

Report of Symposium

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On the first day of the 53rd Session of the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space, the afternoon session was reserved for the joint Symposium of the International Institute of Space Law (hereafter 'IISL') and European Centre for Space Law (hereafter 'ECSL'). After some words of welcome by **Prof. Kai-Uwe Schrogl**, newly appointed Chairman of the Legal Subcommittee, **Prof. Sergio Marchisio** (President of the ECSL) and **Prof. Tanja Masson-Zwaan**, (President of the IISL) opened the Symposium which was devoted to regulatory needs for very small satellites.

Recent years have seen a marked increase in the number of very small satellites (with a weight of 50 kilograms or less). Technological miniaturization is progressing steadily enabling still smaller satellite missions. Though these missions may not yet be able to compete in terms of capability and endurance with their larger counterparts, very small satellites already provide valuable instruments for education, experimentation, validation as well as rudimentary services. Prof. Marchisio observed the important role played by very small satellites in opening up space to those other than the traditional space actors. They provide relatively quick and inexpensive access to space for countries with developing space capabilities as well as universities and other research institutions.

Though small and comparatively short-lived, these missions face the same regulatory requirements as those applicable to larger satellites. The starting point is that size has no bearing on the application of international space and telecommunications law. The obligations imposed upon States apply equally in respect of the very small satellite activities of those States or their nationals. Consequently, very small satellites have to be duly authorised and supervised, fulfil the requirements of orderly frequency management and last but not least, they should respect space debris mitigation guidelines.

Six speakers were invited to share their thoughts and experiences with the Legal Subcommittee on the need to carefully apply the existing regulatory framework to very small satellite missions in order to contribute to sustainable space activities.

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Mr. Abe Bonnema, Marketing Director of Innovative Solutions in Space (ISIS), a 50-person company based in Delft, the Netherlands, which focuses on building and launching very small satellites, began proceedings with his presentation entitled *status and overview on very small satellites: Definition, purposes and projects*. He provided a working definition of a ‘very small satellite’ – any satellite with a mass of up to 20 kilograms – and went on to explain the essential differences between very small satellites and traditional large scientific satellites.

Very small satellites are quick to build and can typically be ready to launch in 12-18 months. The costs involved are much reduced as compared with their larger counterparts. In this regard it is important to recall the special launch procedure for very small satellites. Rather than being launched as primary payloads at considerable cost, they ‘piggyback’ onto prior launches of large scientific satellites or are released from the International Space Station. In terms of construction, very small satellites are often based on a modular design which enables different components to be added or subtracted with relative ease. Mr. Bonnema observed that a very small satellite could be built, launched and operated for one year for less than €1m. For this reason ISIS’ clients are traditionally universities (especially for cubesats and nanosats) but there is also demand from industry, the military and large space operators. In terms of utility, very small satellites are used not only for outreach, education and technological trials but also commercial low data rate applications. Nanosatellites in particular have special applications when used in large numbers or ‘swarms’.

Looking ahead, Mr. Bonnema foresaw a possible role for very small satellites in other fields including astronomy, deep space exploration and even preliminary investigations for asteroid mining. In concluding, Mr. Bonnema drew a particular challenge to the attention of the Legal Subcommittee: Very small satellites often involve actors seeking quick implementation of their proposed space activity but who are not accustomed to dealing with the governing regulatory framework.

Next to speak was **Ms. Lulu Makapela** of the Council for Scientific and Industrial Research (CSIR), South Africa, who focused on the use of *small satellites for scientific-technical development and capacity-building* in space law, particularly for emerging space-faring nations. Ms. Makapela emphasised that a particular benefit of procuring ‘off-the-shelf’ satellite components, combined with the lower costs entailed in launching very small satellites, was that it facilitated access to space for developing countries and their institutions, thereby giving substance to the principles contained in Article I UN Outer Space Treaty (hereafter ‘OST’). In turn this helped to raise awareness of the international legal framework governing space activities and provided meaningful opportunities for those countries to implement international space treaty obligations and to assess and evaluate national space regulations.

Ms. Makapela illustrated South Africa's achievements in small satellite development. First came SUNSAT, built in 1998 and launched in 1999, followed by SumbandilaSat, completed in 2006 and launched in 2009 (though at 64kg and 84kg respectively these would no longer qualify as *very* small satellites). In 2013 TshepisoSat was launched weighing just 1.3kgs. From a compliance perspective, SumbandilaSat and TshepisoSat have been licenced by the South African Council for Space Affairs and entered into the national registry of space objects.

On the other hand, Ms. Makapela acknowledged the risks posed by the proliferation in very small satellites. These satellites tend to be built and delivered as quickly as possible. However, they are still 'space objects' under the treaties and take up scarce resources, namely orbital slots and radio frequency spectrum. Often there may be insufficient time to follow proper legal procedures for notification and registration. Ms. Makapela urged regulators to make decisions more quickly to meet the short timeframes involved in very small satellite projects.

Ms. Makapela also identified the dangers faced in terms of long term sustainability as a result of the variable technical standards employed in the quick construction of very small satellites at low cost. Oversight of quality and reliability is especially important in such cases. In particular, she stressed the importance of adhering to the space debris mitigation guidelines.

Prof. Philippe Achilleas of the Université Paris Sud and Board Member of the ECSL spoke about *international space law and authorisation at a national level*. He reminded the assembled delegates that Article VI OST imposes an obligation on State parties to authorise and supervise all national activities in outer space. He described this as an uncontroversial consequence of the State responsibility principle. In some cases these obligations have been transposed into national laws.

Prof. Achilleas was of the firm opinion that these obligations extend to very small satellite activities as they are 'space objects' properly-so-called. A broad definition of a 'space object' is supported at national level and Prof. Achilleas gave the example of the French space law which regards a 'space object' as 'any object of human origin'. National regulations, he argued, ought to be neutral from a technical standpoint to cover all satellites, including very small satellites, in order to comply with OST obligations. Thus very small satellite operators must comply with national licensing requirements.

However Prof. Achilleas elaborated upon one particular difficulty caused by this approach of equal treatment for very small satellites. National licensing laws often require a satellite operator to carry insurance against damage caused to other satellites or on the surface of the Earth. In the case of very small satellites, the cost of insurance may be out of proportion to the cost of the overall project. In addition, very small satellites are less likely to cause damage on Earth as they would normally burn-up upon re-entry into the atmosphere. There are also practical difficulties relating to the assessment of

liability. It may difficult to identify individual satellites launched in a swarm and therefore hard to ascertain the Launching State to which liability attaches. Prof. Achilleas discussed various options including waiving the requirement for liability insurance or imposing a liability cap in respect of very small satellites. He also raised the possibility of using a financial warranty from the State in circumstances where a satellite is being launched by a public entity.

Mr. Yvon Henri, Chief of the Space Services Department at the International Telecommunication Union (hereafter 'ITU') Radiocommunication Bureau, gave a presentation on the topic of *frequency management at international and national level* where he examined the application of the ITU Radio Regulations to very small satellites. He started by reminding the assembled delegates of the ITU's purpose – the allocation of bands of the radio-frequency spectrum and the registration of frequency assignments and orbital positions in order to avoid harmful interference between radio stations of different countries. In doing so, the ITU should ensure the rational, equitable, efficient and economical use of spectrum (ITU CS 78 & 196).

Cubesats and other very small satellites are playing an important role in securing *equitable* access to the frequency spectrum for a greater number of countries around the globe. Their proliferation should be welcomed but with appropriate caution: Very small satellites are capable of interfering with other large and small satellites using radio-frequency spectrum. Those institutions designing and launching very small satellites, especially universities, are sometimes ill-informed about the need to register their frequency assignments and orbital positions. Bearing in mind that national administrations are obliged to take steps in the event of a signal causing harmful interference, universities need to be involved and informed about the fact that their project could be shut down if they do not follow the proper procedures, including registration in the Master International Frequency Register. However, on a positive note, Mr. Henri stated that the Radiocommunications Bureau is receiving an increasing number of notifications for Advanced Publication Information (API) concerning very small satellites. This is a welcome trend towards a safer space environment.

Mr. Henri further observed that very small satellites mostly use spectrum allocated to the amateur satellite service and MetSat. However, "new generation" small satellites with advance sensors capable of high speed data download are moving towards other services, particularly where they have commercial space applications. He further suggested that amateur (AE) bands should be reserved for universities. Mr. Henri concluded by informing the delegates that the ITU World Radiocommunication Conference (WRC-18) had been invited to consider whether modifications to the regulatory procedures for notifying satellite networks are needed to facilitate the deployment and operation of nanosatellites and picosatellites and to take appropriate measures (Resolution 757 WRC-12).

The penultimate speaker was **Mr. Christophe Bonnal** who represented the Inter-Agency Debris Coordination Committee (hereafter 'IADC'). He discussed the *requirements for debris mitigation* in connection with very small satellites. Mr. Bonnal first reviewed the fundamental principles of the IADC Guidelines: Preventing in-orbit break-ups, removing spacecraft at end of life and limiting objects released during orbital operations.

Mr. Bonnal informed the assembled delegates that the impact of very small satellite swarms had been considered as far back as June 2002. Of paramount importance, he said, is understanding the technical specifications of very small satellites. This includes the size of their components and break-up patterns. The situation must be continually reassessed due to technical progress and ongoing miniaturization.

On the other hand, Mr. Bonnal explained that no specific guidelines exist for very small satellites because they are thought to present a small risk. First, they do not carry fuel or other explosive elements. Second, though small they can still be detected in orbit and hence avoided by larger satellites with propulsion mechanisms. Third, they do not produce an increase in launch debris as they piggyback onto primary payloads. Finally, they tend to be put into low orbits which decay within 25 years or less. However, as the numbers of very small satellites increases significantly, we need to be more rigorous at an international level in our application of mitigation rules, in particular the '25-year rule' for LEO space objects.

A reference report on space debris is being prepared by the International Academy of Astronautics for 2016.

The final speaker of the symposium was **Mr. Otto Koudelka** from Graz University of Technology (TU Graz) in Austria. He offered a *best practice case study* into regulatory compliance for very small satellites using the first of two Austrian contributions to the BRITE constellation, TUGSAT-1/BRITE-Austria. The overall objective of the BRITE mission is to measure the brightness and temperature of massive luminous stars. TUGSAT-1/BRITE-Austria is a modified cubesat of 20cm³, weighing 6.8kgs and equipped with a magnetometer, radio antenna capable of operating across 3 frequency bands, solar cells and a telescope. It was launched to LEO on 25th February 2013 with a mission control centre located in Graz.

Turning to matters of legal compliance, Mr. Koudelka began by discussing the frequency coordination aspects of TUGSAT-1/BRITE-Austria. He acknowledged that the Institute of Communication Networks and Satellite Communications at TU Graz was familiar with the processes for the registration of ground stations and for frequency assignments by the Austrian Radiocommunication Bureau and that the Institute enjoyed a close relationship and regular contact with the ITU. In any event, the registration process began as soon as the Institute was awarded the BRITE contract. API was provided early on and the Institute was able to respond to requests for clarifications sent by administrations in Europe, Asia-Pacific and North

America. This ensured that potential interferences to other space services were avoided. Formal notification was given to the ITU and IARU, with final notification given to the ITU 1 year before launch. Mr. Koudelka emphasised that both international Unions have to be notified, even if only amateur satellite service frequencies are used. A thorough approach to frequency coordination is still lacking in many cubesat launches and consequently there is an interference risk.

Mr. Koudelka noted the positive effect that the BRITE-Austria project had in terms of capacity building in space law in Austria. It gave impetus to the passage of the Austrian Space Law in December 2011. The Austrian national law is now a leading example of national space legislation which imposes a number of preconditions to the grant of authorisation by the administration, thus ensuring Austria abides by its obligations under international space law and telecommunications law. However, the Austrian law is also progressive when it comes to very small satellites. Notably, it allows for possible exemptions from the liability insurance requirement where the project is in the public interest.

Finally, Mr. Koudelka announced that TUGSAT-1/BRITE-Austria was successfully registered with the UN Office for Outer Space Affairs. In summary, the BRITE-Austria project is a good example of the scientific potential of very small satellites. It also provides a best practice case study in terms of regulatory compliance for future missions in Austria and elsewhere. Following the presentations, delegates and participants were invited to provide questions and observations.

Prof. Schrogl, Chair of the Legal Subcommittee, closed the symposium. He sincerely thanked IISL and ECSL for organizing this most illuminating symposium and expressed his appreciation to all the speakers for their contributions and announced that he would raise the issue in the deliberations of the subcommittee during its current session. Following the statement by the Chairman of the Legal Subcommittee, Prof. Schrogl raised and led the discussion on the issue of small satellites in the meeting of the subcommittee. Delegations deliberated along the points developed in the symposium and agreed on asking UNOOSA to provide on its website a compendium on regulatory requirements for small satellites. This can be regarded as a direct and constructive influence of the IISL/ECSL symposium on the work of the Legal Subcommittee and on furthering the application of space law.

As the symposium drew to a close, Prof. Masson-Zwaan noted that the Symposium had become a longstanding tradition at the Legal Subcommittee having been held every year since the early nineties. She reminded all present that this year's symposium was being held in conjunction with a second symposium on the same topic to be held on 29th March at the University of Vienna, Austria. Finally Prof. Masson-Zwaan invited all participants to

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the reception hosted by IISL and ECSL, thereby concluding a most satisfactory afternoon of intellectual presentations and discussions. All presentations can be found on the site of the Office for Outer Space Affairs, at <http://www.oosa.unvienna.org/oosa/COPUOS/lsc/2014/symposium.html>.

