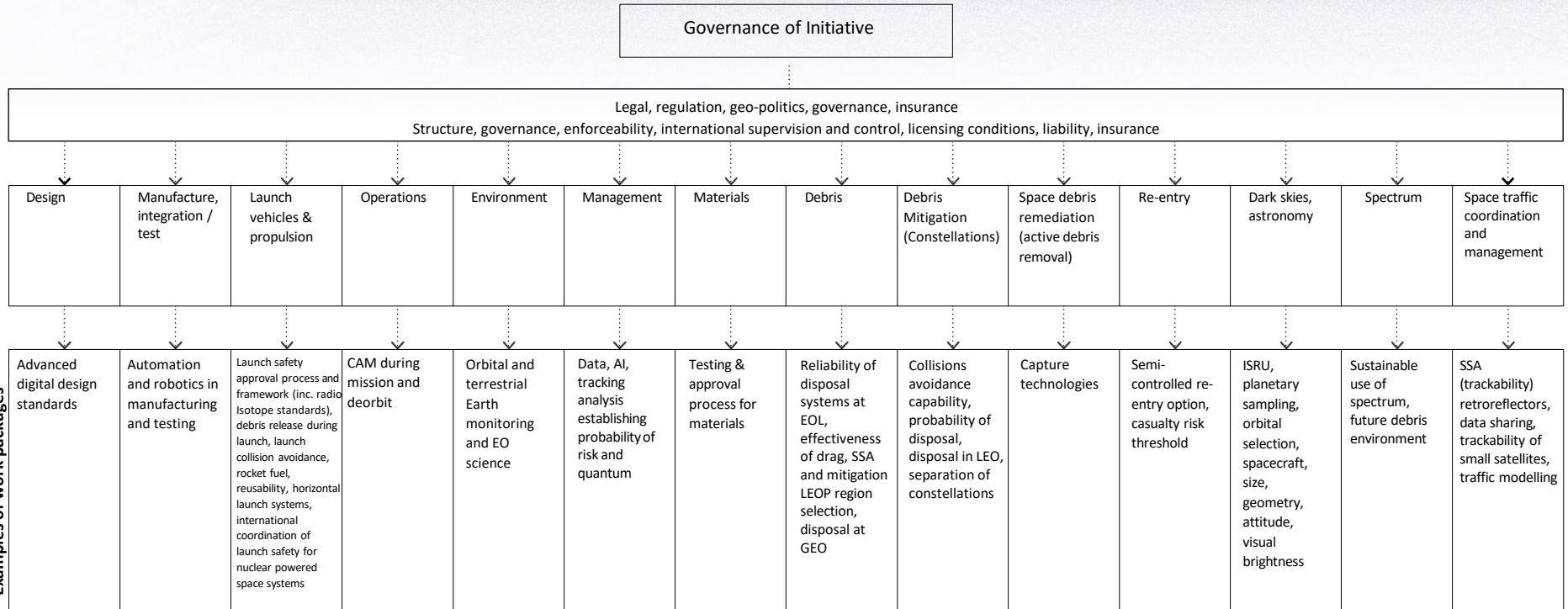
The UK has an opportunity to be the world leader in forming a Kitemark for the sustainable use of space; covering the lifecycle of a satellite.

This work can harness the existing world leading expertise across the UK industry and academia and also the experience of the recognised leading UK finance and insurance community.



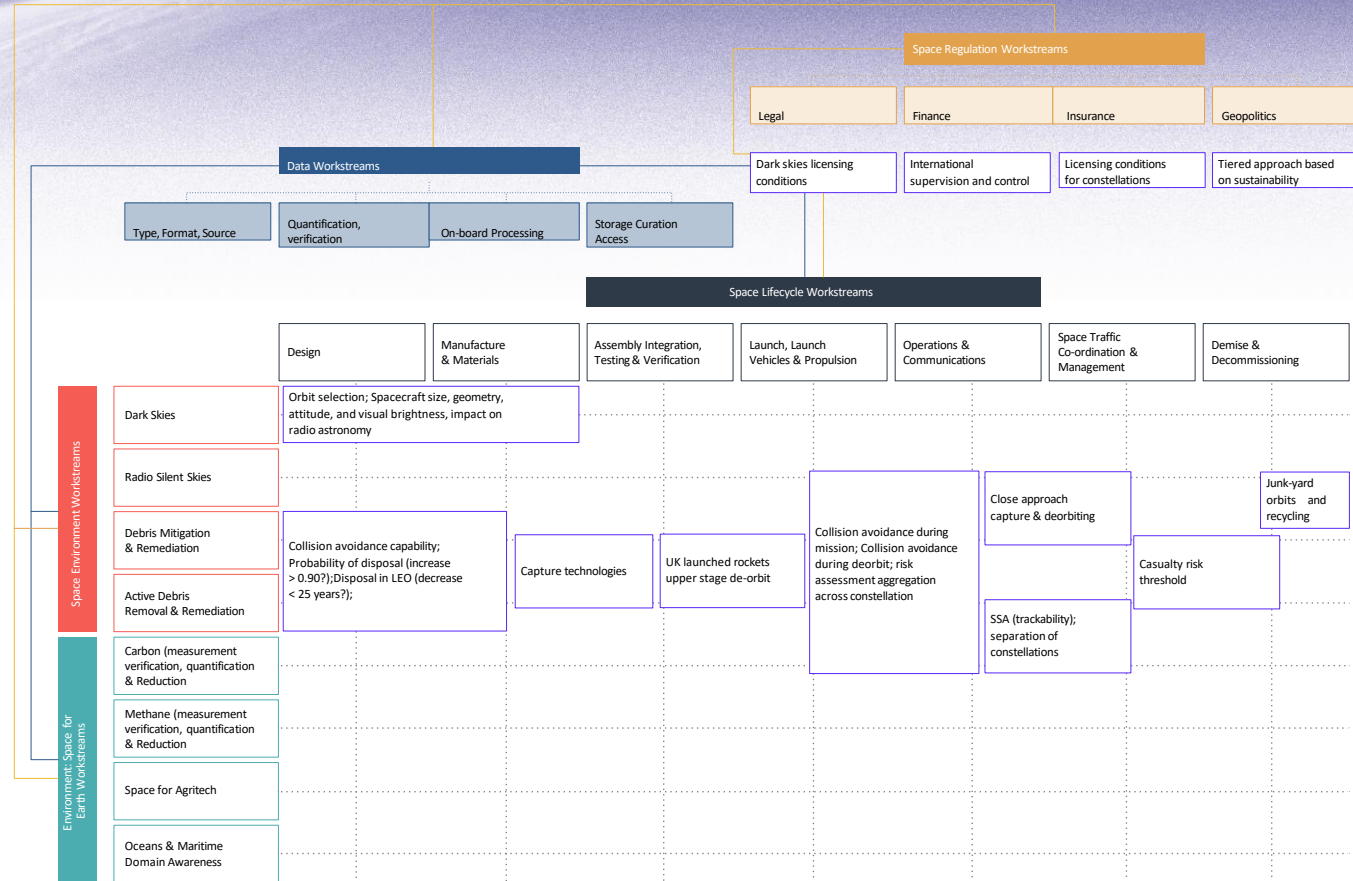
- The Kitemark would be linked to the raising of investment and market access - unlocking ESG assets and investment.
- The Kitemark will provide transparency and confidence to investors as to what can be classed as sustainable space activities, applying effective practices.
- The Kitemark will add to the regulatory and international reputation of the UK licensing system.
- The expertise gained by the UK and knowhow generated by the Kitemark can be exchanged with other space nations, and training offered. This is especially important for new space nations or those seeking to upgrade their regulatory framework. This may also be particularly attractive for engagement across the Commonwealth, the Five Eyes and Japan.

The Kitemark – coverage and examples of the scope of work



Earth & Space Sustainability Kitemark – example workstreams

- Examples of gaps in the current standards are highlighted in the diagram and refer to large constellations.
- Gaps in the existing standards will be identified and addressed through collaboration between the BSI, industry and academia.
- This matrix will be populated with gaps to cover the whole space ecosystem.
- A number of live commercial projects have been identified across the Earth & Space ecosystems and the environment which can commence with immediate effect.
- The work includes both the space and Earth environments.

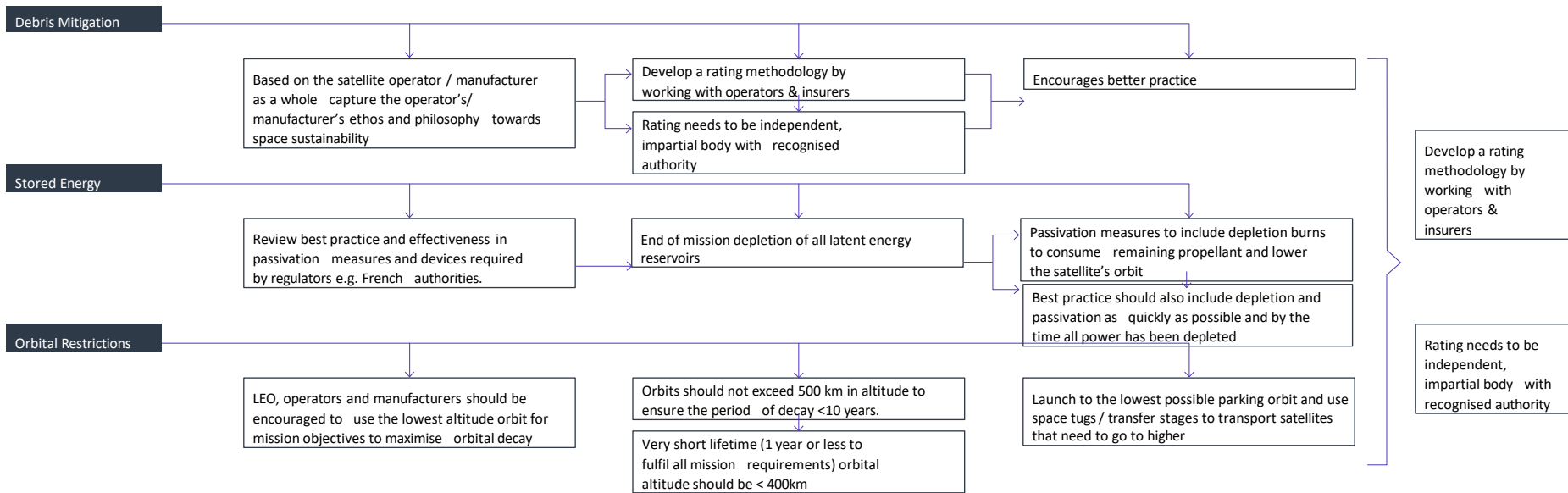


Earth & Space Sustainability — Kitemark considerations for space insurers

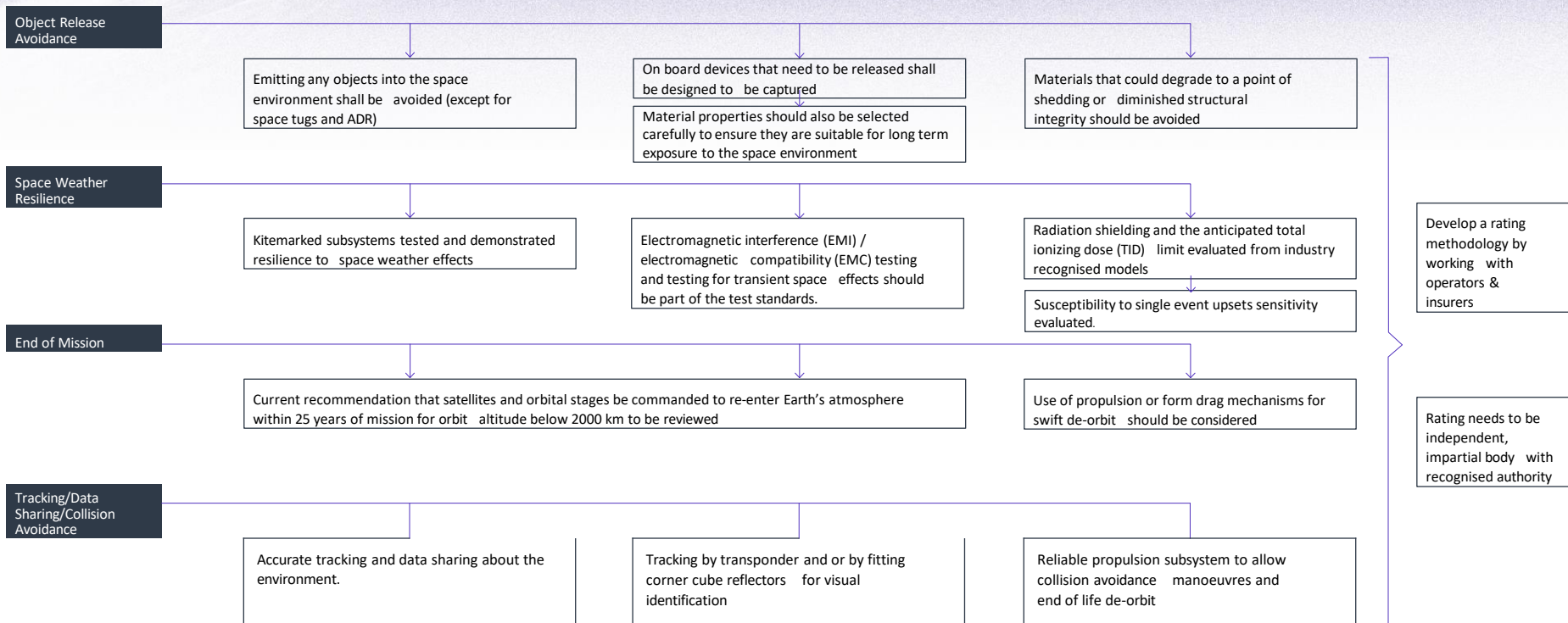
Insurance and sustainability — endorsed by Lloyds of London

- Lloyd’s, has ambitions for all syndicates operating in the Lloyd’s market to integrate ESG into underwriting and investment practices – insurance reporting of ESG characteristics and capabilities is increasingly important

- “Sound ESG practices speaks to a responsible attitude towards running a business”
- Insurance community supportive of initiatives that reduce or seek to reduce risk
- Lloyds of London – seek to establish what may be a “better risk”
- ESG credentials are important if they tend towards increasing reliability and reducing the potential for losses



Kitemark considerations for space insurers & workflows



Earth & Space Sustainability Initiative and Kitemark

— Milestone plan for year one

Earth & Space Sustainability Initiative

- Establish framework and governance structure for the Earth and Space Sustainability Initiative.
- Establish the 'hub and spoke' model - which will bring in industry, academia and the financial and insurance community together, including to establish the Kitemark – and raise funding in this regard
- Establish initial projects – space for Earth environment and ESG programmes:
 - Carbon measurement verification and quantification linked to active carbon reduction activities and technologies
 - Methane measurement verification and quantification linked to active methane reduction activities and technologies
 - Establish practical biodiversity measurement verification and quantification projects linked to both agritech and global sustainability goals
 - Sustainable energy solutions as investor ready ESG projects

As part of the Initiative – the development of the Kitemark

- Identify the gaps in existing space debris mitigation and remediation standards.
- Establish collaborative programmes with the space industry, at all levels, academia and the finance and insurance industries including to fill the gaps in the existing standards (through focused research) particularly in relation to constellations, ADR missions and the overall governance of space sustainability at an international and national level.
- Focus in particular on constellations addressing the whole space lifecycle and link to debris mitigation, remediation, collision avoidance and risk management.
- Work closely with the BSI and ISO and financial and ESG ratings agencies to devise individual kitemarks for the various components of the end to end lifecycle of spacecraft (see slide 9) and an overall Kitemark, with international recognition.
- Key areas to consider include propulsion and manoeuvrability, and a traffic control system for Earth orbit.
- Address the governance of standards at an international and national level.
- Engage with the CAA, DfT, UKSA, DIT and BEIS as to the positioning of the Kitemark within the UK ecosystem.
- Engage widely with other regulators, licensing authorities and governments to ensure recognition of the Kitemark and thus market access.
- Develop a practical toolkit for the implementation of the Kitemark by operators , particularly SMEs.
- Address the growing need for standardisation of launch safety for nuclear power utilisation in space and on planetary bodies.

ESSI and Kitemark Establishment

	Standards	Scope of Work	Governance (Corporate and Financial)	Financial and ESG Rating	Communications and International Engagement
A.	<ol style="list-style-type: none"> 1. Consolidate all existing standards 2. Identify gaps in existing standards (focus: ADR; IOSM; constellations; (laser comms)) 3. Identify how the SSR and EPFL ratings are being implemented, how they related to existing standards and assess gaps in SSR and EPFL ratings. 4. Ensure transparency of all data analysis 	<ol style="list-style-type: none"> 1. Scope all 14 work packages 2. Scope legal and regulatory structure package (link to liability and insurance work of UKSA) 3. Scope insurance package 4. Develop current work and communicate success 	<ol style="list-style-type: none"> 1. Establish structure of Initiative, governing board and constitution 2. Develop business plan 3. Establish financial model – industry funding, subscription based model 4. Consider and establish certifying body (discussions with BSI, UKAS and NPL) 	<ol style="list-style-type: none"> 1. Assess current financial standards – particularly those internationally recognising complying with ESG requirements 2. Develop existing ratings to accept the Kitemark 	<ol style="list-style-type: none"> 1. Engagement with other governments and agencies and FCC and other regulators and governments. 2. Communications plan - holistic approach from investors to schools 3. International workshop with UN and SWF 4. Establish international engagement through UN (UNIDIR)



The Earth ∞ Space Sustainability Initiative

Space publications

November 2022

Liz Quintana

Ofcom

making communications work
for everyone

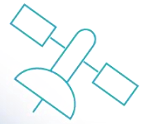
Overview

Four Space publications published on Thursday 10th:

- [Space Spectrum Strategy](#): our plan of work for the next 3-5 years
- [Enabling space services in 14.25-14.50 GHz](#) – expanding capacity uncoordinated terminals
- [Decision on Starlink application for 6 gateway licences](#)
- [Decision on Telesat application for Earth Station Network licence](#)

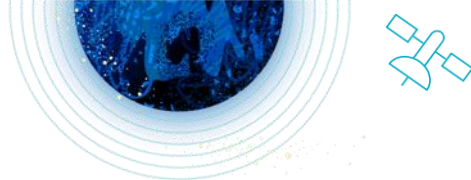


12 month round up



Orbit round up

A summary of what we have explored over the last 12 months at SPLOG meetings



Applications

Regular updates on applications

Legislation

We have discussed the licencing requirements under the OSA and SIA

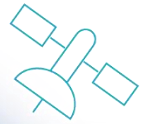
Hot Topics

We have focused on topics key to industry at the time of the SPLOG meeting.

Industry

Ofcom, Sustainability Summit (Joanne Wheeler and Hugh Lewis)

Hot topics



Reduced lifetime requirements



Post-mission disposal – five-year rule

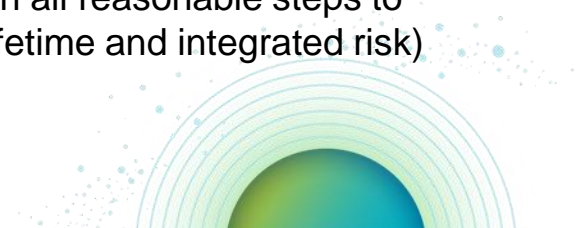
The FCC recently published changes to their rules that require operators in LEO to deorbit their spacecraft “as soon as practicable and no more than five years after the end of mission”

CAA position on a lifetime limit of 5 years after operations

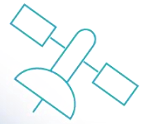
- We are evaluating what the impact of this change might be on the orbital environment
- We are working with international bodies such as the IADC (through the UKSA) to understand what good practice for the orbital environment is
- Changes to the current policy are the responsibility of the UKSA

Current policy

- We seek compliance with the current IADC guidelines on post-mission disposal
- This is used in conjunction with evidence that the applicant has taken all reasonable steps to reduce the risks to ALARP (typically, but not always a reduction in lifetime and integrated risk)



Regulator's Licensing Rules



Seven legislative tests

There are 7 tests that must be assessed as part of your application.

1. National Security
2. International Obligations
3. National Interest
4. Financial
5. Fit and Proper Persons
6. Safety Assessment
7. Environment



Regulators Licensing Rules

Sets out the CAA required to makes assessments against the statutory tests when considering a licence application

Information for all applicants	Rule 3.2	TABLE A
And additional information		
Launch Operator licence application	Rule 3.3	TABLE B
Return Operator licence application	Rule 3.4	TABLE C
Orbital Operator licence application	Rule 3.5	TABLE D
Spaceport licence application	Rule 3.6	TABLE E
Range Control Services licence application	Rule 3.7	TABLE F

[CAP2221: Regulator's licensing rules \(caa.co.uk\)](http://caa.co.uk)

Proposals to change the rules

Qualifications & Employment

Narrow the scope of these requirements to reduce the number of individuals required to provide information
Change certificates requirement to a listing of relevant qualifications

Business plan & other financial records

Consider less prescriptive financial listing allowing for proportionality in relation to size, risks and circumstances

Prescribed Roles

Review which prescribed roles must be assigned at the time of application

Security /Cyber Security

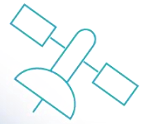
Request for underpinning risk assessment

Document certification

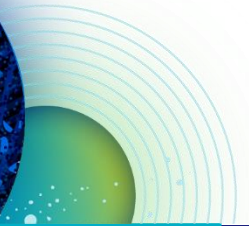
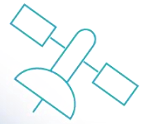
Align with government certification requirements

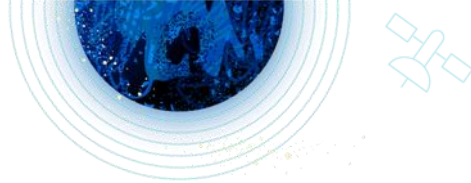
- Consider role for licensing statements – checking the application is complete
- Consider timing for training manager and training manual approvals

Current challenges



Applications





Applications

We have been licensing satellites for almost a year

Various types of licence have been issued (or may be issued) under the OSA and SIA (or both)

- Licences issued = 148
- Applications received = 23
- Pre-applications (traffic lights) = 18

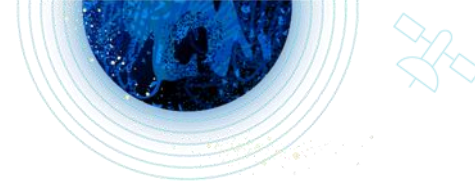
Changes to pre-application (traffic light)

- Traffic light questions are now available online

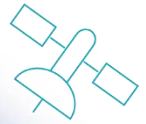
Applications

There have been some challenges during the past year

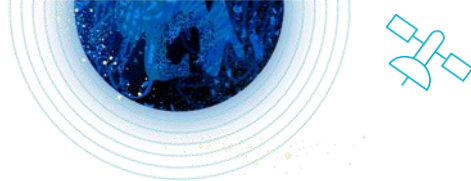
- Given the changes to orbital licensing there has been some reluctance to provide certain information or answer some questions
- The rules and regulations that apply to applicants/licensees often apply to the CAA
- Receiving timely information is key to allowing us to process your application



Safety cases for orbital



Orbital applications



Current requirements for safety information

CAP 2210 Section 5 Safety

- Demonstrate how launch operations have been planned to minimise the risk to public safety and the impact on the orbital environment
- Consider the reliability of the spacecraft intended to be operated in orbit
- Explain how plans & procedures etc. will be adhered to ensure safety operations during all mission phases
- Ensure ground-based elements have suitable functionality to ensure safe operation during all mission phases
- Meet appropriate international standards and guidelines

CAP 2221 Regulators Licensing Rules Table D

- Safety & sustainability information pertaining to
- Launch system
- Space segment
- Mission operations
- Ground segment

Orbital licensing – a role for safety cases?

Safety case: “A structured argument, supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given environment”

CAA do not prescribe how applicants should present information and demonstrations in the safety case.

Suggested approach in launch and spaceport guidance divides the safety case into four parts

“Argument without evidence is unfounded; evidence without argument is unexplained.”

Tim Kelly, University of York

1. Descriptive information - Infrastructure, environment and management information

2. Hazard identification and assessment of major accident scenarios

3. Measure to prevent or limit the consequences of a major accident

4. Demonstrating that the risk is ALARP

Safety best practices

OneWeb





Satellite Orbital Safety Best Practices

Pablo Minguíjon Pallas

2022-11-22

Agenda

- Background
- Document purpose and overview
- Design Time
- Pre-launch and early orbit
- On Orbit
- Satellite Disposal
- Q&A



Background

- This document was kickstarted as a combined effort from a couple of AIAA and CARA members.
- CARA and OneWeb have been collaborating for the past years in SSA-related topics.
 - Weekly meeting to coordinate possible encounters between NASA and OneWeb vehicles.
 - On-demand meetings to discuss other more technical matters (accurate modelling, etc).
- OneWeb has explicit coordination agreements with Iridium and SpaceX.
 - Naturally, encounters with SpaceX are more frequent and our pre-coordinated Concept of Operations has proved extremely useful to streamline reactions and responsibility of maneuvering.
 - NDA in place lets us share low level details of our system.
- OneWeb proactive commitment to Space Safety is internationally recognised.
- Acknowledging the above, CARA & AIAA invited us to participate on this document to push forward a series of high-level best practices that could foster safer space operations at **all levels** and with an **international** vocation.

Document purpose and overview

- For the first time, major operators have come together to produce a wholistic set of best practices, drawn from years of operational experience and the understanding that comes from actually working together to maintain sustainable orbits.
- Regulations must strike the appropriate **balance** of maintaining **sustainable operations** in space without stifling innovation or preventing new applications that bring tangible benefits to the public and governments.
- The **broad and comprehensive** best practices presented in this document are designed to be applicable to any operator **anywhere** in the world, regardless of how they receive conjunction warnings, and represent the best practices that the signatories have adopted. Ideally, the best practices contained herein can provide a foundation for discussions leading to a global consensus of behaviors.

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C: ON ORBIT.....	9
D: SATELLITE DISPOSAL.....	12

- “NASA Spacecraft Conjunction Assessment and Collision Avoidance (CARA) Best Practices Handbook”
- Secure World Foundation’s “Handbook for New Actors in Space”
- U.S. Space Force’s “Spaceflight Safety Handbook for Satellite Operators”
- Space Safety Coalition’s “Best Practices for the Sustainability of Space Operations”

Design Time

- Consider collision avoidance (CA) implications when choosing injection and final orbits.
 - Collocation with other objects
 - Separation with respect to other constellations
 - Coordination with neighbouring vehicles
 - System-level analysis on risk level and encounter rates
- Ensure the adequacy of spacecraft hardware features to support safety of flight best practices
 - Need for maneuvering capability above human-spaceflight altitudes
 - Trackable, either passively or any form of GNSS
 - Deorbit and Reentry considerations
 - Operations team 24/7 availability
- Ensure the adequacy of satellite / ground system software to support safety of flight best practices.
 - High-fidelity predicted ephemeris
 - Capability to perform Conjunction Assessment

Pre-Launch and Early Orbit

- Create and expeditiously publish your strategy to transport yourself to your final orbit
 - Be open about your mission profile so that other Owner/Operators are aware
 - Create clear communication channels with other major space Owner/Operators sharing the same orbital regions
 - Make basic information on your platform available for Conjunction Assessment purposes (hard body radius, maneuverability)
- Perform Launch Collision Avoidance (LCOLA) against (crewed) space assets
 - Very important against crewed missions
- Coordinate with your cataloguing entity before launch and provide facilitating products during launch and early orbit
 - Establishing cataloguing number/ids for common reference
 - Quick generation of post-launch ephemeris and send to the cataloguing agency
 - Prioritise spacecraft commissioning to enable Collision Avoidance

On Orbit

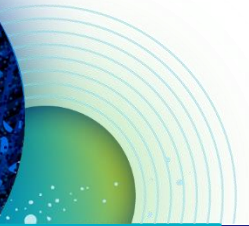
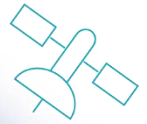
- Maintain quality O/O predicted ephemerides and spacecraft status information and submit/update this information regularly to the CA screening authority
 - High-fidelity prediction ephemeris, including covariances, following international CCSDS standards and CARA recommendations
 - Keep up to date maneuverability status and capacity to generate high-precision ephemeris
- Perform CA risk assessment to identify high-risk conjunctions that require mitigation
 - Use Probability of Collision as the main metric for CA.
 - Develop internal Concept of Operations that clearly and unambiguously addresses high-interest events via active response or coordination with the other operator.
- Pursue adequate mitigation actions to avoid high-risk conjunctions
 - Mitigation action should both clear the high-risk conjunction at hand and not cause any other close to the Time of Closest Approach
 - Coordinate with the Owner/Operators of the secondary vehicle and develop long-term, standardised response logic

Satellite Disposal

- Actively and expeditiously manage the deorbit of LEO satellites that are reaching the end of their useful mission life
 - In case of satellite failure, keep up to date maneuverability and ephemeris-production capabilities status
 - Controlled reentry can be avoided if complete immolation of the satellite is guaranteed
 - If satellite operating orbit does not meet a natural reentry within 5 years (goal of 1 year), the satellite should be transited to an orbit that does meet that criteria.
 - This transit needs to be ruled by the same recommendations previously mentioned
 - Passivation of the platform prior to lose of maneuverability

Q & A

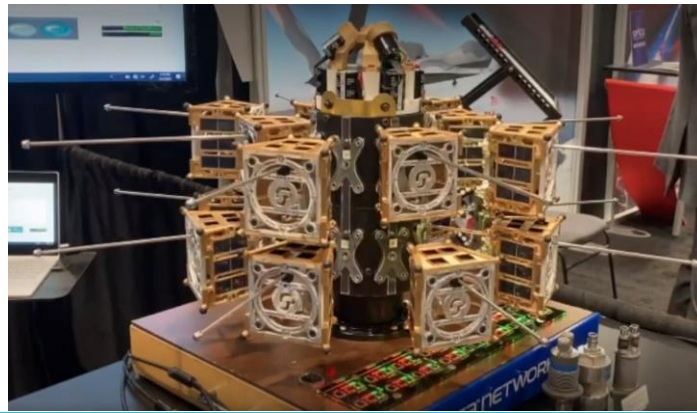
Future opportunities



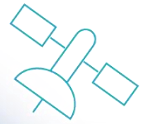
Engagement



Engagement with industry



AOB



Thank you
caa.co.uk/space