

60th IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

32nd IAA/IISL SCIENTIFIC-LEGAL ROUNDTABLE

TECHNOLOGICAL AND LEGAL CHALLENGES
FOR ON-ORBIT SERVICING

Co-Chairs:

Tommaso Sgobba
Steven Freeland

Rapporteurs:

Marc Haese
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Report of the Roundtable

Marc Haese

Chairpersons: Andrew Ratcliffe (UK Space Agency) and Prof. Steven Freeland (Western Sydney University)

Rapporteur: Marc Haese (Germany)

Table of Speakers

	Name	Institution, Country	Presentation
1	Dan King	McDonnell Douglas (MDA), Canada	“On-Orbit Satellite Servicing: The Future is Now”
2	Michel Frezet	Airbus Defence & Space, France	“The Airbus Space Tug”
3	Guoyu Wang	Beijing Institute of Technology, China	“Legal Challenges to OOS and a China’s Perspective”
4	Ian Christensen	Secure World Foundation, USA	“Opportunities for Industry-Led Norms of Behavior in On Orbit Servicing”

Note: Just some days before the Roundtable the Secretariat of the IAA/IISL Scientific Legal Liaison Committee was informed that Kenneth Hodgkins (US State Department), who was planned to speak as well, would not be able to participate.

On-orbit servicing (OOS) of satellites holds huge benefits for future scientific missions, application satellites, new commercial programmes and further steps in space exploration. Several technical solutions have been developed in the past decades and proven that they are fit for service (i.e. Hubble and ISS). This development accelerates and goes along with the need for a strong international collaboration, particularly for running the systems cost-effectively and reliably. These new partnerships raise plenty of legal questions e.g. with respect to liability for on-orbit operations and servicing. Thus, both aspects are to be considered, the need to make better use of already launched systems and also the question of how to ensure firm legislation for future

missions. The 2017 IAA/IISL Scientific-Legal Roundtable has addressed those questions from technical as well as from legal standpoints, allowing an interdisciplinary perspective.

About 35 attendees joined the session, which was opened with short welcoming addresses by the Secretary General of the IAA, Jean-Michel Contant and the President of the IISL, Kai-Uwe Schrogl. Subsequently, the co-Chairs of this year's Roundtable, Steven Freeland (Western Sydney University) and Andrew Ratcliffe (UK Space Agency), introduced the topic from a legal and a technical point of view.

Dan King, the first speaker from the panel, explained that "remotely touching things" (in orbit) has been tested and demonstrated already for decades, and technical challenges have largely been overcome. Key heritage and experience has been gathered from the Space Shuttle missions and the International Space Station. Nowadays, supervised remotely operated robots or co-bots (robots supporting human operations) can be trusted. They are being applied to many space and terrestrial applications where both highly valuable assets and/or lives are at stake. Furthermore, Dan King expects OOS to help lower the costs of space exploitation and the opening of new markets. However, a regulatory framework is needed to support new business applications. In his view, positive starts have been made with the 2015 US Space Act, the "CONFERS" of DARPA (US Defense Advanced Research Projects Agency) and the Luxembourg Space Mining Law. Key challenges that will remain for the time being are space debris, e.g. removal of aging assets, and a responsible use of space.

In the next presentation Michel Frezet introduced the concept of a space tug as a versatile vehicle that brings satellites into orbit, delivers satellites into final orbit and supports various operations during and at the end of satellites life span. A space tug will introduce reusability into on-orbit operations and change space logistics and servicing. New operations such as payload exchange, in-orbit assembly or even manufacturing, debris removal and live extension will be possible. Having started development of a space tug for Low Earth Orbit in 2017 Airbus is also planning its evolution to geostationary operations and even deep space applications.

The first speaker from the legal perspective was Guoyu Wang. Although it is not widely known, China has been active in in-orbit servicing since about 2016. In China, on-orbit servicing is being conducted without suitable legal framework, in 'Negotiorum Gestio', which basically means management without mandate. OOS is recognized neither in international nor in space law, and doing so may not only hold benefits for the actors. Guoyu Wang advocates applying this practice for outer space, with liability to be limited.

Notification should be taken as a precondition; being tacit should be deemed as presence of consent; and unilateral announcement should preclude voluntary service. Legal challenges arise from an increasing use of space and the question of space traffic management, STM. China will further develop its OOS abilities whereby international cooperation is necessary and commercialisation is desired. Future demonstration missions should be used to better also understand related legal and political challenges.

The last panel speaker, Ian Christensen, discussed gaps within existing legal and political frameworks with respect to OOS. He underlined the demonstrated practicability of norms – meaning a common understanding of appropriate behaviour – in space governance. With the private sector becoming the dominant player in space over the next decade, satellite operators should possibly receive incentives to set norms without waiting for governments to act; such initiative would also increase sustainability of their own business models. Ian Christensen also highlighted DARPA’s “CONFERS” (<https://www.darpa.mil/news-events/2017-10-04>) as an example of an industry-to-industry (and government) consortium to develop technical standards for OOS. In the future, OOS also needs to be connected to activities in space situational awareness (SSA). Generally, a holistic approach should be applied, comprising interfaces and designs, operational practices, data exchange and sharing, and transparency and confidence building measures.

After the four lectures of invited speakers a discussion of about one hour followed, first amongst co-Chairs and speakers, then entering Q&A with the audience, with most questions debating possibilities to handle and to address existing gaps in the current legal and political regime.

The following key points can be noted from the session:

- Technical concepts and solutions for OOS have been developed and already demonstrated to a large extent. Future OOS systems will change satellite and space craft operations significantly, bearing chances for new business models from industry. International cooperation will increase whenever transparency is possible.
- Norms for OOS should take into account best practices and existing standards and will be of advantage for all. They should be developed by all stakeholders (industry, operators, customers and governments) and should aim at principles and safe operations procedures.
- Recommendation Interest in On-Orbit Servicing and proximity missions in general is growing. The Chairmen recommend to the IAA, the IISL and the IAF to encourage further dialogue and engagement in the topic towards developing appropriate best practice/guidelines.

These guidelines require active discussion between those working on the technical and policy sides.

None of the authors prepared a full paper.