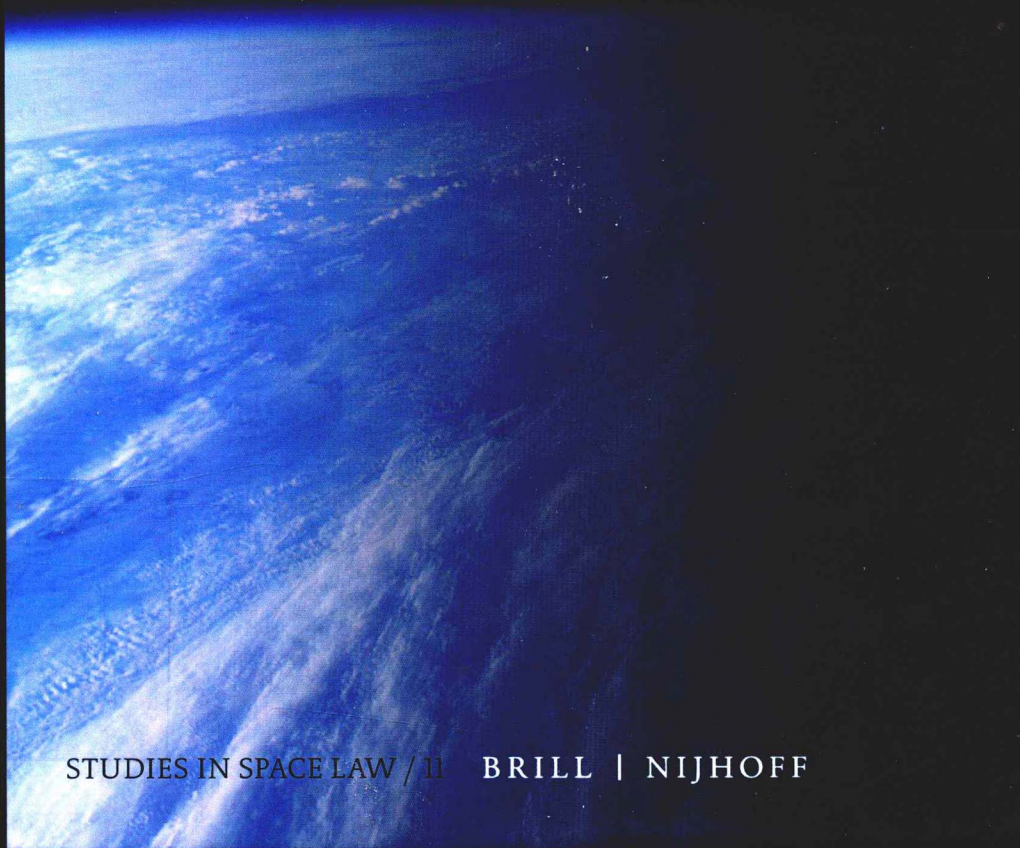


SMALL SATELLITES

REGULATORY CHALLENGES AND CHANCES

EDITED BY
IRMGARD MARBOE



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Small Satellites

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Foreword

This book documents a rare incident in international space law making: that academic efforts can actually have a direct impact on the decisions taken by the diplomats and state representatives. This happened at the 2015 session of the UNCOPUOS Legal Subcommittee, when a new agenda item on 'Exchange of views on the application of international law on small satellite activities' was established for the 2016 session. The adoption of this new agenda item did not happen by chance. It emerged from the Workshop organised by the Law Faculty of the University of Vienna and an IISL/ECSL Symposium. Both events, having dealt with the theme, took place during the 2014 session of the Legal Subcommittee and fed directly into the decision taken in 2015 to establish an agenda item on legal aspects of small satellites activities in 2016. In addition to that effect, the two activities also led to the request addressed to the Secretariat of the Legal Subcommittee to prepare a handout on 'Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites', which was published before the 2015 session.

I do not go too far in saying that decisive cornerstones for both the Secretariat handout and the setting of the new agenda item have been laid through the Workshop lead by Irmgard Marboe for which the proceedings are presented in this book. Through sound academic analysis and an open and constructive dialogue with the delegations participating in the Workshop, it was achieved what is so often missing: the joint search for substantive approaches and solutions based on an objective and reasoned academic groundwork. The University of Vienna has proven to be an exceptional platform for achieving exactly this. And, it should be said also with some reassurance, the way the Legal Subcommittee was open to this approach and was extremely quick in deciding on a new agenda item demonstrated that this forum is not the body leading long-lasting and fruitless discussions, but that it can be quick and smart.

The Workshop was not only instrumental in setting the agenda item on legal aspects of small satellite activities. Through these proceedings, it will also be instrumental in preparing the deliberations under the agenda item. Delegations will find all relevant issues assembled in this volume ranging from authorisation over frequency management to debris mitigation and all dimensions of small satellite activities from university CubeSats to mega-constellations of thousands of satellites, for which plans are currently mushrooming. Backed with the most valuable insights provided by this book, the Legal Subcommittee can enter into promising debates on the issue of legal aspects of small satellite

activities and the whole community interested in this field will find here an excellent source of up-to-date information and analysis.

Kai-Uwe Schrogl

Chair Legal Subcommittee 2014–2016
United Nations Committee on the
Peaceful Uses of Outer Space

Preface

On behalf of the International Institute of Space Law (IISL) and the European Centre for Space Law (ECSL) we warmly welcome this publication edited by Irmgard Marboe of the University of Vienna. The book contains papers by representatives from academia, industry, government, and international organisations, which ensures a broad view of all aspects of the topic of small satellites. This topic is widely recognised as presenting promises as well as challenges in various domains, including their legal and regulatory aspects.

That is the reason why, during the 2014 session of the UNCOPUOS Legal Subcommittee, two events were organised for the delegates of the Subcommittee. First, on 24 March, the opening day of the session, the traditional annual symposium organised by IISL and ECSL addressed 'Regulatory needs for very small satellites'. Second, the University of Vienna hosted a conference at its premises on 29 March, addressing 'Small Satellites: Chances and Challenges'. This book contains the papers presented during the latter event.

We are proud that two concrete results of these events in 2014 can be highlighted. Firstly, a new single issue/item for discussion was agreed to be included on the agenda of the fifty-fifth session of the Legal Subcommittee, entitled 'General exchange of views on the application of international law to small satellite activities'. Secondly, an information handout titled 'Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellite', addressing issues related to registration, authorisation, debris mitigation, and frequency management with respect to small and very small satellites was jointly developed by the United Nations Office for Outer Space Affairs (UNOOSA) and the International Telecommunication Union (ITU) and published on the website of UNOOSA.

These results show that the joint efforts of space law associations such as IISL and ECSL and academic institutions such as the University of Vienna can play a meaningful role in the further development of the law of outer space for the benefit of humankind.

This book contains a wealth of information for all those interested in the subject of small satellites. It will serve as a very rich and up-to-date source for students, practitioners, academics, engineers, and scientists. Not in the least, we are convinced that this book will be able to assist the delegates of the Legal Subcommittee in finding ways to realise the promises of small satellites, while ensuring that the challenges they present are addressed in an efficient and effective manner.

Tanja Masson-Zwaan

President, IISL

Sergio Marchisio

President, ECSL

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List of Abbreviations

ABAE	Bolivarian Agency for Space Activities of Venezuela
ADCS	Attitude Determination and Control System
AEB	Agência Espacial Brasileira (Brazilian Space Agency)
AECA	Arms Export Control Act (US)
AEM	Agencia Espacial Mexicana
AIAA	American Institute of Aeronautics and Astronautics
AIS	Automatic Identification System
AIT	Assembly, Integration and Test
ALBA	Alianza Bolivariana para los Pueblos de Nuestra América
API	Advance Publication Information (ITU)
ASAL	L'Agence Spatiale Algérienne (Algerian space agency)
ASAP	Austrian Space Applications Programme
ASAT	Anti-Satellite (Weapon)
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
ATV	Automated Transfer Vehicle
BGBI	Federal Law Gazette (Austria)
BMVIT	Ministry of Transport, Innovation and Technology (Austria)
BMWi	Federal Ministry of Economic Affairs and Energy (Germany)
BNSC	British National Space Centre
BR IFIC	International Frequency Information Circular of the Bureau (ITU)
BSSI	Basic Space Science Initiative (UNOOSA)
BSTI	Basic Space Technology Initiative (UNOOSA)
CCC	Commerce Country Chart
CCE	Comisión Colombiana del Espacio (Colombian Commission of Space)
CCL	Commerce Control List (US)
CCP	Common Commercial Policy (EU)
CCSDS	Consultative Committee for Space Data Systems
CDF	Concurrent Design Facility
CEA	Conference of the Americas
CELAC	Community of Latin American and Caribbean States
CEV	Centro Espacial Venezolano (Venezuelan Space Center)
CFSP	Common Foreign and Security Policy (EU)
CICESE	Center for Scientific Research and Higher Education (Mexico)
CLTP	CanSat Leader Training Program
CNES	Centre National d'Etudes Spatiales (France)
COST	European Cooperation in Science and Technology
COTS	Commercial Off-The-Shelf

COMSTAC	Commercial Space Transportation Advisory Committee (US)
CONIDA	National Commission for Aerospace Research and Development (Peru)
COSPAR	Committee on Space Research
CPUT	Cape Peninsula University of Technology (South Africa)
CSA	Canadian Space Agency
CSLA	Commercial Space Launch Act (US)
AST	Commercial Space Transportation (Faa)
CTB	Cargo Transfer Bags
DARPA	Defense Advanced Research Projects Agency (US)
DDTC	Directorate of Defense Trade Controls (US)
DICE	Dynamic Ionosphere Cubesat Experiment
DMC	Disaster Monitoring Constellation
DLR	Deutsches Zentrum für Luft- und Raumfahrt (Germany)
EA	Amateur-satellite service (ITU)
EAA	Export Administration Act (US)
EAR	Export Administration Regulations (US)
ECCN	Export Control Classification Number (US)
ECJ	Court of Justice of the European Union
ECSL	European Centre for Space Law
ECSS	European Cooperation on Space Standardisation
ED	Space Telecommand (ITU)
EGC	Emerging Growth Company
EH	Space Research (ITU)
EIAST	Emirates Institution for Advanced Science and Technology (UAE)
EK	Space tracking (ITU)
EMC	Electromagnetic Testing
EO	Earth observation
EOL	End of Life
EPFL	École polytechnique fédérale de Lausanne (Switzerland)
ER	Space telemetering (ITU)
ESA	European Space Agency
ESOC	European Space Operations Centre
ET	Space Operation
EU	Mobile-Satellite Service
EU GEA	EU General Export Authorisation
EW	Earth exploration-satellite service
EXA	Ecuadorian Space Agency
FAA	Federal Aviation Association (US)
FASTSAT	Fast, Affordable, Science and Technology Satellite
FCC	Federal Communications Commission (US)

FEFTA	Foreign Exchange and Foreign Trade Act (Japan)
FFG/ALR	Forschungsförderungsgesellschaft/Agentur für Luft- und Raumfahrt (Research Promotion Agency/Aeronautics and Space Agency) (Austria)
FII	Fundación Instituto de Ingeniería (Venezuela)
FINRA	Financial Industry Regulatory Authority (US)
FPGA	Field-Programmable Array
FYS	Fly Your Satellite Programme (ESA)
GAS	Ground Application Segment
GC	General Correspondence
GCC	General Clauses and Conditions (ESA)
GCS	Ground Segment
GEO	Geosynchronous Equatorial Orbit
GNB	Generic Nonosatellite Bus
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
GSO	Geostationary-Satellite Orbit
HCOC	Hague Code of Conduct (against Ballistic Missile Proliferation)
HEO	Highly Elliptical Orbit
HSTI	Human Space Technology Initiative (UNOOSA)
HTV	H-II Transfer Vehicle
IAA	International Academy of Astronautics
IAC	International Astronautical Congress
IADC	Inter-Agency Space Debris Coordination Committee
IARU	International Amateur Radio Union
ICAO	International Civil Aviation Organization
ICBM	Intercontinental Ballistic Missiles
ICD	Interface Control Documents
IEE	Instituto Ecuatoriano del Espacial (Ecuadorian Space Institute)
IEEE	Institute of Electrical and Electronics Engineers
IEEPA	International Emergency Economic Powers Act (US)
IGA	International Space Station Intergovernmental Agreement
IIRS	Indian Institute of Remote Sensing
ILO	International Labour Organisation
ILR	Institut für Luft- und Raumfahrt (Department of Aerospace Engineering) (Germany)
IISL	International Institute of Space Law
INPE	National Institute for Space Research (Brasil)
IPO	Initial Public Offerings
ISAE	Institut Supérieur de l'Aéronautique et de l'Espace (France)
ISC	International Space Company (Russia)

ISO	International Organization for Standardization
ISU	International Space University (France)
ISRO	Indian Space Research Organisation
ISS	International Space Station
ITAR	International Traffic in Arms Regulations (US)
ITT	Invitation to Tenders (ESA)
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency
JEM	Japanese Experiment Module
JOBS Act	Jumpstart Our Business Startups Act (US)
JSLC	Jiuquan Satellite Launch Center (China)
JSC 'ISS'	Joint-Stock Company 'Academician M.F. Reshetnev Information Satellite Systems' (Russia)
J-SSOD	JEM Small Satellite Orbital Deployer
LAPAN	Indonesian National Institute of Aeronautics and Space
LEO	Low Earth Orbit
MAST	Missing Aircraft Search Team
MCC	Mission Control Centre
MEO	Medium Earth Orbit
MERCOSUR	Mercado Común del Sur
METI	Ministry of Economic, Trade and Industry (Japan)
MIFR	Master International Frequency Register of the Bureau (ITU)
MIT	Massachusetts Institute of Technology (US)
MPL	Maximum Probable Loss
MTCR	Missile Technology Control Regime
NASA	National Aeronautics and Space Administration (US)
NASRDA	National Space Research and Development Agency (Nigeria)
NATO	North Atlantic Trade Organisation
NEOSSat	Near Earth Object Surveillance Satellite
NOAA	National Oceanic and Atmospheric Administration
Non-GSO	Non-Geostationary-Satellite Orbit
NSF	National Science Foundation (US)
OBC	On Board Courier/Computer
ÖVE	Österreichischer Verband für Elektrotechnik (Austrian Electrotechnical Association)
POCC	Payload Operations Control Centre
P-POD	Poly Picosat Orbital Deployer
PSLV	Polar Satellites Launch Vehicle
PUS	Packet Utilisation Standard
ROSCOSMOS	Federal Space Agency of Russia

SCC	Satellite Control Segment
SDR	Software-Defined Radio
SEC	Securities Exchange Commission (US)
SED	Storm Enhanced Density
SFL	Space Flight Laboratory (Canada)
SMIFR	Space Master International Frequency Register (ITU)
SLS	Space Launch System
SLV	Shipments of Limited Value (US)
SNL	Space Networks List
SNS	Space Networks System (ITU)
SOCC	Spacecraft Operations Control Centre
SS	Space Segment
SSC	Swedish Space Corporation
SSTL	Surrey Satellite Technology Ltd
STA	Special Temporary Authority (US)
STA	Strategic Trade Authorisation (US)
TAA	Technical Assistance Agreement (US)
TAM	Technical Assistance Missions
TAS	Typical Application System
TCBM	Transparency and Confidence-Building Measures
TEU	Treaty on the European Union
TFEU	Treaty on the Functioning of the European Union
TP 'NISS'	Technological Platform 'National Information Satellite System'
TT&C	Telemetry, Tracking and Telecommand
TTCP	Technology Transfer Control Plan (US)
TUB	Technical University of Berlin (Germany)
TUI	Tethers Unlimited, Inc
TGF	Terrestrial Gamma-Ray Flashes
UCV	Universidad Central de Venezuela
UNEFA	Universidad Nacional Experimental de la Fuerza Armada Nacional Bolivariana
UHF	Ultra High Frequency
UNCOPOUS	United Nations Committee on the Peaceful Uses of Outer Space
UTIAS	University of Toronto Institute for Aerospace Studies
UNISEC	University Space Engineering Consortium
UNISPACE	United Nations Conferences on the Exploration and Peaceful Uses of Outer Space
UNOOSA	United Nations Office for Outer Space Affairs
UNGA	United Nations General Assembly
USML	United States Munitions List

VHF	Very High Frequency
VKI	Institut Von Karman pour la Dynamique des Fluides (Belgium)
VRSS	Venezuelan Remote Sensing Satellite
WMD	Weapons of Mass Destruction
WRC	World Radiocommunication Conference (ITU)
XSLC	Xichang Satellite Launch Center (China)

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1945

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1967

Outer Space Treaty: Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, done 27 January 1967, entered into force 10 October 1967, 610 UNTS 205, 6 ILM 386 (1967).

1968

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1972

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1975

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1979

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1992

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