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**25<sup>th</sup> IAA/IISL Scientific Legal Roundtable  
“The New Age of Small Satellite Missions”**

Chairpersons: Rainer Sandau (Germany), Lesley Jane Smith (Germany)  
Rapporteur: Nicola Rohner-Willsch (Germany)

The trend towards building small satellites that are smaller, faster, better and cheaper was a reaction to falling industry budgets in the late Nineties. The scientific community awoke to the capabilities and advantages that small satellites hold for existing and new space applications. Twenty years on, the number of small satellites in operation calls for increased regulatory attention. The pattern of constructing and launching small satellites within a short time-scale continues unabated.

The joint IAA/IISL Scientific Legal Roundtable looked at the subject from a technical perspective, including salient economic, policy and regulatory aspects. The papers presented provided a coherent picture of the status quo, enabling future prospects for this group of satellites to be mapped out. With its invited papers, the Roundtable is designed to facilitate interdisciplinary debate around the subject selected. The fact that the 25<sup>th</sup> Roundtable took place during the 2010 session, taken together with the high number of participants (around 60 people were present during the middle of the session) demonstrates the interest and demand for this kind of interdisciplinary discussion.

The opening welcome statement to the 25<sup>th</sup> Roundtable was delivered by Kai-Uwe Schrogl, chair of the Liaison Committee, followed by the IISL President, Tanya Masson-Zwaan, with a final address by the Secretary General of the IAA, Jean-Michel Contant. 33 years and 3 days before, Prague had hosted the very first IAA/IISL Scientific Legal Roundtable of its kind. Contant praised the former scientists who pushed the interdisciplinary work, calling upon the young researchers to continue this exchange between scientists and lawyers.

The chair, Rainer Sandau, introduced the topic, by outlining the importance of earth observation and the need for increasing the flexibility of systems, and with this, small satellite systems. Small satellite systems are supported by several contemporary trends such as miniaturization or new launchers for small satellites. The main advantages of small satellites are their cost effectiveness and a greater variety of missions. The co-chair, Lesley Jane Smith, welcomed and introduced all panel speakers.

In the first presentation delivered by Sir Martin Sweeting, “Small Satellite Missions for Earth Observation - Status & Trends” attention was drawn to the increasing impact of legal aspects on small satellite systems. Three decades ago, small satellites were a matter of science only; now, they have become fully operational systems. Where early uses included education and military aspects, they are currently deployment for a variety of purposes. Sir Martin provided the current definitions: <500kg small, <250 mini, <100 micro sat. Today’s satellites must fulfil ambitious requirements: low cost, reliability and capability for many applications. Over time, failure rates were reduced and a revolution took place in manufacturing processes. Since 1981 >45 small satellites and constellations have been launched, with increased time

resolution and better quality and wide use of data. Greater international collaboration has been initiated for disaster monitoring and multispectral imaging (de-forestation, mineral deposits). The main application remains disaster monitoring, as, for example, during the Tsunami in the Indian Ocean or the Earth Quake in Chile. In coming years, data resolution will increase, but the challenge will be to create the storage capacity for the immense volume of data: more capable systems enable new missions. On the legal side, the mitigation of space debris, the business realities and access and use of EO data require earth observation data policies. Although the class of 50-350 kg satellites is the most frequently used, the availability of suitable launchers is becoming the main constraint.

In the second presentation, Eberhard Gill addressed “Distributed Space Systems of Small Satellites - Opportunities and Challenges”. Today, small satellites are miniaturized and have a good economic life span. The Delfi-C3, designed and manufactured by Delft University, and launched in April 2008, is still 100% operational. Education, technology demonstration, military use, Earth observation and exploration, are all part of satellite missions. Nowadays, students from a good number of universities know how to plan and run entire satellite missions. Miniaturization enables fast access to space (within 2 years). The goal is to have highly miniaturized, mass-distributed, autonomous space systems for unrivalled applications. The speaker concluded that small satellites do not replace but augment our capabilities in space. Combining miniaturization technology with distributed space systems can revolutionize our way of doing and using spaceflight.

The next presentation, delivered by Attila Matas, focused on “ITU radio regulatory requirements for small satellite design and operation”. The ITU key priorities are radio spectrum, international standards, emergency communications, climate change monitoring, digital divide and cybersecurity. The ITU Mission is to ensure rational, equitable, efficient and economical use of the radio frequency spectrum by all radiocommunication services - including those using the geostationary satellite orbit or other satellite orbits - and to carry out studies on radiocommunication matters. The radio regulation mechanisms are an example of the control of interference through frequency allocation, regulatory protection, power limits and coordination. Administrations have to ensure interference-free operating conditions. The presentation highlighted the following: space regulations and legal framework, ITU Radio Regulations, Allocation Table (Article 5), examples for non-GSO (GEO?) small satellite design and the RR, with details of details of notification requirements, API, Coordination and Notification procedures, the HELP-AP 4 data management tools. The web site <http://www.itu.int/ITU-R/go/space/en> provides further information

In the final presentation, Ram S. Jakhu addressed “Liability and related legal aspects of small satellites”. Due to extensive improvements in satellite and launch technologies, the trend towards building and launching smaller, faster, better and cheaper satellites is expected to continue and to result in an exponential increase in number of objects in space. This development will undoubtedly prove significantly advantageous to the armed forces of various nations, numerous space enthusiasts and students, universities, small companies and developing countries. At the same time, the growth of small satellites (known as microsats, cubesats, cansats, nanosats, picosats, etc.) will give rise to several regulatory issues that are dealt with in this presentation. The most important question addressed by Ram Jakhu relates to the liability for damage caused under the current international space law, particularly the 1972 Liability Convention. Given the increase in numbers of public and private players launching, or procuring the launch of, small satellites, some of the foregoing may not be governed by this Convention; this leaves any question of liability to be dealt with under the

general principles of international law. The question of national regulation of such satellite activities is closely related to this, particularly in those countries which do not have appropriate legal regimes in place.

The following topics were among the subjects discussed in the ensuing panel discussion: Components of swarms come from about 50 countries. What is the referring liability to be expected? Do we have predictable restrictions? Is the communication from satellite to satellite a major constraint (ref. interference)?

Regulatory aspects often constrain the feasibility of satellite technologies. Still, there is insufficient awareness of regulatory duties for scientists at national level and some states do not have appropriate national space laws. A pro- active discussion should be continued. The panel discussion, moderated by Sandau and Smith, was then opened to the floor, with a variety of issues raised across the audience. This lively discussion preceded the conclusion of the 25<sup>th</sup> IAA/IISL Scientific Roundtable.

Table of speakers:

	<b>Name</b>	<b>Presentation</b>	<b>Country/Institution/Contact</b>
1	Sir Martin Sweeting	Small Satellite Missions for Earth Observation - Status & Trends	United Kingdom, Surrey Satellite Technology Limited, <a href="mailto:M.Sweeting@SSTL.co.uk">M.Sweeting@SSTL.co.uk</a>
2	Eberhard Gill	Distributed Space Systems of Small Satellites - Opportunities and Challenges	The Netherlands, Delft University of Technology, <a href="mailto:e.k.a.gill@tudelft.nl">e.k.a.gill@tudelft.nl</a>
3	Attila Matas	ITU radio regulatory requirements for small satellite design and operation	International Telecommunication Union <a href="mailto:Attila.Matas@itu.int">Attila.Matas@itu.int</a>
4	Ram S. Jakhu	Liability and related legal aspects of small satellites	Canada, Institute of Air and Space Law, <a href="mailto:ram.jakhu@mcgill.ca">ram.jakhu@mcgill.ca</a>