UNITED NATIONS
Office for Outer Space Affairs

Promoting Space Sustainability

Civil Space Surveillance and Tracking Project

UK Space Agency

June 2021

Implementation of the Guidelines for the Long-term Sustainability (LTS) of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space

I. Short description of the outer space activity [*1000-word max.*]

[Include any relevant background or technical information that may be helpful.]

SST Operations

The UK Space Agency and Ministry of Defence (MOD) work together to deliver the UK's Space Surveillance and Tracking (SST) capability to meet both national security and civilian requirements. The UK began piloting National SST services in January 2021. These services are currently available to government users and will be extended to UK-licensed commercial satellite operators in 2022. Our National SST services are provided by a team of civilian and military analysts based in the Space Operations Centre in RAF High Wycombe. Our analysts use commercial and proprietary software to analyse data from a global network of sensors to monitor orbital events. Government stakeholders are warned of the most critical events in case they affect key services or the government's legal liability for the actions of UK spacecraft.

As pilot national SST services expand to include non-government users, we will continue to make improvements to the service. This includes investing, jointly with the MOD, in the specialist software needed to track and predict events in space. We are working with SST end users to design and build a user interface to provide clear, actionable information for decision-making. We will also consider whether to invest in new sensors or additional sensor data based on the needs of the service. We are also committed to work with the MOD to create a joint civilian and military National Space Operations Centre (NSPOC) to provide a Space Domain Awareness capability for government users and industry in the future.

Research and Development

In 2020, the UK Space Agency part-funded seven projects aimed at developing SST capability through industry. The projects focused on either low-cost LEO (Low Earth Orbit) surveillance and tracking or the use of artificial intelligence and machine learning. For example, Fujitsu developed a solution that uses artificial intelligence and quantum inspired computing to optimise different elements involved in Active Debris Removal missions. This could help to ensure that future missions are cheaper, use less fuel and remove as much junk from orbit as possible. D-Orbit tested the cameras and star-tracking software on board their ION satellite launching vehicle to capture images of

debris, using data from live missions in space. This kind of technology could enable us to track satellites and space junk in a way that is not possible from Earth.

We intend to launch future opportunities, which will again involve match-funded projects to support the private sector to introduce competitive new SST technology and services, potentially delivering new national sensors for use in two years. The specific projects and the type of investment will be selected following open market engagement to assess the best value for money options.

In June 2021 we launched a grant initiative specifically requesting proposals for feasibility studies of a future Active Debris Removal mission. The studies we are requesting now could pave the way to a UK-led mission launching in 2025 to de-orbit two or more targets from Low Earth Orbit.

International Cooperation

The UK has a strong track record of working with other countries and as part of international forums. We are the largest investor in space safety for the European Space Agency, including a £10m commitment to the Active Debris Removal/In orbit servicing demonstration programme (ADRIOS). From 2015 to 2019 the UK provided SST services through its participation in the EU SST consortium, which it co-founded. The UK delegation to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) has played an important role in drafting and agreeing the LTS guidelines. In addition to taking an active role in specific space related forums, the UK has also raised the issue of space sustainability among G7 nations.

We will continue to work with international forums and allied nations to ensure that we can continue to use the Earth's orbit safely and sustainably. This could include sharing more data with partners such as other countries and the Inter-Agency Space Debris Coordination Committee (IADC), working together to establish international standards as well as joint investments in initiatives to reduce space debris.

II. Connection with the LTS Guidelines [*500-word max.*]

[Please indicate any relevant links between the activity above and the LTS Guidelines or portions of the preamble.]

The UK is a supporter of the LTS guidelines.

In particular, our work to develop our SST capability supports:

- B2: Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects
- B3: Promote the collection, sharing and dissemination of space debris monitoring information
- B4: Perform conjunction assessment during all orbital phases of controlled flight

These guidelines align closely with the UK's SST priorities. We have worked closely with satellite operators to understand the data and information they need to operate safely. We are using this to design pilot SST services that provide clear, accurate and timely warnings of conjunction events to enable satellite operators to make a safe decision on how to manoeuvre. The UK routinely shares analysis and reporting about orbital events with allied nations and will continue to explore opportunities to collaborate with other nations as we strengthen our international partnerships.

Our investment in Research and Development in the UK and through international forums supports:

- D1: Promote and support research and development of ways to support sustainable... use of outer space
- D2: Investigate and consider new measures to manage the space debris population in the long term

The UK Space Agency is committed to championing innovation in space sustainability. Through grant funding we have supported UK based companies to develop products and services to enable better SST and support Active Debris Removal missions. In 2020 we part funded seven projects that developed either low-cost LEO (Low Earth Orbit) surveillance and tracking or the use of artificial intelligence and machine learning for space debris mitigation. This work developed technologies to enhance capabilities in space surveillance and debris removal, and the UK Space Agency intends to fund further research and development of this kind in the future to continue to support innovative space sustainability initiatives. In addition, debris removal may be central to managing the space debris population in the long term. We are launching feasibility studies to explore the possibility of conducting a UK-led Active Debris Removal Mission.

We have also worked with international partners to promote research and development in this area. The UK is the largest contributor to the European Space Agency's Space Safety programme and continues to support collaborative R&D into space sustainability, such as the high-profile Swiss-led mission to remove European debris.

III. Lessons learned [*500-word max.*]

[Please share any information or observations that may assist others in their space activities.]

Civil and military cooperation

The strong working relationship between UKSA and the MOD colleagues working on SST is incredibly valuable. Working together strategically and operationally helps by pooling expertise and resources as well as avoiding duplication. We have been able to develop joint software systems to provide a single operating picture across the UK and support collaborative analysis of active events in orbit. This positive relationship will be strengthened further as we work towards establishing a joint civilian and military National Space Operations Centre (NSPOC).

User engagement

We have involved the end users of SST services in every stage of the design and development of the SST pilot service. Government users and satellite operators were interviewed to understand their priorities and information needs, and tested prototypes of the tools to give real-time feedback. These users will continue to be consulted as different capabilities are developed and brought online. We have received overwhelmingly positive feedback from users on this approach, and this has been invaluable to ensuring that the service meets the users' needs and will best support safe and sustainable operations.