McGill

Centre for Research in Air and Space Law
Centre de recherche en droit aérien et spatial

Celebrating the 65th Anniversary of the Institute of Air & Space Law

4TH MANFRED LACHS INTERNATIONAL CONFERENCE ON CONFLICTS IN SPACE AND THE RULE OF LAW

27-28 May 2016

Montreal, Quebec, Canada

Hotel Best Western Ville-Marie

Program, Abstracts and Biographies

Sponsored by

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ROOM
The Space Journal

Useful Contact Information

Conference Location:

Hotel Best Western Ville-Marie
20th Floor, Room Mont Royal I
3407, Peel Street, QC H3A 1W7

Dinner Location (27 May 2016):

McGill Faculty Club,
3450, McTavish Street, H34 0E5

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BACKGROUND

Almost sixty years of exploration and use of outer space have brought unprecedented benefits to humankind. Humanity now depends heavily upon space, and even a single "day without satellites" would have disastrous impacts for everyone on Earth, particularly those who increasingly rely on space assets. However, many concerns exist today across a broad spectrum of issues with regard to space activities that impact upon notions of national and global security. Space technologies, activities and issues involve States, commercial space enterprises, non-State actors and possibly even terrorist organizations. As space infrastructure grows more vital to global economic, business and strategic systems, the potential of space conflict therefore appears to increase. Possible armed conflict in space might have devastating implications for the space systems of all nations, and perhaps even for life on Earth.

This 4th Annual Manfred Lachs Conference will address issues related to the state-of-the-art in current and future military and security technologies and activities, the development of military policies and doctrines, the challenges and risks they represent in terms of space security, the national exploitation of space natural resources, space sustainability, and the peaceful uses of outer space for the benefit of all. In addition, the various presentations by renowned academics and subject-matter experts will address the adequacy and inadequacy of the current rules of international space law, public international law, and international humanitarian law with respect to conflict avoidance in outer space.

Ram S. JAKHU
Conference Co-Chair

Dale STEPHENS
Conference Co-Chair

CONFERENCE PROGRAM COMMITTEE

1. Paul **DEMPSEY**, Institute of Air & Space Law, McGill University (IASL), Canada
2. Steven **FREELAND**, Western Sydney University, Australia
3. Ram **JAKHU**, Institute of Air & Space Law, McGill University (IASL), Canada
4. Bhupendra **JASANI**, King's College, London, UK
5. David **KENDALL**, United Nations Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Canada
6. Joseph **PELTON**, The International Association for the Advancement of Space Safety (IAASS), USA
7. Lucien **RAPP**, Space Institute for Research on Innovative Uses of Satellites (SIRIUS), France
8. Tommaso **SGOBBA**, The International Association for the Advancement of Space Safety (IAASS), The Netherlands
9. Michael **SIMPSON**, Secure World Foundation (SWF), USA
10. Isabelle **SOURBES-VERGER**, Centre national de la recherche scientifique (CNRS), France
11. Dale **STEPHENS**, University of Adelaide, Australia
12. Jinyuan **SU**, Xi'an Jiaotong University, China

COLLABORATING INSTITUTIONS

The Arthur C. Clarke Foundation
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Adelaide Law School, University of Adelaide
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France

Space Institute for Research on Innovative Uses of Satellites (SIRIUS)
France

The International Association for the Advancement of Space Safety (IAASS)
The Netherlands

CONFERENCE PROGRAM

THURSDAY 26 MAY 2016

18.00 – 20:00 RECEPTION (sponsored by ROOM, The Space Journal)
Room: Mont Royal I [20th floor]

FIRST DAY

FRIDAY 27 MAY 2016

7:30 – 8:30 REGISTRATION
Room: Mont Royal I [20th floor]

8:30 – 9:10 WELCOMING REMARKS
Ram Jakhu, Associate Professor, Institute of Air & Space Law, McGill University, CANADA
Paul Dempsey, Director, Institute of Air & Space Law, McGill University, CANADA
Daniel Jutras, Dean of Faculty of Law, McGill University, CANADA

KEYNOTE SPEECH
David Kendall, Chair of the United Nations Committee on the Peaceful Uses of Outer Space (2016-2017), CANADA
Niklas Hedman, Chief of the Committee, Policy and Legal Affairs Section of the United Nations Office for Outer Space Affairs, AUSTRIA

9:10 – 10:30 SESSION 1 - Technological Developments and New Threats – Weapons Systems, Space Regulation, Sustainability and (Peaceful) Uses of Space

CO-CHAIRS:
David Kendall, Chair of the United Nations Committee on the Peaceful Uses of Outer Space (2016-2017), CANADA
Paul Meyer, Adjunct Professor of International Studies, Fellow in International Security, Simon Fraser University and Senior Fellow, The Simons Foundation, CANADA

SPEAKERS:
1. Laura Grego, Senior Scientist, Global Security Program, Union of Concerned Scientists, US.
Current and future anti-satellite technologies: what challenges do they present?

2. Bhupendra Jasani, Visiting Professor, Department of War Studies, King's College London, UK
Military uses of outer space and the international space law

3. Joseph D Pelton, Executive Board, International Association for the Advancement of Space Safety, USA
Urgent security concerns in the Protozone

4. Igor Ashurbeyli, Editor-in-Chief, ROOM, The Space Journal, RUSSIA
Protecting planet Earth from military and non-military space danger

RAPPORTEURS:	*Stacey Henderson,* Research Development Officer, Research Unit on Military Law & Ethics, University of Adelaide *Peter Slater,* Senior Solicitor/In-House Counsel, Western Australia Police & Post-Graduate Student, University of Adelaide
10:30 – 11:00	REFRESHMENT BREAK
11:00 – 12:30	SESSION 2 - Technological Developments and New Threats (continues)
CO-CHAIRS:	**Igor Ashurbeyli,** Editor-in-Chief, ROOM, the Space Journal, RUSSIA **John D Rummel,** Visiting Scholar, Institute of Air & Space Law, McGill University, USA
SPEAKERS:	**1. Attila Matas,** Head Space Publications and Registration Division, International Telecommunications Union, Radiocommunications Bureau (BR), SWITZERLAND Conflicts related to radio frequency interference, jamming, frequency misuses, abuse of procedures, etc. **2. Lucien Rapp,** Professor, Scientific Director of the Space Institute for Research on Innovative Uses of Satellites (SIRIUS), University of Toulouse, FRANCE **& Nadège Carme,** PhD Candidate at SIRIUS, FRANCE **& Remy Durand-Carrier,** PhD Candidate at SIRIUS, FRANCE Space industrial war: Towards a risk of creeping takeovers in the global space industry? **3. Melissa de Zwart,** Professor, Adelaide Law School, University of Adelaide, AUSTRALIA GOOGLE in space? How will space governance accommodate non-State actors? **4. Sanat Kaul,** Chair, India Chapter of International Foundation for Aviation, Aerospace and Development, INDIA GNSS and conflict: Indian perspective
RAPPORTEURS:	*Bayar Goswami,* Graduate Student, Institute of Air & Space Law, McGill University, *Maria Rhimbassen,* Accountant/Librarian, International Space University
12:30 – 14:00	LUNCH Keynote Luncheon Speech by **Frank de Winne**, Astronaut from European Space Agency, BELGIUM

14:00 – 17:30

SESSION 3 - Emerging Strategic Space Issues: Areas of Potential Conflict

Room: Mont Royal I (20th floor)

CO-CHAIRS:

Bhupendra Jasani, Visiting Professor, Department of War Studies, King's College London, UK

Niklas Hedman, Chief of the Committee, Policy and Legal Affairs Section of the United Nations Office for Outer Space Affairs, AUSTRIA

SPEAKERS:

1. Ward Munters, Doctoral Researcher, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM
& Jan Wouters, Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM
The road not yet taken for defusing potential conflicts in active debris removal: a multilateral organization

2. Christopher D Johnson, Project Manager, Secure World Foundation, USA
The inevitability of conflict in space? Communicating and harnessing long-term State interests

3. James D Rendleman
& Brian D Green, USSTRATCOM JFCC SPACE, Vandenberg Air Force Base, California, USA
Space weapons according to Stewart

4. Eytan Tepper, Doctoral Candidate, Institute of Air & Space Law, McGill University
The regime complex of conflicts in space: A roadmap to space governance

SESSION 4 - Conflicts Related to Exploitation of Space Natural Resources

Room: Ville-Marie (4th floor)

Steven Freeland, Professor, School of Law, Western Sydney University, AUSTRALIA

Joseph Pelton, Executive Board, International Association for the Advancement of Space Safety, USA

1. John D Rummel, Visiting Scholar, Institute of Air & Space Law, McGill University, USA
Selling lunar resources for fun, profit, and export: A test that the OST cannot pass?

2. Philip de Man, Senior Researcher, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven
& Jan Wouters, Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM
A workable exploitation of 'celestial bodies': key principles for avoiding conflicts

3. Maria Manoli, Research Assistant, Institute of Air & Space Law, McGill University
Commercial space as a source of conflicts and the need for 'space pluralism'

4. Liu Hao, Director, Institute of Aviation Law and Standard, Beihang University, Beijing, CHINA
& Fabio Tronchetti, Advisor, HowLyMo Law Firm, Beijing, CHINA
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15:30 – 16:00	REFRESHMENT BREAK	
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RAPPORTEURS:	*Ted A Newsome & Aram D Kerkonian,* Graduate Students, Institute of Air & Space Law, McGill University	*Stacey Henderson,* Research Unit on Military Law & Ethics Research Development Officer, University of Adelaide *Peter Slater,* Senior Solicitor/In-House Counsel, Western Australia Police & Post-Graduate Student, University of Adelaide
18:30 – 22:30	COCKTAIL & DINNER (McGill Faculty Club, 3450 McTavish Street, H34 0E5) *Keynote Speaker:* **Paul Meyer**, former Canada's Ambassador to the UN and the CD; Adjunct Professor of International Studies, Fellow in International Security, Simon Fraser University and Senior Fellow, The Simons Foundation, CANADA	

SECOND DAY

SATURDAY 28 MAY 2016

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CO-CHAIRS:	**Natália Archinard,** Deputy Head of the Education Science and Space Section, Department of Foreign Affairs, SWITZERLAND **José Monserrat Filho,** Vice-President, Brazilian Association of Air and Space Law, BRAZIL	**Paul Dempsey**, Director, Institute of Air & Space Law, McGill University, CANADA **Dale Stephens**, Director, Research Unit on Military Law and Ethics, University of Adelaide, AUSTRALIA

SPEAKERS:	**1. Deborah Housen-Couriel**, Research Fellow, Interdisciplinary Cyber Research Center, Tel Aviv University, ISRAEL Cyber and space security: intersecting challenges **2. George Kyriakopolous**, Lecturer in International Law, National and Kapodistrian University of Athens, GREECE Challenges posed by the action of non-State actors in outer space **3. Jessica West**, Manager and Editor, Space Security Index, Project Ploughshares, CANADA End of a global commons? Can strategic restraint in space be maintained?	**1. Tare Brisibe**, former Chair of Legal Sub-Committee of the UNCOPUOS, SWITZERLAND Outer space and the law of weaponry **2. Guy Phillips**, Commander (Retired), Adjunct & Sessional Assistant Professor, Royal Military College of Canada, CANADA Rules of engagement (ROE) for military space operations **3. Ayhan Sorgucu**, Military Judge in the Turkish Airforce, TURKEY Security based space activities, 'peaceful uses' of outer space and new threats
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	4. P J Blount, Adjunct Professor, LL.M. in Air and Space Law, University of Mississippi, USA Sorting out self-defense in space: Understanding the conflicting views over self-defense in the EU code of conduct **5. Kiran Nair**, Wing Commander, Indian Air Force, INDIA Exploring the role of United Nations in tapping potential of international law and international cooperation to alleviate risk of space conflict	**4. Kuan-Wei Chen (David)**, Research and Administrative Assistant, Manual on International Law Applicable to Military Uses of Outer Space(MILAMOS) Project, CANADA "Principles of humanity" and "dictates of public conscience": The origins and evolution of the Marten's Clause and its applicability to armed conflict in outer space **5. Yaw Nyampong**, Senior Legal Officer, African Union Commission (Pan-African University), ETHIOPIA/CANADA A critical analysis of the international humanitarian law principle of distinction as it relates to the use of dual-use space-based assets in armed conflict
RAPPORTEURS	*Sandy Belle Habchi*, Research Assistant, Institute of Air & Space Law, McGill University *Aleksandra Puscisnka*, Graduate Student, Institute of Air & Space La, McGill University	*Iseoluwa Christopher Akintunde*, Graduate Student, Institute of Air & Space Law, McGill University *Harris Innes-Miller*, Student, Political Sciences, McGill University

12:30 – 14:00

LUNCH
& POSTER PRESENTATIONS BY

1. **Ali Aghahosseini**, Doctoral Candidate, University of Nantes, FRANCE
U.S. commercial space launch competitiveness Act of 2015: National legislation as a new source of conflict or an opportunity for reform?

2. **Bayar Goswami**, Graduate Student, Institute of Air & Space Law, McGill University, INDIA
Protection of celestial bodies – Avoiding the mistakes of Earth in exploration of outer space

3. **Biswanath Gupta,** Research Scholar, Rajiv Gandhi School of Intellectual Property Law, IIT Kharagpur, INDIA
& K D Raju, Associate Professor of Law, Rajiv Gandhi School of Intellectual Property Law, IIT Kharagpur, INDIA
Security issues in commercial launching: A case study of India

4. **Iseoluwa Christoper Akintunde & Rizkia Amelia Sania Putri**, Graduate Students, Institute of Air & Space Law, McGill University, NIGERIA & INDONESIA
Legal issues and conflicts arising from passenger participation in suborbital flights : Rethinking the definition of 'astronaut' under international law

5. **Malgorzata Polkowska**, Professor, National Defense Academy, Warsaw, POLAND
Polish perspectives on legal challenges of military use of outer space

6. **Ramya Sankaran & Nivedita Raju**, Gagrats Advocates & Solicitors, INDIA
Will empires strike back – unilateral legislation Fuel space wars

14:00 – 15:30

SESSION 7 – The Way Forward: Models for future Global Space Governance

CO-CHAIRS:

Yaw Nyampong, Senior Legal Officer, African Union Commission (Pan-African University), ETHIOPIA/CANADA
Jan Wouters, Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM

SPEAKERS:

1. Paul Meyer, Adjunct Professor of International Studies, Fellow in International Security, Simon Fraser University and Senior Fellow, The Simons Foundation, CANADA
The dark forces awaken: prospects for space arms control in an adversarial age

2. Natália Archinard, Deputy Head of the Education Science and Space Section, Department of Foreign Affairs, SWITZERLAND
Global space governance and the role of middle space powers

3. John S Goehring, Major, Headquarters, US Air Force, Space Command, USA
Real-world lessons on achievable space governance from the international code of conduct for outer space activities, the Iran Nuclear Agreement, and the Paris Climate Agreement

4. José Monserrat Filho, Vice-President, Brazilian Association of Air and Space Law, BRAZIL
Toward a collective space security

5. Thomas Gillon, Senior Advisor-Business Development, Canada Centre for Mapping and Earth Observation, CANADA
The uniqueness of space! Bringing space power theory back down to Earth

RAPPORTEURS: *Maria Rhimbassen,* Accountant/Librarian, International Space University
Tetyana Krupiy, Post-Doc Fellow, Faculty of Law, McGill University

15:30 – 15:45 REFRESHMENT BREAK

15:45 – 17:15 SESSION 8 – The Need for and Scope of a Manual on International Law Applicable to Military uses of Outer Space (MILAMOS)

CO-CHAIRS: **Ram Jakhu**, Associate Professor, Institute of Air & Space Law, McGill University, CANADA
Tare Brisibe, former Chair of Legal Sub-Committee of the UNCOPUOS, SWITZERLAND

SPEAKERS: **1. Duncan Blake**, Wing Commander, Australian Air Force, AUSTRALIA
Reconciling *lex speciali* in the event of hostilities in outer space *(via Skype or recorded)*

2. Dale Stephens, Director, Research Unit on Military Law and Ethics, University of Adelaide, AUSTRALIA
The normative role of international operational military law manuals

3. Peter Hulsroj, Director, European Space Policy Institute (ESPI), AUSTRIA
& Anja Nakarada Pecujlic, External Consultant, ESPI, AUSTRIA
Space through the lens of neutrality

4. Cassandra Steer, Erin JC Arsenault Post-Doctoral Fellow, Institute of Air & Space Law, McGill University, AUSTRALIA
Is there a risk of condoning space warfare by regulating it?

RAPPORTEURS: *Sandy Belle Habchi*, Research Assistant, Institute of Air & Space Law, McGill University
Aleksandra Puscinska, Graduate Student, Institute of Air & Space Law, McGill University

17:15 – 17:25	CONFERENCE CLOSING REMARKS **Dale Stephens,** Director, Research Unit on Military Law and Ethics, University of Adelaide, AUSTRALIA

ABSTRACTS

SESSION 1 - Technological Developments and New Threats – Weapons Systems, Space Regulation, Sustainability and (Peaceful) Uses of Space

Laura Grego, Senior Scientist, Global Security Program, Union of Concerned Scientists, USA

Current and future anti-satellite technologies: what challenges do they present?

Over the last decade, technologies that are capable of posing risks to satellites grown significantly in sophistication and capacity, and have become even more widely available. Diplomatic initiatives have not been effective in limiting their advancement and spread. Simultaneously, the United States and Russia continue to retain large nuclear arsenals on high alert, and China is reportedly considering increasing the number, capacity and alert status of its nuclear weapons delivery systems. Attacks on satellites can create or escalate terrestrial crises in ways which can be potentially difficult to predict, posing danger among nuclear powers. This paper takes a look at some of the most important anti-satellite technologies available now and those likely to mature in the near future, while discussing approaches and limits on such technologies so as to reduce the risk of misperception, miscalculation and the unintentional creation or escalation of a crisis.

Bhupendra Jasani, Visiting Professor, Department of War Studies, King's College London, UK

Military uses of outer space and the international space law

In this paper an attempt is made to identify the current and planned military and security related space systems as well as their capabilities. Presently, the capabilities of some of the civil systems are approaching those of military assets in space posing challenges and risks to security in the outer space environment. The current international legal status of military or defence-related systems, whether deployed at present and those with potential to be deployed, is examined briefly. An example would be the examination of whether the uses of outer space are consistent with the current principles of international law concerning such activities. In addition, an attempt will be made to answer certain questions such as: what are space weapons and who controls their deployment/use in today's world? What are the nuclear, radiological, or particle beam weapons and could they be deployed in space in the next 20 years and how might the risks of this occurring be minimised? Does jamming of and/or cyber-attacks on satellites and earth bound space related systems constitute a violation of international law, and if so, in what circumstances?

Joseph D Pelton, Executive Board, International Association for the Advancement of Space Safety, USA

Urgent security concerns in the protozone

The control and regulation of commercial airspace by national and regional aviation agencies and by the International Civil Aviation Organization under the Chicago Convention, as amended, is well established. The Outer Space Treaty and its associated treaties, conventions and international agreements as achieved and agreed to by means of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), the good offices of the United Nations Office of Disarmament Affairs (UNODA), or other "soft law" mechanisms also have allowed key international understandings to be reached with regard to the prohibition to placing space weapons into orbit or outer space, nation states' liability responsibilities with regard to space objects, and precautions that should be taken with regard to nuclear power supplies, etc.

What is currently a lacuna in global space governance is what is variously called "sub-space", "proto-space" or the "protozone". This area above commercial air space (i.e., 21 kilometers) and below the

Van Karman Line (i.e., 100kilometers) or alternatively below the region where satellites can be placed into Earth orbit (i.e., 160 kilometers) is an area where there are wide range of new applications. But in spite of ambitious plans to fly space planes, hypersonic transport vehicles, high altitude platforms/aerostats and perhaps other craft within these altitudes where there are no national nor international regulatory bodies with a clearly defined safety or regulatory responsibility for this region.

Currently there are many new applications for the protozone that include or could soon include: (i)sub orbital flights—crewed and non-crewed; (ii) hypersonic transportation—crewed; (iii) stratospheric balloons and dirigibles—crewed; (iv) dark sky stations and ion engine propelled craft; (v) robotic aircraft transporters; (vi) high altitude platforms for communications, remote sensing, etc.; (vii) stratospheric surveillance platforms; and perhaps (viii) various types of weapon systems and devices.

There would seem to be a most urgent need to address the uses of the proto-zone in the context of: (i) national or international traffic control and management (i.e., in terms of the technical, operational, and safety regulatory concerns and issues); (ii) allowable and prohibited uses; (iii) national, private entity or international liabilities and responsibilities; (iii) safety and coordinative responsibilities and duties; (iv) inspection and control beyond traffic control and management; and especially the status, control and prohibitions against the use or flight of weapons systems in this region that is above commercial space and below outer space.

As such, this paper will explore the complex nature of current or proposed uses for the so-called "protozone" and highlight possible approaches that might be taken with regard to liability issues, prohibitions against the use of weapon systems and devices in this region, and incipient traffic control and management issues both with regard to defense, governmental and civic applications for this zone. The discussion will not only consider regulatory and legal issues, but technical and operational challenges for the management and control of a vast volume of space that is much, much larger than that currently represented by civil air space.

Igor Ashurbeyli, Editor in Chief, ROOM, The Space Journal, RUSSIA

Protecting planet Earth from military and non-military space danger

Typically, when we address the issue of aerospace safety, we start at the very bottom (e.g., air defence, ballistic missile defence) and then we move up the scale – that is as far as the technological and financial capabilities and geopolitical concerns of the moment will allow us to.

I would like to take the opposite approach and begin at the very top, in deep space. Perhaps a middle ground of aerospace defense can be found through defining the defense of our planet Earth, because in the face of a global space threat, all of our "intraplanetary geopolitical squabbles" will simply disappear.

Issues of discussion will revolve around (1) Protecting planet Earth from military and non-military space danger; and (2) International integration as a factor of mutual safety. As such, the report will categorize all the major space threats: (1) *Space debris* – a detailed data presentation about all spacecraft and their location in orbit will be made available, an analysis of distribution and allocation by country is also presented, and symptoms of cascading effects (Kessler syndrome) – the quickly developing chain reaction of the appearance of secondary fragments of space objects, caused by the increasing number of space debris collisions in near-Earth space will be offered; (2,3) *Asteroid and comet danger (ACD)* – the danger posed by asteroids and comets which has been scientifically proven since the end of the 20th century will be exhibited and the report will illustrate that since ACD presents a serious threat to our civilization, finding countermeasures must become

one of the most important tasks that humanity must tackle in the 21st century. An analysis of how various sizes, speeds, and other parameters of asteroids and comet nuclei may cause global, regional or local catastrophes upon collision with Earth will also be made available.

Furthermore, the report will also analyse other potential threats (i.e., (4) *Meteor threat* – historical chronology; and *Electromagnetic and radiation emission* – analysis based on the frequencies and energy emitted.) and possible biological danger from unknown or dangerous biological objects. Finally, main countermeasures and protection methods will be reviewed for every type of threat presented, including terrestrial and space bases, and warning and forecasting methods.

SESSION 2 - Technological Developments and New Threats (continues)

Attila Matas, Head Space Publications and Registration Division, ITU BR, SWITZERLAND

Conflicts related to radio frequency interference, jamming, frequency misuses, abuse of procedures, etc.

The purpose of this paper is to provide an overview of the most recent World Radiocommunication Conference (WRC-15) decisions related to international regulatory framework governing satellite radiocommunication which exists to ensure the interference-free operation of satellite systems, and to present some of the actions that the ITU Radiocommunication Bureau (Bureau) is taking, along with other initiatives in developing to combat *harmful interference* to satellite systems and *maintenance of the Master International Frequency Register (MIFR).*

The ITU Radiocommunication Sector is committed to maintaining right of access and efficient use of the orbit/spectrum resource and to maximizing operation free from harmful interference. This virtuous mechanism is supported by international regulations, global standards, guidelines and the assistance by the Bureau. The international regulatory framework is provided by a set of legal instruments that include the ITU Constitution (CS), Convention (CV) and Radio Regulations (RR) that have the status of intergovernmental treaties and are legally binding on all Member States. They define the objectives, rights and obligations of parties.

Lucien Rapp, Professor, Scientific Director of the Space Institute for Research on Innovative Uses of Satellites (SIRIUS), University of Toulouse, FRANCE
& Nadège Carme, PhD Candidate at SIRIUS, FRANCE
& Remy Durand-Carrier, PhD Candidate at SIRIUS, FRANCE

Space industrial war: Towards a risk of creeping takeovers in the global space industry?

This paper analyzes the development of industrial cooperation in space activities since the end of World War II. It highlights a gradual emancipation of space companies' industrial cooperation and strategies from governmental programs (II). In recent years, this emancipation results in the proliferation of numerous Joint Venture agreements (III) and in a significant number of mergers and/or acquisitions exceeding $ 500 million (IV). These transactions or JVs have caused a consolidation trend in the space industry, now structured differently around subcontractors of first, second and sometimes, third tiers ; space subcontractors whose business generates financing needs that exceed their cash resources and of which the increasing number calls for industry consolidation (V). These financing requirements and the need for consolidation could be factors of vulnerability of space industry in a speculative context where the space industry combines numerous factors of attractiveness for investors (companies, funds) (VI), raising the crucial question of the effectiveness of the control systems implemented by states in the field of concentrations, foreign investment or

exports of dual-use technologies (VII). The conclusion brings some recommendations that can be made in such a context (VIII).

Melissa de Zwart, Professor, Adelaide Law School, University of Adelaide, AUSTRALIA

GOOGLE in space? How will space governance accommodate non-State actors?

The successful launch and upright landing of the first stage of SpaceX's Falcon 9 rocket on 21 December 2015 heralds not only the viability of reusable rockets (dramatically cutting the cost of launch) but also 'a critical step along the way towards being able to establish a city on Mars' according to SpaceX founder and CEO Elon Musk. Musk has made no secret of his desire to colonize Mars and has also contemplated the need to terraform Mars to make it habitable for humans. But who has the right to control or regulate such activities and how is space law going to accommodate the growing number of non-state actors involved in space activities from short term tourism, to exploration, mining and even colonization? Is it possible that corporations may grow in power and influence equal to nation states, just as Google has done on Earth? If so, how will these corporations be regulated and where do they fit within the scope of effective space regulation?

The US has recently passed the SPACE Act of 2015 which mandates an assessment of current and proposed space activities to identify an appropriate regulatory regime which would 'promote the US commercial space sector, and meet the United States obligations under international treaties (s 108)'.

How will the approach to regulation of space activities be changed by this revised regulatory approach, one influenced by the highly competitive and laissez faire attitudes of private enterprise?

Sanat Kaul, Chair, India Chapter of International Foundation for Aviation, Aerospace and Development, INDIA

GNSS and conflict: Indian perspective

Under the Outer Space Treaty, the outer space is the common province of all mankind. But the reality is otherwise. Space is what oceans were in 17th to 19th Centuries – A playground for powerful countries and pirates. Besides use of space in warfare, the commercial rivalry between competing spacefaring nations and their respective private companies can also lead to conflicts in space.

Global Navigation Satellite System (GNSS) is one of the most useful space technological developments. Most people do not realize how much GNSS is involved in their modern economies and lifestyles. It provides direction while driving in an unknown area. It helps trekkers lost in mountains find their way. It keeps logistic company manage their fleet more efficiently. It helps ships in maintaining their course. The entire aviation industry uses it for flying, especially over high seas where other navigational systems like radars are not so effective.

Access is free to all GNSS services; e.g., the US GPS, the Russian GLONASS system and the Chinese Bediou system. The European Union is planning its own Galileo system while India has started its own Regional Navigation Satellite System (RNSS) of 7 satellites over India, four of which are already in orbit. However, GNSS is a dual use technology and thus it is prone to abuse. It is used for precision bombing as well as by UAV's. It can be used by terrorists and non-state actors for causing deaths, injuries and damage to property.

This paper will address the following questions:

Why are countries looking for their own GNSS? How vulnerable is GNSS technology? How 'scintillation' can cause GNSS signals to break up or cause variations in receivers? How hackers both

ethical and non- ethical can cause damage to GNSS and thereby to users - like aircrafts, airports, ships, or even small applications based on it. How will conflicts in GNSS and its applications impact the rule of law? Is the law ready to regulate it?

Appropriate solutions to such conflicts in space are imperative for securing the beneficial uses of the GNSS and its down to earth applications and maintaining our future lifestyle.

SESSION 3 - Emerging Strategic Space Issues: Areas of Potential Conflict

Ward Munters, Doctoral Researcher, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM
& Jan Wouters, Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM

The road not yet taken for defusing potential conflicts in active debris removal: a multilateral organization

The dual-use nature of active debris removal (ADR) and on-orbit servicing (OOS) technology implies the latent possibility of aggressive interference with foreign entities' space objects. This can create an atmosphere of escalatory competition in which space actors start or continue to develop offensive or retaliatory space capabilities to protect their space assets. An arms race or conflicts in space could follow, to the detriment of the peaceful uses of outer space for the benefit of all.

Apart from the drafting of non-binding rules of conduct, guidelines and transparency measures and the difficulty of negotiating restrictive binding regulations, the paper will discuss a third way to help safeguard security and peace in space that has not received adequate attention in literature: a broad intergovernmental organization of a civilian nature tasked with the research, design and operation of ADR/OOS-missions. Rather than limiting freedom of action, the organization offers, in principle, a positive means of peaceful collaboration while reducing the need for unilateral ADR/OOS-operations.

The advantages of this approach are manifold. Through extensive multilateral cooperation many of the legal hurdles surrounding space debris and ADR (*e.g.* definition, liability, jurisdiction and control) can be surmounted. Moreover, a co-governed, depoliticized, multilateral organization to implement ADR-operations, open to all willing and peaceful participants, promotes far-reaching transparency and acts as an institutionalized Transparency and Confidence Building Measure (TCBM). Tensions and misunderstandings can be reduced and the threat of escalation neutralized, while collective experience, institutional learning and goodwill is put towards more effective, future international legal instruments on space debris and ADR with global support.

Christopher D Johnson, Project Manager, Secure World Foundation, USA

The inevitability of conflict in space? Communicating and harnessing long-term State interests

Many believe that conflict in space, including armed conflict, is simply inevitable. They use statements and acts by foreign militaries to bolster views of the growing inevitability of conflict. This view of inevitable conflict is then used to justify increased domestic spending and development of ever-more advanced space systems and preparedness. In a vicious cycle, their assertions and forward-leaning postures are received internationally as justification for further statements and actions, which again heighten tensions. Before this self-fulfilling prophecy materializes, the paradox of an outcome no one wants but everyone expects must be understood and solutions offered.

Firstly, is understanding and communicating the shared long-term interest to avoid conflict in space. Secondly, is realizing that rather than being inevitable, conflict in space would be the result

of unilateral, short-term interests, and diplomacy failing to reach compromises for mutual benefit. If no one wants conflict in space, why must it happen?

This paper will have insights from the law and economics movement, explaining the concept of c*onstrained maximization* by rational actors who adopt long-term plans which help them forgo short-term temptations in favor of richer gains in the future. Constrained maximizers agree to live within the rules of an international legal community in order to maximize the benefits of living within that community. The shared community of space depends on rational actors articulating plans, then adopting norms which serve their long-term plans, rather than norms which allow their short-term defections for temporary and unilateral gains, or no norms at all.

James D Rendleman
& Brian D Green, USSTRATCOM JFCC SPACE, Vandenberg Air Force Base, California, USA

Space weapons according to Stewart

What is a "space weapon?" There is no generally accepted definition. The Russian Federation and the People's Republic of China proposed a definition in their draft Prevention on the Placement of Weapons in Space Treaty, and academic writings have floated others. But the devil is in the details. Defining the term too broadly could unduly restrict lawful, peaceful space activity, whereas defining it too narrowly could allow pernicious space activities to appear justified.

Should a definition of "space weapon" include systems or operations that attack terrestrial components of space systems, or interfere with system command and control? Should it encompass normally benign technologies that can be repurposed to engage adversary systems? Perhaps the definition of "space weapon" should be broad: "an instrument or instrumentality of attack or defense used to fight against space systems or from the space domain."

The ambiguity in definition makes arms-control measures purporting to ban space weapons difficult to implement and nearly impossible to enforce. Some space technologies have tremendous dual-use potential, making it difficult to distinguish a non-weapon space system from a space weapon system. Even if a definition of "space weapon" achieves wide acceptance, States may still seek to prevent or circumvent international restrictions on the development or use of space weapons. The right of self-defense must also be secured.

This article discusses different proposed definitions of "space weapons," assesses their advantages and shortcomings, and concludes that the most workable test might just be Justice Stewart's dictum: "I know it when I see it."

Eytan Tepper, Doctoral Candidate, Institute of Air & Space Law, McGill University, ISRAEL

The regime complex of conflicts in space: A roadmap to space governance

Space warfare can be divided into three types, according to their theater: (1) solely in space; (2) space ↔ earth (e.g., ASAT); and (3) cyber, where a cyber-attack targets space assets. No state has known operative capabilities for the first type (except surveillance), very few for the second, but the third is cheaper and more accessible, and will therefore be the leading model of space warfare. The applicability of the Laws of Armed Conflict to space conflicts is uncertain, despite attempts to apply it - OST Article III to the first two types and the 2013 UN's GGE recommendations to the third.

The branch of International Relations known as Regime Theory and its contemporary paradigm of 'Regime Complex' provide the analytic tools for understanding and constructing the governance of conflicts in space. Regimes are a subset of norms, descriptive, prescriptive or both, which are shared expectations and they may or may not be institutionalized into a treaty, soft law or forum (e.g., the

nuclear suppliers group). Regime Complex is a loosely coupled set of separate regimes in one issue area.

This paper will use these tools to analyze the regime complex of space conflicts and provide a roadmap for the development of governance thereof, covering: (1) the three types of space conflicts; (2) introduction to Regime Theory and the notion of Regime Complex; (3) mapping the existing regime complex of space conflicts, including applicable norms and multilateral forums with appropriate mandate; and (4) a roadmap and recommendations for future action.

Florence Gaillard-Sborowsky, Research Fellow, Fondation pour la Recherche Stratégique, FRANCE

Space and security relationships issues from a political and technological point of view

This paper explores the link between space and security from a political science point of view. The multiple dimensions of this relationship will be first considered. In a second part this paper will look into the threats and risks that space security needs to tackle, focusing on ASAT's programs from a historical and technological point of view and featuring up- to -date technologies. Finally, we want to discuss the national versus international space security issues so as to determine if a common approach could be possible at international level and what would be its prerequisites.

Space and security have been consubstantial from the beginning of the space era. Nevertheless, the use of the original notion "outer space for security" has evolved throughout time. Not only have the two terms been reversed to form "security in/of outer space" but also they have been extended. The security concept has developed variant forms such as the economic security, environmental security etc. There has likewise been created a "space security" over the past 30 years. But today what do we mean by space security? And what are the dimensions of this expression? Moreover, what are the real threats and/or risks in space? We must particularly consider the technological development in terms of ASAT in a context where this issue sparks a new international debate and where the US ASAT5s budget increases. To complete this overview, we will examine the coexistence of national space security (i.e., UK,2014 /USA etc.) and efforts by the international institutions, especially by the UN, to gradually built a space security, in line with the UN chart's idea of collective security.

SESSION 4 - Conflicts Related to Exploitation of Space Natural Resources

John D Rummel, Vising Scholar, Institute of Air & Space Law, McGill University, USA

Selling lunar resources for fun, profit, and export: A test that the OST cannot pass?

A new company, Borchgrevink Synergy (B.S.), based in the United States, has an aim to mine the ices at the Lunar South Pole, converting them to rocket fuel that they hope to sell in Earth orbit. The founders (Canadian, Norwegian, and American) hope the fuel will be both accessible and marketable to support a developing space economy—and make them a profit. Mining lunar ices from permanently shadowed craters, the company has the potential to export a large quantity of rocket fuel made from (mostly) water ice, which has been deposited there over several billion years of cometary and asteroidal impacts. To minimize costs, B.S. has considered a variety of methods of fuel export. Because the rim of the crater they are planning to mine is permanently in sunlight, making solar power cheap and plentiful, they plan to collect the ice, electrolyze it on the Moon, and place the fuel in light-weight tanks brought to the Moon for that purpose. These will be sent to Earth-orbit by the use of an electromagnetic accelerator in small tanks of liquefied hydrogen and oxygen traveling at velocities of over 2.5 m/s—reaching Lunar escape velocity and requiring minimum internal guidance to reach an Earth-orbit rendezvous with company spacecraft, which will then deliver the fuel to its customers.

In this paper I will examine this scenario in light of the law of outer space, particularly the Outer Space Treaty and the Moon Agreement, and highlight the aspects of the B.S. business plan that pose particular challenges under both treaties—as well as those that have the potential to usher in a rush to the "high ground" of the South and North Poles of the Moon.

Philip de Man, Senior Researcher, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM
& Jan Wouters, Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM

A workable exploitation of 'celestial bodies': key principles for avoiding conflicts

The discussions surrounding the exploitation of celestial bodies are complicated due to a number of conceptual difficulties, one of which is the lack of a legal definition of a celestial body. This issue has made it difficult to distinguish celestial bodies from their natural resources, which in turn has complicated the legal regulation of the exploitation of celestial bodies. In recent months, this theoretical discussion has been outflanked by important developments in the space mining industry and the national laws supporting them.

This paper will argue that *a priori* definition of a 'celestial body' is not possible in the existing international space law context, nor is it required for arriving at a workable regime of exploitation. Rather, the regime should be guided by a limited set of key principles for avoiding conflicts between competing users wishing to engage in similar activities. The paper will therefore set out a number of principles that should guide the exploitation of celestial bodies based on the scope and nature of the activities, rather than the theoretical classification of matter in space as a certain category of celestial body.

The paper will also take into account the differing legal regimes that apply to States depending on their ratification of existing multilateral space law treaties and the development of their national space law. As such, the content of the suggested principles will take cues from the Outer Space Treaty, the Moon Agreement and the various incarnations of the United States Commercial Space Launch Competitiveness Act of 2015.

Maria Manoli, Research Assistant, Institute of Air & Space Law, McGill University, GREECE

Commercial space as a source of conflicts and the need for 'space pluralism'

A few years ago, the notion 'commercial space' was established to refer to space activities that entail commercial character and begin to dominate in the whole range of space-related disciplines. Indeed, since the beginning of the 21st century, the role of private actors in the field of space activities appears enhanced changing the traditional perceptions for a 'use and exploration' of outer space solely for scientific and peaceful purposes.

Although such development is welcomed in the field of space industry as it reinforces the space domain and its place in the global economy, antinomies and contradictions are often encountered between the legal framework that surrounds such development and the traditional principles and concepts encompassed in lex spatialis.

In fact, the above concern is not merely theoretical with major example of the signature of the U.S. – The Space Resource Exploration and Utilization Act of 2015 by the U.S. government, which raised a significant number of conflicts in the international legal and academic community as to its legality. Without taking position on the correctness or erroneousness of such a legislative move, once could definitely argue that the need for pluralism in space law has not arrive.

Therefore, this paper argues the necessity to consider the needs and intentions of both traditional and modern space actors, together with their perceptions as to what modern space should constitute. It also questions what should be the concept behind the establishment of new provisions in the *corpus juris spatialis* – or behind the reconsideration of the existing ones – in order to harmoniously accommodate the commercial tendencies of the space industry within the realm of space law for the sake of legal preparedness for what is yet to come.

Liu Hao, Director, Institute of Aviation Law and Standard, Beihang University, Beijing, CHINA
& Fabio Tronchetti, Advisor, HowLyMo Law Firm, Beijing, CHINA

UNGA Resolution 69/32 on 'No first placement of weapons in space': a meaningful step forward in the field of space security?

On 2 December 2014 the United Nations General Assembly (UNGA) adopted with a vote of 126 in favor, 4 against, and 46 abstentions, Resolution 69/32 on 'No first placement of weapons in space'. The adoption of Resolution 69/32, which has received little attention in academic circles, represents, instead, a development worth of consideration due to its political and legal implications. On one hand, it indicates the willingness of the UNGA to take a more active role in promoting a secure space environment as well as the readiness of a crescent number of States, under the leadership of China and Russia, to put forward creative proposals to achieve that goal. On the other hand, however, its controversial reception indicates that a universal solution to the issue of space security still lays far ahead, as States maintain substantially different positions on how to deal with the prevention of the weaponization of outer space.

In the light of the above the purpose of this paper is to analyze the content of the resolution, evaluate its positive features and shortcomings, and assess its chances to provide a meaningful and positive contribution to a more secure outer space.

SESSION 5 – Different Forms of Use of Force

Deborah Housen-Couriel, Research Fellow, Interdisciplinary Cyber Research Center, Tel Aviv University, ISRAEL

Cyber and space security: intersecting challenges

Recent military and civilian developments are deeply affecting our understanding of the scope, depth and criticality of new strategic threats to countries both in outer space and in cyber space. These "fourth and fifth domains" have until now largely been treated as separate realms by states and by intergovernmental organizations that are working to promote governance, policy and legal issues in each context. Yet outer space and cyberspace are better characterized as interdependent elements of a complex and continually-evolving nexus of activity for state and non-state actors. This article analyzes the progress being made in the development of norms of conduct – whether binding or non-binding – for space security and cybersecurity, and argues for a dovetailing of efforts regarding certain of these initiatives. The basis for such an approach lies in the fact that satellite communications are overwhelmingly carried out through cyberspace, and as such are subject to the vulnerabilities and strategic threats prevalent in both realms. Initiatives such as those under the aegis of the UN's Office for Outer Space Affairs, its Office for Disarmament Affairs and its First and Fourth Committees; the European Union, the Council of Europe, the Organization for Security and Cooperation in Europe, NATO and the Shanghai Cooperation Organization have addressed a number of issues that have ramifications in both the outer space context and the cybersecurity context. Of particular concern are issues around the use of force by states and their right to self-defense under the UN collective security regime; and state responsibility and liability for activities causing harm

in both realms. Moreover, just as states find themselves in a new threat environment in the space and cyber contexts, commercial entities operating satellites that support critical infrastructure such as air traffic control systems, GPS and telecommunication networks, are more and more vulnerable to strategic risks caused by hostile and malicious actors. The ongoing efforts to elucidate and develop normative guidance regarding both outer space and cyberspace can benefit from overlapping state interests and insights. Above all, the approach of states and intergovernmental organizations should reflect the dual reality of the present militarization and commercialization of both outer space and cyberspace.

George Kyriakopolous, Lecturer in International Law, National and Kapodistrian University of Athens, GREECE

Challenges posed by the action of non-State actors in outer space

The progressively increasing involvement of non-state entities in international relations has led, in recent years, an intense debate about the role of the so-called non-state actors in shaping modern international law.

A 'non-state actor' is an entity that is not a State under International Law. A typology of non-state actors comprises intergovernmental organizations, NGOs, multinational corporations and groups such as rebel groups, terrorist organizations, civil society organizations, corporations and individuals. They are classified into three broad groups: sub-state actors, supranational actors and extra-national actors.

The increasingly intense activities of these actors inevitably affects space law, in the context of which States used to be the privileged subjects. However, the action of organizations such as INTELSAT or INMARSAT - especially after their privatization – as well as the contribution to outer space exploration and exploitation of inter-governmental bodies such as ESA indicate that the balance has already been disturbed. Nowadays, the landscape becomes even more complicated due to the existence of private companies wishing to undertake commercial space activities (mining, tourism) but also due to the growing fear that non-state entities may engage in terrorist attacks against targets in space.

Faced with this new reality, space law still provides (Article VI OST) that States are responsible for activities of non-governmental entities – which evidently does not support the upgraded position of non-state actors in outer space. It is thus obvious that the existing legal framework must keep pace to stay relevant. The object of this paper is to consider how this can be done.

Jessica West, Manager and Editor, Space Security Index, Project Ploughshares, CANADA

End of a global commons? Can strategic restraint in space be maintained?

At the dawn of the first space race, U.S. President Eisenhower declared a choice between preserving outer space as a peaceful, global commons, or engaging in armed competition. Through mutual agreement, the U.S. and the U.S.S.R chose both, using the principle of freedom of space to pursue military competition, and governing this balance between peace and war through strategic restraint. Today, a second, more volatile space race is unfolding. To reflect on the potential for armed conflict in outer space, this paper will first consider how strategic restraint emerged and was sustained, and the extent to which it is threatened by new actors, new resources, and new technologies. As formal agreements to ban the use of weapons in space remain elusive, it will ask how this restraint can be maintained in the face of more complex competition.

PJ Blount, Adjunct Professor, LL.M. in Air and Space Law, University of Mississippi, USA

Sorting out self-defense in space: Understanding the conflicting views over self-defense in the EU code of conduct

In the summer of 2015, the EU hosted the Multilateral Negotiations on an International Code of Conduct for Outer Space Activities at UN headquarters in New York. These "negotiations" immediately proved to be contentious across a number of issues and quickly devolved into something more akin to "consultations." At the end of the week-long event, no text was adopted, and no clear path forward in the impasse was evident.

Among the numerous issues that states took exception to was the inclusion of the right to self-defence in the Code of Conduct. States varied widely in their statements on the legal and political effects of such a clause. This paper will investigate these differing views through the lens of international law on the use of force and international space law. The analysis will add clarity to the different views being advocated by states in connection to the right of self-defence, and examine ways in which the law can mediate among these views. Such analysis is critical to the process of developing rules that maintain peaceful uses of outer space.

This paper will first give a brief introduction to the law governing self-defence as found in the UN Charter and international custom. It will then turn its attention to building an understanding of how self-defence fits into the legal commitment of states to use space for peaceful purposes. Next it will discuss a number of different views expressed at the Multilateral Negotiations and analyze their legal/political content. The final section of the paper will address whether or not there is a path forward that can help unify states around a suitable compromise over the inclusion of self-defense in future space security documents.

Kiran Nair, Wing Commander, Indian Air Force, INDIA

Exploring the role of United Nations in tapping potential of international law and international cooperation to alleviate risk of space conflict

Space law evolved in 1967 during the dramatic manifestations of military space competition amongst the super powers. The bulk of satellites were military, space use was largely military and confrontation rather than cooperation was the prime mantra. Thus, the interpretation related to using outer space for 'peaceful purposes' as also the spirit of 'international cooperation and human development' had a narrow context. Since then; the number of space players has increased enormously along with the uses. The bulk of satellites are now civilian considering that of the 1,167 operational satellites in orbit, only 12% are military. Also, almost all nations use space and aspire to increased use and are open to international cooperation in space activities. The global will for cooperation and commercial gain, and basic legal framework exist allowing the alleviation of conflict in space. The context is much wider now and a focus on the affirmative obligations of peaceful uses in the spirit of international cooperation and development rather than just the negative proscriptions to limit conflict under the aegis of an internationally recognized body like the United Nations needs to be undertaken. This paper argues that while the legislation has remained unchanged, the situation has changed. It re-examines the scope of international law and international organizations like the United Nations in the present context to foster international cooperation, national development and limit conflict in space.

SESSION 6 – Conflicts in Space and International Humanitarian Law (IHL)

Tare Brisibe, former Chair of Legal Sub-Committee of the UNCOPUOS, SWITZERLAND

Outer space and the law of weaponry

In considering rules relating to specific weapons systems and armed conflict, particularly the legality of new weapons, means and methods of warfare, this paper highlights and contrasts International Humanitarian Law Rules vis-à-vis Arms Control and Disarmament frameworks applicable to the use of weapons in the outer space context. The scope, content and implementation of Article 36 of Protocol I Additional to the 1949 Geneva Conventions, is examined against provisions of Arms control / Disarmament instruments, including those under negotiation, such as: the 1967 Outer Space Treaty; the Hague Code of Conduct against Ballistic Missile Proliferation; the Draft EU Code of Conduct and; the Draft Sino-Russian Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects.

Guy Phillips, Commander (Retired), Adjunct & Sessional Assistant Professor, Royal Military College of Canada, CANADA

Rules of engagement (ROE) for military space operations

This paper will consider Rules of Engagement (ROE) in military space operations. ROE are the doctrinal tool used to ensure adequate political and military command and control during military operations. They also ensure the rule of law. They are specifically tailored for particular military operations or forces and are a key instrument for strategic defence roles. ROE combine the relevant factors from political, international/diplomatic and operational considerations with the overarching domestic and international legal requirements. This amalgam is structured to address what is and is not permissible in military operations. They reflect a force's ability to conduct operations in a particular geographic area and can control activities to prevent crisis escalation, to act defensively against hostile acts or intent, and to act offensively, all while complying with national and international laws.

ROE for space operations would have to address what defensive and offensive acts are permitted under the *jus ad bellum* and the *jus in bello*. Because they can address geographic or physical constraints on the area of operations, they could reflect space traffic management concerns, thereby reducing the threat of crisis escalation because of proximity concerns. While "targeting directives" are the military orders/doctrinal tool used to review potential targets for legal strike or engagement, and to assure that collateral damage is properly considered, ROE also address these concerns by providing authorizations or limitations on particular weapon use.

The paper will work through these considerations and propose the sorts of ROE that would be lawful for military space operations.

Ayhan Sorgucu, Military Judge in the Turkish Airforce, TURKEY

Security based space activities, 'peaceful uses' of outer space and new threats

Space activities have been increasingly gaining an interdisciplinary dimension, and a strategic importance for all countries concerned with security in the widest sense. In this context, while space used to be concerned with aeronautics and defense, it has now come to apoint which shares a varity of research areas and applications within the security platform along with the changing global threats.

Legal regime of outerspace consists of the Outer Space Treaty and a handful of other agreements. According to Outer Space Treaty Article 3 "The moon and the other celestial bodies shall be used by all State Parties to the Treaty exclusively for peaceful purposes".

The principle of using space for peaceful aims regulated with the 3rd Article of Outer Space Treaty gives full authority for only moon and heavenly bodies in accordance with the 4th article of the aforementioned Treaty. Taking the above regulation in to consideration, it can be claimed that there is a legal loophole about the man-made satellite or space stations that are orbiting the earth.

Furthermore, the ultimate purpose of the international legislation is to ensure that all the activities of the states bound by the legislation are peaceful and in accordance with the interests of humanity. However, if a nation acts defensively in space and if this exercise is performed by the military, this does not necessarily mean that the space is used for hostile intentions.

The aim of this paper is to examine how relevant the international legislation constituting the legal regime of outer space is for military activities in outer space. In this paper, the classical and new security concepts are explored comparatively in the face of the new threats, new space visions as perceived by the major space powers in the World.

Kuan-Wei Chen (David), Research and Administrative Assistant, Manual on International Law Applicable to Military Uses of Outer Space(MILAMOS) Project, CANADA

Principles of humanity" and "dictates of public conscience": The origins and evolution of the Marten's clause and its applicability to armed conflict in outer space

The Marten's Clause was originally coined in 1899, and has to date been restated and reinterpreted in a variety of ways. Some perceive the Clause as being redundant, others strongly believe various modern-day embodiments of the provision "have ensured its continuing vitality". How has the Marten's Clause evolved over the past century or so, and how has it been interpreted and applied in the modern context? With the potential of an armed conflict taking place in outer space, and the increasing discussion about the need to clarify norms of international law that are applicable to stem, or at the very least minimise the resultant damage arising from, such conflict, it is apt to take a closer look at the Marten's Clause and analyse the extent and ways which this age-old provision is applicable to the final frontier.

Yaw Nyampong, Senior Legal Officer, African Union Commission (Pan-African University), ETHIOPIA/CANADA

A critical analysis of the international humanitarian law principle of distinction as it relates to the use of dual-use space-based assets in armed conflict

The principle of distinction is one of the core principles underpinning many rules of international humanitarian law (IHL). One such rule of IHL deriving from the principle of distinction has three interrelated components. First, the rule requires parties to a conflict to distinguish between civilian objects and military objectives at all times. Secondly, it dictates that attacks may only be directed against military objectives. Finally, the rule stipulates that attacks must not be directed against civilian objects. This is a necessary compromise that IHL provides for in order to protect civilians and civilian objects in armed conflict. Without the principle of distinction, there would be no limitation on the methods of warfare. The principle of distinction and many of the rules deriving therefrom are norms of customary international law binding on all states applicable in both international and non-international armed conflicts.

In so far as objects are concerned, the rules of IHL define military objectives as limited to "*those objects which by their nature, location, purpose or use make an effective contribution to military action*

and whose partial or total destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage". Civilian objects, on the other hand, are defined as all objects that are not military objectives. Any direct attack against a civilian or civilian object is not only a violation of IHL but also a grave breach. Direct attacks against civilians and/or civilian objects are categorized as war crimes. Additionally, any weapon that is incapable of distinguishing between civilians/civilian objects and fighters/military objects is also prohibited under IHL.

This paper critically examines the applicability and relevance of the IHL principle of distinction to dual-use space-based assets used in support of armed conflict. It takes into account the provisions of the Outer Space Treaty particularly Articles III and IV in an effort to determine how and the extent to which such dual-use space-based assets used in support of armed conflict may or may not be protected from attack under international law, including both IHL and space law.

SESSION 7 – The Way Forward: Models for future Global Space Governance

Paul Meyer, Adjunct Professor of International Studies, Fellow in International Security, Simon Fraser University and Senior Fellow, The Simons Foundation, CANADA

The dark forces awaken: prospects for space arms control in an adversarial age

International cooperation on outer space security has fluctuated significantly over the past decades, marked by periods of common endeavor and relative stability as well as times of destabilizing developments and rising tensions.

In recent years, a high-water mark of space security diplomacy was represented by the consensus 2013 UN Group of Governmental Experts (GGE) report on Transparency and Confidence Building Measures (TCBM) that set out a rich menu of measures which seemed to promise new levels of cooperative security conduct by states.

Ironically, the GGE report was quickly followed by a series of negative developments that threaten to negate and even reverse the cooperative trend it espoused. These developments include the introduction (by Russia and China) and rejection (by the US) of a revised draft treaty on the Prevention of Placement of Weapons in Outer Space (PPWT); the adoption by the UN General Assembly of a divisive resolution on "No First Placement" of space weapons; the failure of the EU to obtain support for completing multilateral negotiations of its proposed Code of Conduct and escalating strategic tensions between the US on one hand and Russia and China on the other.

The reemergence of these 'dark forces' are analyzed as to their significance within the multilateral diplomatic arena for space security and conclusions drawn regarding the prospects for making progress on space security goals within a more adversarial geopolitical context.

Natália Archinard, Deputy Head of the Education Science and Space Section, Department of Foreign Affairs, SWITZERLAND

Global space governance and the role of middle space powers

At a time tensions are increasing between the leading space powers, the risk of seeing a conflict arising in or from outer space is raising up. Since the USA withdrew unilaterally from the ABM Treaty in 2002 and the Russian Federation annexed Crimea in 2014, mistrust has been growing. This geopolitical context has influenced the international discussions on space security, showing how strategic space has become for leading powers. The different approaches proposed by them do reflect their geopolitical concerns. As a result, most of the international initiatives launched since 2005 in this field have been facing major difficulties. After the controversial reactions to the

conference organised by the European Union in July 2015 on its proposal for a draft International Code of Conduct, the special meeting, which took place in October 2015 at the UN General Assembly joining the 1st and the 4th Committees, did not decide on the way to pursue joint discussions about space security and sustainability. On their sides, the Conference on Disarmament continues with no formal agenda and the UNCOPUOS encounters difficulties in reaching consensus about its draft guidelines on the long---term sustainability of outer space activities.

Apart of the game in which the biggest space powers are opposing their views, there are a lot of small to medium space powers asking to reinforce the global space governance in order to ensure the safe and long---term use of outer space for all. These countries need to take the lead to bring forward international discussions.

John S Goehring, Major, Headquarters, US Air Force, Space Command, USA

Real-world lessons on achievable space governance from the international code of conduct for outer space activities, the Iran Nuclear Agreement, and the Paris Climate Agreement

Existing space treaties are ill-equipped to deal with many of the issues affecting space security today, thereby necessitating modern contributions to global space governance. The academic debate surrounding the call for space governance can be distilled into a choice between the pursuit of binding multilateral treaties or of non-binding norms. Proponents of the former assert that nothing less than binding law will suffice to address global problems, while proponents of the latter believe "muddling through" with "soft law" is more attainable.

The debate is not merely theoretical, however. Three recent endeavors to establish forms of international cooperation illustrate the difficulties of reaching agreement under any instrument. The draft International Code of Conduct for Outer Space Activities, an expressly non-binding instrument, faced strong opposition from a U.S. Congress fearful of having no input into a national security matter. The Iran nuclear agreement of 2015, also a non-binding instrument, drew even stronger Congressional opposition, further exposing the dysfunction in the U.S.'s ability to address national security matters through soft law. By contrast, the Paris Climate Agreement of 2015 is a binding instrument, yet it tailors its legal obligations in such a way that Congress, once again, is bypassed.

This paper examines these three instruments, with a focus on the role of the U.S., in order to explore what kind of international cooperation is attainable in the world today. The lessons they can teach us, it concludes, lend practical insight into the question of what form of space governance is achievable, and why.

José Monserrat Filho, Vice-President, Brazilian Association of Air and Space Law, BRAZIL

Toward a collective space security

Since the early 21st century the possibility of military conflicts in outer space has increased considerably. The accelerated preparation for placing weapons in outer space is a concrete reality. The world community is more and more concerned about this growing trend and it is surely the main strategic global question today; this dangerous situation is often defined as a "new Cold War". The services and benefits afforded by space have become vital necessities for all States and people. Therefore, for a majority of States, a collective space security plan is much more preferable than a unilateral approach that would potentially include resorting to space weapons. A collective space security plan would put the common objective of mutual and cooperative security above the particular security interests of each State, whereas a unilateral action does not usually provide solutions acceptable to all States and public opinion. Such complex issue must be addressed

politically and legally. The political negotiations should conclude with the adoption of a viable and reliable agreement. All States – with or without space programs – have the right to be protected by an all embracing global system of collective space security. The present paper aims at developing these concepts as a contribution to the project of a new Space Age when the exploration, use and exploitation of outer space, including the Moon and other celestial bodies, will be carried out only for peaceful purposes.

Thomas Gillon, Senior Advisor-Business Development, Canada Centre for Mapping and Earth Observation, CANADA

The uniqueness of space! Bringing space power theory back down to Earth

Those who think about warfare in space often base their fundamental assumptions on the thesis that space is, or will soon become, a medium of armed conflict like the air, land and sea. As such space should, at least initially, be examined through lenses provided by the great warfare and power theorists of the past; those who have helped to explain and build the foundation for thinking about power on the sea, in the air and on land. Carl von Clausewitz, Giulio Douhet and Alfred Thayer Mahan are the great trinity of power theorists that will serve as the basis for this paper. It is upon the foundation of their work that generations of scholars and strategists have built libraries devoted to the study of warfare and the wielding of national power. Unfortunately, those who wish to apply power theory to space have not considered the seminal works of power theory through the proper, contextually appropriate, lens. The lessons learned in the classic texts are the product of specific historical circumstances, *terrestrial circumstances*, and as such they are not entirely applicable to a theory about the uses of space. Space is unique and one cannot simply import concepts that work in the realm of terrestrial warfare into space. The possibility of conflict in space requires an entirely new way of thinking.

SESSION 8 – The Need for and Scope of a Manual on International Law Applicable to Military uses of Outer Space (MILAMOS)

Duncan Blake, Wing Commander, Australian Air Force, AUSTRALIA

Reconciling *lex speciali* in the event of hostilities in outer space

Article III of the *Outer Space Treaty* makes it clear that outer space is subject to the broad *corpus* of international law. Yet 'space law', or the set of space-specific treaties, are often thought of as *lex specialis*. As such, they benefit from the rule *lex specialis derogat legi generali* (a more specific rule prevails over a more general rule covering the same circumstances). The application of this rule has its challenges, such as in determining whether to apply Article VI of the *Outer Space Treaty* and the *Liability Convention* to a given set of circumstances, whether to apply more general principles of State responsibility to those circumstances or whether to apply the sets of rules concurrently and, if so, how. Additional challenges arise because the broad *corpus* of international law also encompasses other areas of *lex specialis*. In the context of armed conflict, the law of armed conflict is regarded as *lex specialis*. The possibility of the initiation and conduct of armed conflict in space cannot be dismissed, in spite of the apparently specialised principle of the peaceful use of the Moon and other celestial bodies, the specialised limitations on military activities in outer space and the specialised principles of mutual cooperation and assistance, due regard and the avoidance of harmful interference without prior consultation. There is no clear hierarchy, nor rules, that would resolve a conflict between two sets of *lex specialis*, although the International Law Commission's

'Fragmentation Study' achieved greater clarity in articulating the problem. The particular challenge of the application of the law of armed conflict in specific domains for warfare in which other specific bodies of law apply has been confronted in the *San Remo Manual of International Law Applicable to Armed Conflict at Sea*, in the *Harvard Manual of International Law Applicable to Air and Missile Warfare* and, most recently, in the *Tallinn Manual of International Law Applicable to Cyber Warfare*, although in the last case, the set of special law applicable to the domain is significantly more limited than in the other two domains. McGill University, together with the University of Adelaide, now seeks to draft a *Manual of International Law Applicable to Military Uses of Outer Space* (MILAMOS). The drafters will again confront the challenges of reconciling the application of two sets of *lex specialis*. This paper will introduce research, which I intend to undertake, concurrent with participation in the drafting of MILAMOS, into the question of resolving conflicts in the application of differing sets of *lex specialis*.

Dale Stephens, Director, Research Unit on Military Law and Ethics, University of Adelaide, AUSTRALIA

The normative role of international operational military law manuals

Modern International Humanitarian Law (IHL) can be characterized by its long historical pedigree, its broad scope and its unparalleled density of regulation. Despite the extent of the formal regulation of armed conflict, there is much that is missed or not even contemplated in the growing universe of means and methods of warfare. Hence, added to the current formal legal framework that underpins armed conflict, is the growing presence of more informal and dynamic deliberative processes that vie for legitimacy in shaping the development and application of the law. Such processes seek to make normative contribution to the law through the development and publication of respective International Operational law Manuals. Such Manuals, prepared not by States but by private experts, are becoming more frequent and specific in their focus, ranging from collating rules applicable to naval warfare, air and missile warfare, cyber warfare and also warfare conducted in, through and from outer space (MILAMOS).

This chapter will analyze the effect of these deliberative processes and examine the methodological approaches adopted when locating and identifying relevant rules and principles of IHL. Suffice to say, it is becoming clear that International Operational Law Manuals are finding their normative place within the practice of operational law. Governments and military commanders (and their lawyers) are influenced by these indirect sources in the drafting of Rules of Engagement and other legal operational tools for setting the boundaries surrounding the application of force. It is the rise of the International Operational Law Manual that heralds perhaps the most significant contribution to contemporary military legal decision-making in current times. This presentation will canvass the reasons that underpin the rise of the Manual, assess their methodological character and identify their place within the firmament of IHL theory and practice.

Peter Hulsroj, Director, European Space Policy Institute (ESPI), AUSTRIA
& Anja Nakarada Pecujlic, External Consultant, ESPI, AUSTRIA

Space through the lens of neutrality

The endeavour in this paper would be to look at space and space activities from the perspective of neutrality concepts and norms. The following issues would be addressed: a) do normal neutrality rules apply to space and can they apply? Can parallels be drawn from air transport and maritime activities? What is contraband and how is it understood in space, specifically in the context of art. 8 of the Fifth Hague Convention of 1907? b) if normal neutrality rules do not apply, what is the consequences? What are the roles of arts. I, III and IX of the OST? Is the Continental Shelf Case one solution? Or is it *non-liquet*? c) Is space a *sui generis* neutral domain? What is the "province of all

mankind" and how does it interact with the concepts of neutrality? Is *terra nullius* always neutral? Is mankind always neutral? Does John Rawls' social contract theory have a role to play?

Cassandra Steer Erin JC Arsenault Post-Doctoral Fellow, Institute of Air & Space Law, McGill University AUSTRALIA

Is there a risk of condoning space warfare by regulating it?

Some would assert that there is no law governing a potential conflict in outer space, and that it is a lawless frontier. Others assert that the law on the use of force, the law of armed conflict and environmental law all apply, however it is unclear exactly which normative rules would apply and how. The tension then arises: should efforts be made to codify or otherwise clarify the rules applicable to potential space warfare, or would doing so in fact create legitimacy for States which may wish to justify increased military activity in space? Would regulating space warfare in fact condone it?

The argument to be made in this paper is that it would not. By clarifying the norms applicable, space warfare may not be prevented *in toto*, however the number and kinds of cases for escalating a situation from tension to conflict could be reduced simply by having more clarity. As well, in the eventuality that conflict does take place in space, internationally recognized rules could help to mitigate its effects and bring it to a close. Multiple international instruments could contribute to this, and could work in parallel rather than in competition with each other. For instance, efforts to clarify the applicable law of armed conflict in space would not be in defiance of negotiations for a Treaty for the Prevention of the Placement of Weapons in Outer Space. Rather, such instruments could complement each other in providing clarity on the Rule of Law in space.

BIOGRAPHIES

Archinard, Natália

Deputy Head of the Education Science and Space Section, Department of Foreign Affairs, SWITZERLAND

Doctor Natália Archinard was assigned by the State of Geneva to the Space Programme Office of the World Meteorological Organization (WMO) in 2005 in 2005. In 2006, she joined the Swiss Federal Department of Foreign Affairs in Berne where she has since dealt with science and space policy with a focus on international relations. Her responsibilities include leading the Swiss delegation of the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS) as well as representing Switzerland in the process led by the European Union (EU) with regards a proposal for an International Code of Conduct on space activities. As a Swiss delegate to the European Space Agency (ESA) and to the ESA-EU High-Level Space Policy Group, she has developed a cross-cutting view on European and global space policy. She also contributes to the national positions on outer space in the disarmament fora. Dr. Archinard was educated in mathematics at the University of Geneva (Switzerland) and at the Swiss Federal Institute of Technology in Zurich (ETHZ) where she obtained her PhD in 2000.

Ashurbeyli, Igor

Editor in Chief, ROOM, The Space Journal, RUSSIA

Doctor Igor Ashurbeyli is a scientist, businessman and visionary who founded and became the CEO of Socium, a small software and consulting company, known today as Socium-A. In 1991 he founded and published, Who's Who, Baku's monthly newspaper, during which he was the Vice President of a private business association known as Union of Cooperative in Azerbaijan (1990-1991), and the President of the Association of Scientific and Industrial-Technical Enterprises of Azerbaijan (1988-1991). From 1991 to 1994, Doctor Ashurbeyli founded and held the chair as President of JCS International Bureau of Information and Telecommunications while he authored and published the Russian encyclopedia of information and telecommunication, following which he consistently held the positions of Deputy General Manager, Financial Director, First Deputy General Manager, and CEO of JSC Almaz and the position of CEO of JSC GSKB Almaz-Antey (1994-2011). In 2004 he founded the Non-profit, Non-governmental Expert Society on Space Threat Defense which he then resided as Chairman of its board and became a board member to. He was also granted the status of an affiliated expert society with the UN Economic and Social Council through the Expert Society on Space Threat Defense. Later he also became the Scientific Director of JSC KB-1, a private company that forms part of Socium-A (2011-2015).

Doctor Ashurbeyli is a Gold Member of the Executive Committee of the Russo-British Chamber of Commerce in London, UK (2004-present); the Founder and Owner of the Aerospace International Research Center in Vienna, Austria (2013-present); the Vice president of the International Imperial Orthodox Palestine Society and Director of the Palestinian and Israel Department (2014-present); the Founder and Owner of international real estate companies Socium-A in Monaco, Greece, Mauritius and Azerbaijan (2014-present); and Editor-in-Chief of ROOM, an international space journal based in London, UK (2014-present).

Blake, Duncan

Wing Commander, Australian Air Force, AUSTRALIA

Wing Commander Duncan Blake has been a Legal Officer in the Royal Australian Air Force for the past 21 years working at the tactical, operational and strategic levels at home and on operational deployments overseas. He just completed a posting as legal advisor to the Defence Space Coordinating Office and he chaired inter- departmental and international working groups in respect of strategic

space law. He is currently in a non-legal position, managing the development of a joint operations concept for military use of outer space, in order to coordinate space capability development and force structure decisions in the Australian Department of Defence. He has contributed widely to legal aspects of military space policy and strategy within the Australian Department of Defence, and has also written several articles in this area (one of which earned the Lieber Society prize in 2011).

Blount, PJ

Adjunct Professor, LL.M. in Air and Space Law, University of Mississippi, USA

PJ Blount is an Adjunct Professor in the LLM program in Air and Space Law at the University of Mississippi School of Law and an Adjunct Professor in the Department of Political Science and Law at Montclair State University. Previously, he served as Research Counsel for the National Center for Remote Sensing, Air, and Space Law at the University of Mississippi School of Law. He teaches Space Security Law, International Telecommunications Law, Cyber Law, Human Rights Law, and Intellectual Property. Doctor Blount's primary research areas are legal issues related to space security and cyberspace governance. He has published and presented widely on the topic of space security law and has given expert testimony on space traffic management before the House of Representatives Subcommittee on Space. He also serves as the co-editor-in-chief of the Proceedings of the IISL; as the editor-in-chief of the Journal of Space Law; as an editorial board member of the Journal of Astrosociology; and on the Board of Directors of the International Institute of Space Law.

Brisibe, Tare

Former Chair of Legal Sub-Committee of the UNCOPUOS, SWITZERLAND

Doctor Brisibe is a Barrister & Solicitor of the Supreme Court of Nigeria and a legal consultant. He was former Chairperson of the Legal Subcommittee - United Nations Committee on the Peaceful Uses of Outer Space, for the biennium 2012 to 2014. Doctor Brisibe worked with mobile satellite operator Inmarsat Global, as well as aeronautical communications consortium SITA. He is a former legal adviser to the National Space Research and Development Agency of Nigeria, and has been involved with multiple international law expert working groups, notably as Representative of Nigeria and Member of the Hague Space Resources Governance Working Group; Member of the Group of Peer Reviewers for the NATO CCD COE Tallinn Manual (version 2.0) on International Law Applicable to Cyber Warfare; Member of the Permanent Court of Arbitration, Advisory Group on Optional Rules for Arbitration of Disputes Relating to Outer Space Activities; Member of the UNIDROIT Committee of Governmental Experts for preparation of a Space Protocol to the 2010 Cape Town Convention; and Vice Rapporteur of the International Telecommunication Union Development Sector (ITU-D) Study Group Question on Satellite Regulation for Developing Countries.

Chen, Kuan-Wei (David)

Research and Administrative Assistant, Manual on International Law Applicable to Military Uses of Outer Space(MILAMOS) Project

Kuan-Wei (David) Chen was previously a Teaching and Research Assistant at the Van Vollenhoven Institute for Law, Governance and Development, Leiden University; and the Co-ordinator of the Telders International Law Moot Court at the Grotius Centre for International Legal Studies. Since 2009, he has been working as a Research Assistant at the Institute of Air and Space Law. In 2014, he became a Course Lecturer at the Faculty of Law of McGill University, and is currently the Research and Administrative Assistant of the Manual on International Law Applicable to Military Uses of Outer Space (MILAMOS) Project. He is also the Editor of the Annals of Air and Space Law, published by McGill University's Centre for Research in Air and Space Law. He holds an undergraduate degree in Law and Politics from the School of Oriental and African Studies (SOAS), University of London, an LLM (cum laude) in Public International Law from Leiden University and an LLM in Air and Space Law

from the Institute of Air and Space Law, McGill University, where he was also the Boeing Fellow in Air and Space Law.

De Man, Phillip

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Philip De Man is a Senior Researcher at the Leuven Centre for Global Governance Studies in Belgium. He lectures international space law at the Master of Space Studies of the Universities of Leuven and Ghent (Belgium). He obtained his PhD on international space law at the University of Leuven with his dissertation revolving around the topic of the exploitation of natural resources of outer space. His publications cover a wide range of topics of international and European law, including space law and policy, international humanitarian law and the law of international organizations.

Dempsey, Paul Stephen

Director, Institute of Air & Space Law, McGill University, CANADA

Paul Stephen Dempsey is Tomlinson Professor of Global Governance in Air & Space Law and Director of the Institute of Air & Space Law at McGill University, in Montreal, Canada. For more than two decades, he held the chair as Professor of Transportation Law, and was Director of the Transportation Law Program at the University of Denver. He was also Director of the National Center for Intermodal Transportation, a consortium of the University of Denver and Mississippi State University. Earlier, he served as an attorney with the Civil Aeronautics Board and the Interstate Commerce Commission in Washington, DC, and was Legal Advisor to the Chairman of the ICC.

Professor Dempsey served as a consultant to US and foreign airlines, railroads, motor carriers, bus companies, transportation labor organisations, industry associations, government agencies, and telecommunications companies.

He was also named "Educator of the Year" and inducted into the Colorado Aerospace Hall of Fame by the Colorado transportation community. For 23 years, he was faculty editor of the Transportation Law Journal. He also served on the Editorial Boards of the Denver Business Journal, and The Aviation Quarterly (Lloyds, London), and currently serves on the Editorial Board of the German Journal of Air & Space Law, and is Editor-in-Chief of the Annals of Air & Space Law. He is President of the International Air & Space Law Academy, and vice-Chair of the Aviation Section of the Transportation Lawyers Association.

De Winne, Frank

Astronaut from European Space Agency, BELGIUM

Frank de Winne was born in Ghent, Belgium on 25 April 1961. He graduated from the Royal School of Cadets, Lier, Belgium in 1979. He was awarded the AIA Prize for the best thesis on his master's degree in telecommunications and civil engineering from the Royal Military Academy, Brussels, Belgium in 1984. He completed the Staff Course at the Defence College in Brussels, gaining the highest distinction in 1991. And in 1992 he graduated from the Empire Test Pilot's School in Boscombe Down, United Kingdom, where he was awarded the McKenna Trophy.

Frank De Winne held several positions in the Belgian Airforce. From 1996 to August 1998, Frank was a senior test pilot in the Belgian Air Force, responsible for all test programmes and for all pilot–vehicle interfaces for aircraft and aircraft software updates. From August 1998 to January 2000, Frank was the Squadron Commander of the 349th Fighter Squadron at Kleine Brogel Airbase, Belgium. During

operation Allied Force, Frank was the detachment commander of the Deployable Air Task Force, a combined Belgian/Dutch detachment that flew about 2000 sorties during the NATO campaign. Frank has logged 17 combat sorties.

In January 2000, Frank joined ESA's Astronaut Corps based at the European Astronaut Centre in Cologne, Germany. From 30 October to 10 November 2002, Frank flew the Odissea mission, a support flight to the International Space Station. He served as a flight engineer on the updated Soyuz TMA spacecraft on launch, and on a Soyuz TM for re-entry.

From 27 May to 1 December 2009 Frank was sent on the OasISS mission, a long-duration flight to the International Space Station. As part of Expedition 21 Frank became the first European commander of the ISS. He was also Soyuz TMA-15 and Expedition 20 flight engineer.

Currently, Frank holds the position of Head of the European Astronaut Centre since 1 August 2012.

De Zwart, Melissa

Professor, Adelaide Law School, University of Adelaide, AUSTRALIA

Professor de Zwart is an expert in the legal issues affecting the development of cutting edge technology. Prior to joining academia, she was Legal Manager of the Commonwealth Scientific and Industrial Research Organization where she was engaged in providing advice with respect to and negotiating the protection and commercialization of technology. She has a particular interest in the regulation of digital technologies and the governance of the internet and has published widely in these areas. Professor de Zwart teaches intellectual property law, internet law, media law and space law. In 2015, she was the Project leader of the Adelaide X MOOC Cyberwar, Surveillance and Security, which has attracted over 20,000 enrolments worldwide. She is also the Deputy Director of RUMALE (Research Unit on Military Law and Ethics) at Adelaide Law School at the University of Adelaide, Australia.

Filho, José Monserrat

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Mr Filho held the positions of Head of the International Cooperation Office of the Brazilian Space Agency (2011-2015); Head of the International Affairs Office of the Ministry of Science and Technology (2007-2011); Director of Communication of the Ministry of Science and Technology (1985-1987); Director of the Magazine "Ciencia Hoje" (Science Today), published by the Brazilian Society for the Advancement of Science – SBPC (1984-1994); and Editor of the newspaper "Jornal da Ciência", also published by SBPC (1991-2007).

He is a Member of the Brazilian official delegation at the Legal Subcommittee of the United Nations Committee for Peaceful Uses of Outer Space (COPUOS) since 1997 and holds the Chair as Vice-President of the Brazilian Association for the Air and Space Law (SBDA). Mr Filho was awarded the José Reis Award of Scientific Journalism, by Brazilian National Council for Scientific and Technological Development (CNPq), in 1994.

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Steven Freeland is Professor of International Law at Western Sydney University, Australia, where he teaches both postgraduate and undergraduate students, and supervises PhD students, in the fields of International Criminal Law, Commercial Aspects of Space Law, Public International Law and Human Rights Law. He is a Visiting Professor at the University of Vienna, Permanent Visiting Professor of the iCourts Centre of Excellence for International Courts, Denmark, a Member of Faculty of the London Institute of Space Policy and Law, and was a Marie Curie Fellow in 2013-2014. He has also been a

Visiting Professional within the Appeals Chamber at the International Criminal Court (ICC), and a Special Advisor to the Danish Foreign Ministry in matters related to the ICC. He has been appointed to advise both the Australian Commonwealth Department of Industry, Innovation and Science, and the New Zealand Government, on issues related to the regulation of space activities. Among other appointments, he is a Director of the Paris-based International Institute of Space Law, a Foundational Member of that Institute's Directorate of Studies, and a Member of the Space Law Committee of the London-based International Law Association.

Gaillard-Sborowsky Florence

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After being a research fellow at the Institute of International and Strategic Relations (IRIS) between 1999 and 2000, Ms Gaillard-Sborowsky joined the Foundation for Strategic Research in 2001. She also conducted research at the General Delegation for Armaments from May 2002 to December 2003, at the laboratory of GREMMO, CNRS, at the Maison de L'Orient in Lyon. She has obtained multiple degrees in History from the Université Lumière Lyon II, Law from Grenoble Menès-France, and Strategic Studies from Paris XIII.

Gillon, Thomas

Senior Advisor-Business Development, Canada Centre for Mapping and Earth Observation, CANADA

Doctor Gillon is currently Senior Advisor – Business Development at the Canada Centre for Mapping and Earth Observation. He has lectured on space policy, strategy and law. Doctor Gillon's interests in space security, the military use of space and earth observation/remote sensing have been developed over years working with the defence space community while at the Department of National Defence and Global Affairs Canada. He holds a PhD in Political Studies from Queen's University at Kingston, Ontario and an MA in Military and Strategic Studies from the University of Manitoba.

Goehring, John

Major, Headquarters, US Air Force, Space Command, USA

Major John Goehring is an active duty US Air Force JAG. He currently serves in the position of Chief, Space and Operations Law, for Headquarters, Air Force Space Command, Colorado. Major Goehring received his BA from the University of California at Berkeley, his JD from Tulane University, New Orleans, and recently received his LLM in Air and Space Law from McGill University's Institute of Air and Space Law, where he wrote his thesis on the draft International Code of Conduct for Outer Space Activities.

Green, Brian D

USSTRATCOM JFCC SPACE, Vandenberg Air Force Base, California, USA

Brian Green is a Major in the United States Air Force Judge Advocate General's Corps. He presently serves as Chief, Space and International Law, for Headquarters Fourteenth Air Force , Vandenberg Air Force Base, California. He advises the Commander of the Fourteenth Air Force and United States Strategic Command's Joint Functional Component Command for Space, staff and the Joint Space Operations Centre on legal specialties including space, operations, international, and national security law. Major Green participates in planning for and executing global and theater space operations and exercises. He also coordinates with supported geographic combatant commanders' staffs. Major Green holds BAs in Political Science and Art from the University of Washington, a JD from the University of Virginia, and an LLM in Air and Space Law from McGill University.

Grego, Laura

Senior Scientist, Global Security Program, Union of Concerned Scientists, USA

Doctor Laura Grego focuses on the technology and security implications of national missile defense and of space security. She is the author or co-author of more than 20 peer-reviewed, published papers on a range of topics. Since joining UCS in September 2002, she has been cited by Boston Globe, Chicago Tribune, Los Angeles Times, New Scientist, New York Times, Washington Post and USA Today, and has appeared on Fox News, the Discovery Channel and NPR. She has also testified before Congress and addressed the United Nations Conference on Disarmament on space security issues. Before joining UCS, Dr. Grego was a postdoctoral researcher at the Harvard-Smithsonian Center for Astrophysics. She earned a doctorate degree in experimental physics at the California Institute of Technology and a bachelor of science degree in physics and astronomy at the University of Michigan.

Hao, Liu

Director, Institute of Aviation Law and Standard, Beihang University, Beijing, CHINA

Doctor Liu Hao graduated from China University of Political Science and Law (CUPL) with a Ph.D in Law, and is currently working in Beihang University (BUAA, Beijing University of Aeronautics and Astronautics) as Director of Institute of Aviation Law and Standard. He joined the Drafting Committee of Aviation Law of China in 2009. Due to his continuous contribution to the aviation law drafting and other consultation work to the militaries and government agencies of China, he was selected as the State Expert of ATM and appointed as the Deputy Director of National Research Center of Air Traffic Management Law and Standard in 2011. Doctor Hao is a visiting staff of City University of Hong Kong and visiting scholar of DePaul University. He taught Legal System of PRC, Aviation Law in China and other related courses in Hong Kong, South Korea, Canada and some European Countries for several years.

Hedman, Niklas

Chief of the Committee, Policy and Legal Affairs Section of the United Nations Office for Outer Space Affairs, AUSTRIA

Niklas Hedman is Chief of Committee, Policy and Legal Affairs Section of the United Nations Office for Outer Space Affairs (OOSA). He serves as Secretary of the Committee on the Peaceful Uses of Outer Space (COPUOS) and its Scientific and Technical Subcommittee and Legal Subcommittee. He is also Secretary of the United Nations Inter-Agency Meeting on Outer Space Activities (UN-Space), which is the central coordination mechanism for space related activities in the United Nations system. He is responsible for OOSA capacity-building activities in space law and policy. Before joining the United Nations in 2006, he worked in the Swedish Ministry for Foreign Affairs, particularly in the areas of ocean affairs and law of the sea; space law and space policy; as well as disarmament and non-proliferation, including PAROS and the Hague Code of Conduct Against Ballistic Missile Proliferation (HCOC). He represented Sweden to COPUOS for 10 years and held various positions, including Chair of the UNISPACE III+5 report A/59/174. Mr. Hedman represented Sweden to the final rounds of negotiations on the International Space Station Intergovernmental Agreement (ISS-IGA), and was chief negotiator to the governmental framework agreement on space cooperation between Sweden and the United States of America. He is a member of the International Space Law Committee of the International Law Association (ILA), International Institute of Space Law (IISL) and International Academy of Astronautics (IAA).

Housen-Couriel, Deborah

Research Fellow, Interdisciplinary Cyber Research Center, Tel Aviv University, ISRAEL

Deborah is an independent legal and policy expert in Israeli and global cybersecurity and regulation. She researches, publishes and speaks frequently on these issues. She is a member of the Israeli Bar Association and Special Counsel to the New York law firm Zeichner, Ellman and Krause LLP.

Currently, she participates in the International Group of Experts drafting the "Tallin 2" manual on state activity in cyberspace; and in the ILA's Study Group on Cybersecurity, Terrorism and International Law. In 2014 Deborah was a member of Israel's National Cyber Bureau public committee on the cyber professions; and in 2010-11 she co-chaired the National Cyber Initiative Policy and Regulation Committee. She works with closely with Konfidas Digital, a leading Israeli cybersecurity firm; and is a Research Fellow at Tel Aviv University's Interdisciplinary Cyber Research Center; the Herzliya Institute for Counter-Terrorism; and the Minerva Center at Haifa University's Law Faculty.

Hulsroj, Peter

Director, European Space Policy Institute (ESPI), AUSTRIA

Peter Hulsroj is the Director of the European Space Policy Institute, Vienna, Austria since 2011. From 2008 until 2011 he was the Director of Legal Affairs and External Relations at ESA. Mr Hulsroj also served as Legal Adviser, Preparatory Commission, The Comprehensive Nuclear-Test-Ban Treaty Organization from 2004 until 2008. Before that, he was Head of the Contracts & Legal Affairs Division, EUMETSAT from 1991 until 2004. He served as Contracts Officer in EUMESTAT, Darmstadt, Germany from 1989 until 1991 and as Contracts Officer in the European Space Agency, ESTEC, Noordwijk, The Netherlands from 1985 until 1989. Preceding that he was attorney at the Law firm Bech-Bruun, from 1982 until 1985.

Jakhu, Ram S

Associate Professor, Institute of Air & Space Law, McGill University, CANADA

Doctor Jakhu holds a tenured position of Associate Professor at the Institute of Air and Space Law, Faculty of Law, McGill University. He is also Associate Director of Centre for Research in Air and Space Law of McGill University. He teaches and conducts research in international space law, law of space applications, law of space commercialization, space safety and security, national regulation of space activities, law of telecommunications, and public international law. He served as Director, Centre for the Study of Regulated Industries, McGill University, during 1999-2004, also as the First Director of the Master of Space Studies Program of the International Space University, Strasbourg, France, during 1995-1998.

He is Chairman of the Management Board of the Manual on International Law Applicable to Military Uses of Outer Space; Member of the Global Agenda Council on Space of the World Economic Forum; Member of the Governance Group of the Space Security Index; and Fellow as well as the Chairman of the Legal and Regulatory Committee of the International Association for the Advancement of Space Safety. He is Managing Editor of the Space Regulatory Series, member of the Editorial Boards of Space and Evolution, Annals of Air & Space Law, Astropolitics, and German Journal of Air & Space Law.

He was member of the Advisor Group of Legal Experts on Optional Rules for Arbitration of Disputes Relating to Outer Space within the Permanent Court of Arbitration, and member of the Board of Directors of International Institute of Space Law for 14 years. In 2007, he received a "Distinguished Service Award" from the International Institute of Space Law for significant contribution to the development of space law.

Jasani, Bhupendra

Visiting Professor, Department of War Studies, King's College London, UK

Doctor Bhupendra Jasani worked for the British Medical Research Council between 1958 and 1972 after which he joined the Stockholm International Peace Research Institute (SIPRI) in Sweden in 1972. In 1987, he joined the Royal United Services Institute for Defence Studies, and in 1984 he conceptualized the Western European Union Satellite Centre, now known as the European Union

Satellite Centre. In 1990, he joined the Department of War Studies, King's College London, where he developed the use of commercial remote sensing satellites for applications to monitor multilateral arms control treaties, confidence building measures and peacekeeping operations. Subsequently he produced several reports for the International Atomic Energy Agency (IAEA) on behalf of the UK and German Governments on the use of commercial observation satellites to enhance the Agency's safeguards procedures (1996 -2000), and in 2003 the European Commission (EC) established the Global Monitoring for Security and Stability (GMOSS) study through which he coordinated treaty monitoring and early warning of conflicts and natural disasters projects using commercial remote sensing satellites. Doctor Jasani was actively involved in the Palme Commission on Disarmament and Security, contributing to the final report Our Common Future in 1987. Currently, he is an Adjunct Professor, Faculty of the International Strategic and Security Studies Programme, National Institute of Advanced Studies, Bangalore, India and at ISU.

Johnson, Christopher D

Project Manager, Secure World Foundation, USA

Chris Johnson is a Project Manager for Secure World Foundation and entered the space field in 2010 as an intern at the United Nations Office for Outer Space Affairs (OOSA) in Vienna, Austria during the 53rd Committee on the Peaceful Uses of Outer Space. He has also served as an intern in the Office of International and Interagency Relations (OIIR) at NASA Headquarters in Washington, DC, and as a legal stagiaire in the International Law and EU Legal Affairs division at the European Space Agency's Legal Department at ESA Headquarters in Paris, France. Mr Johnson was admitted to practice law in New York State in 2005, in England and Wales in 2008, and to the bar of the District of Columbia in 2016. This summer, he will serve as the Space Policy, Economics, and Law (PEL) Department Chair at the International Space University's Space Studies Program in Haifa, Israel.

Jutras, Daniel

Dean of Faculty of Law, McGill University, CANADA

Professor Daniel Jutras was on leave from 2002 to 2004 from the Faculty, acting as personal secretary to the Chief Justice of Canada, the Right Honourable Beverley McLachlin, in the position of Executive Legal Officer of the Supreme Court of Canada. He is a former Director of the Institute of Comparative Law and has served as Associate Dean (Admissions and Placement), and Associate Dean (Academic) in the Faculty. He was named to the Wainwright Chair in Civil Law in 2011. In 2013, Professor Jutras was appointed by the Supreme Court of Canada to serve as amicus curiæ in the Reference on the Reform of the Senate of Canada, and was awarded a Queen Elizabeth II Diamond Jubilee Medal. The Barreau du Québec awarded him the Advocatus Emeritus (AdE) distinction in 2014. Then in January 2016, Professor Jutras was named a Federal Member of the Independent Advisory Board for Senate Appointments by the Honourable Maryam Monsef, Minister of Democratic Institutions.

Kaul, Sanat

Chair, India Chapter of International Foundation for Aviation, Aerospace and Development, INDIA

Doctor Sanat Kaul has been a Civil Servant in India for a span of 36 years. He has specialized in issues of Aviation, Space and Tourism. He was Joint Secretary in the Ministry of Civil Aviation and was on the Board of Air India and Airport Authority of India. He has led India's delegation to a large number of bilateral air service negotiations and has been instrumental in the setting up of green field airports as well as leasing of airports in their initial years. Doctor Kaul was India's Permanent Representative to the Council of the International Civil Aviation Organization in Montreal, Canada, during which he raised the issue of ICAO's involvement in matters of near space flights like sub-orbital or space tourism. During his time at ICAO in Montreal he also started a non-profit society called International

Foundation for Aviation and Development which he also Chaired. Upon his return to India, he pursued a similar project (India Chapter) but established the foundation as a separate legal entity. He is currently the Chairman of International Foundation for Aviation, Aerospace and Development (India Chapter) and represents India on the Board of International Association for Advancement of Space Safety.

Kendall, David

Chair of the United Nations Committee on the Peaceful Uses of Outer Space (2016-2017)

David Kendall was Vice-President of the International Astronautical Federation and Chairman of the IAF Finance Committee from 2008-2012. He is the Senior Executive Advisor to the President of the Canadian Space Agency and previous Director General of the Space Science and Technology and Space Science branches of the agency. He is also a faculty member of the International Space University. He was principal investigator of an experiment that was flown on Space Shuttle mission STS_41G and has been a visiting scientist at the Service d'Aeronomie (CNRS) in Paris, France. Mr Kendall serves on numerous national and international advisory committees and working groups, is the past Canadian National Representative to both the Committee on Space Research (COSPAR) and the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP), is a past COSPAR Bureau Member, a full member of the International Academy of Astronautics (IAA), past Chairman of the Inter-Agency Space Debris Coordination Committee (IADC), Canadian Head of Delegation to the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS), and a past co-chair of a subgroup of the international ad hoc Group on Earth Observations (GEO).

In 2002, Kendall was awarded the Queen Elizabeth II Golden Jubilee Medal in recognition of significant achievement to Canada. He has served in many positions with the International Space University including as member and chair of the ISU Academic Council and as a Director of the Space Studies Program.

Kyriakopoulos, George

Lecturer in International Law, National and Kapodistrian University of Athens, GREECE

Doctor Kyriakopoulos has won Prix de thèse of the French Society of Air and Space Law and is an Attorney at Law, member of the Athens Bar Association. He held the position of Professor of International and Air Law at the Military Aviation Academy from 1998-2002, after which, he became Legal Advisor to Minister of National Defense for Air Law and International Law matters in Greece (2005-2006). From 2008-2010, he became a Member of the Greek Air Accident Investigation and Aviation Safety Board, and between 2009-2010, he acted as Expert for the Committee for the amendment of the Greek Code of Air Law, in the Ministry of Transport. Since 2009, he has lectured in International Law at the University of Athens, specifically in the fields of Public International Law, Air Law, Space Law, Law of the Sea, Telecommunications Law, International Institutions, and International Criminal Law. Since 2011 he has been a Member of the Board of Directors of the Hellenic Society of International Law and International Relations. He acts as point of contact (Greece) for the European Center of Space Law (ECSL).

Manoli, Maria

Research Assistant, Institute of Air & Space Law, McGill University, GREECE

Maria Manoli is a graduate of McGill University, Institute of Air and Space Law, where she pursued her LLM in Air and Space Law (2015-2016), during which she was also the Erin JC Arsenault fellow (2014) in Space Governance and the recipient of the Nicolas M Matte award (2015). Prior to her enrollment at McGill she completed an LLM in Public International Law (2012) and an LLM in Civil Law (2013), at the National and Kapodistrian University of Athens, where she also obtained her undergraduate degree in Law in 2012. She earned all her degrees with upper-second class honors.

Maria Manoli has worked for several governmental and non-governmental organizations. Specifically, she has worked as a legal trainee for the Court of Appeals in Athens (2012-2013), for the Legal Counsel of Greece (2013 – assigned to the Greek Ministry of Environment Energy and Climate Change) and for the Hellenic Competition Commission (2014). She also interned at the Secure World Foundation (Colorado, US) during the summer of 2015 as a junior project manager and conducted research on the legal aspects of space natural resources exploitation. She is currently working as a research assistant for the Institute of Air and Space Law at McGill University, where she is conducting research on space law matters.

Matas, Attila

Head Space Publications and Registration Division, ITU BR, SWITZERLAND

Attila Matas serves as Head of the Space Publications and Registration Division in the ITU BR Space department. He is responsible for the processing and publication of GSO and non-GSO space systems and Earth stations submitted by administrations for inclusion in the formal coordination procedures or recording in the Master International Frequency Register (MIFR). Mr Matas has been heavily involved in the ITU BR since 1993 in the development and efforts to treat the space notices using computer tools for data capture, validation and publishing, resulting in the adoption of BR IFIC publication on DVD-ROM, mandatory electronic filing and the BR Space database systems on-line. He represents the ITU at the UN COPUOS and is an active participant in the World Radiocommunication Conferences (WRC) since 1992. During several WRCs he served as a secretary on the agenda items related to frequency allocations and regulation of satellite Radio-navigation and active or passive space sensors. As of WRC-03 he is a secretary of the RES 609 – Radio-navigation Satellite Service Consultation meeting in the band 1164-1215 MHz responsible for the coordination of new satellite navigation systems.

Meyer, Paul

Adjunct Professor of International Studies, Fellow in International Security, Simon Fraser University and Senior Fellow, The Simons Foundation, CANADA

Paul Meyer is Fellow in International Security, Adjunct Professor of International Studies at Simon Fraser University and a Senior Fellow with The Simons Foundation. Prior to assuming his current appointments in 2011, Mr Meyer had a 35-year career with the Canadian Foreign Service. Mr Meyer had diplomatic assignments in Oslo, Moscow, Brussels (NATO), Washington, Tokyo and from 2003-2007 in Geneva where he served as Canada's Ambassador and Permanent Representative to the United Nations and to the Conference on Disarmament. At the Department of Foreign Affairs and International Trade's HQ, Meyer held a variety of positions including Director General for International Security (1998-2001) and Director General for Security and Intelligence (2007-2010). Throughout his work, Meyer has sought to promote international security by means of creative diplomacy. He currently is teaching a course on arms control and disarmament diplomacy at SFU's School for International Studies and is engaged in research and writing on issues of nuclear non-proliferation and disarmament, outer space security and international cyber security.

Munters, Ward

Doctoral Researcher, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM

Ward Munters is a doctoral research at the Leuven Centre for Global Governance Studies and the KU Leuven Institute for International Law. His research focuses on the international legal framework of the long-term sustainability of space activities, with a particular interest in the legal definition and

categorization of space debris. Mr Munters has an LLM from KU Leuven (2013); and an MSc in Space Studies from KU Leuven/UGent.

Nair, Kiran Krishnan

Wing Commander, Indian Air Force, INDIA

Wg Cdr Kiran Krishnan Nair occupies a position with the Centre for Airpower Studies, New Delhi on issues related to space security since 2012. He has been dealt with space issues for the last 15 years and has also served on a variety of Space Committees and projects of the Government of India. He has undertaken lectures and presentations at numerous national and international forums. He has a number of publications to his credit and these include articles in national periodicals like the Airpower Journal, Week Magazine, India's National Security Annual Review, USI Journal, Agni Journal, Defence Science & technology Journal, Asian defence Review etc. and international publications like those of the United Nations (UNIDIR, 2007), the Space Policy Institute of George Washington University, the Journal of Space Law of the University of Mississippi, the Annals of Air and Space Law of McGill University etc.

Nyampong, Yaw

Senior Legal Officer, African Union Commission (Pan-African University), ETHIOPIA/CANADA

Doctor Yaw Nyampong was the Executive Director of the Centre for Research in Air and Space Law at McGill University immediately prior to joining the African Union Commission as Senior Legal Officer of the Pan-African University. At present, Doctor Nyampong is responsible for anticipating and addressing all legal issues pertaining to the establishment and operation of the Pan-African University. He was admitted to the practice of law in the Republic of Ghana in October 2000 and in the province of Ontario (Law Society of Upper Canada) in June 2014. He has an LLB from the Faculty of Law, University Ghana, Legon, and completed both his master's and doctorate degrees at McGill University in Canada, specializing in Air & Space Law where he held an Arsenault Postdoctoral Fellowship in Space Governance at the Institute of Air and Space Law between 2011 and 2012, and a Boulton Fellowship at the McGill's Faculty of Law between 2012 and 2013.

Pelton, Joseph N

Executive Board, International Association for the Advancement of Space Safety, USA

Doctor Joseph Pelton is the former Dean and Chairman of the Board of Trustees of the lnternational Space University in Strasbourg, France. He currently serves on the Executive Board of the lnternational Association for the Advancement of Space Safety. He is also the Director Emeritus of the Space and Advanced Communications Research Institute, which he founded at George Washington University. His book Global Talk, Future Talk, Future View won the International Astronautical Association (IAA) Eugene Emme Literature Award. ln July 2013 he received the Sir Arthur C Clarke Award for International Achievement in recognition for his role in starting the Arthur C Clarke Foundation. He also received the Arthur C Clarke Foundation's Lifetime Achievement award in 2001. In 1983, Doctor Pelton was Managing Director of the National Committee for World Communications Year – a US Presidential Appointment. He also established the Pelton Award for outstanding senior project in the School of Engineering at George Washington University.

Nakarada Pecujlic, Anja

External Consultant, European Space Policy Institute (ESPI) AUSTRIA

Anja Nakarada Pecujlic is an External Consultant of the European Space Policy Institute, Vienna, Austria since 2014. From 2009 until 2014 she studied at the Faculty of Law, University of Vienna, where she specialized in international law with the main focus on international space law. Subsequently, she continued to conduct space legal research and participated as a speaker in several

conferences (International Astronautical Congress (IAC) 2015, Jerusalem, Israel; Space Treaties at the Crossroad Conference 2015, Athens, Greece; IAC 2014, Toronto, Canada; Space Security and Space Sustainability Conference 2014, Perking, China). Furthermore, she served as a judge in 2014 Asia-Pacific round of the prestige competition: Manfred Lachs Moot Court. This April, she was one of the four young professionals awarded by Space Generation Advisory Council the prestigious Global Grant to participate in the Fusion Forum and Space Symposium 2015 in Colorado, USA.

Phillips, Guy

Commander (Retired), Adjunct & Sessional Assistant Professor, Royal Military College of Canada, CANADA

Cdr Phillips joined the Canadian Forces in 1985 and practiced law exclusively in the Canadian Forces as a Legal Officer in the Office of the Judge Advocate General until 2012. In addition to prosecuting and defending at courts martials, he advised on a wide variety of military and civilian legal issues, including international issues such as Law of the Sea, Air Law, Operational Law, Law of Armed Conflict and Negotiating Status of Forces treaties. The pinnacles of his career were in International Law and Operational Law, including as legal advisor to the Canadian Air Task Group Middle East in Doha, Qatar, during the "Gulf War" in 1990-91; the Commander of the military forces in the UN Transition Mission in Haiti (UNTMIH) in 1997; the Commander of NATO SFOR Brigade North-West in Banja Luka, Bosnia-Hezegovina, in 2003104 ; the CO of HMCS Frdericton during OP SAIPH in the Gulf of Aden, Indian Ocean and Persian Gulf in 2009/10 (patrolling for pirates and sea-borne terrorists). Professor Phillips started teaching undergraduates and graduate students at the Royal Military College of Canada (RMC) in 2006 where he currently continues to teach as an Adjunct Assistant Professor.

Rapp, Lucien

Professor, Scientific Director of the Space Institute for Research on Innovative Uses of Satellites (SIRIUS), University of Toulouse, FRANCE

Lucien Rapp is Professor of law at the Law School of the University of Toulouse, France. He is the Scientific Director of the Space Institute for Research on Innovative Usages of Satellites (SIRIUS), which he founded in 2013. SIRIUS is an Academic Chair between the University Toulouse1-Capitole and the Toulouse Business School. It is sponsored by CNES (Centre National d'Etudes Spatiales), Airbus Defense and Space and Thalès Alenia Space.

Rendleman, James D

USSTRATCOM JFCC SPACE, Vandenberg Air Force Base, California, USA

Mr Rendleman is the Supervising Attorney, Operations, Space and International Law for the US Strategic Command's Joint Function Component Command for Space. He has been associated with the space community for nearly 40 years. Before taking his current position, Mr. Rendleman served in a wide variety of science and technology, engineering, acquisition, and senior management and policy roles. He has worked to improve international space cooperation. An attorney and Member of the State Bar of California, Mr. Rendleman has engaged in law practice as a partner, solo practitioner, and associate with firms in Los Angeles, San Francisco, and Napa, California. He is an associate fellow of the American Institute of Aeronautics & Astronautics (AIAA), Chair of its legal aspects of aero & astronautics technical committee, and member of AIAA's international activities, public policy and directed energy committees. He is also a Member of the International Institute of Space Law.

Rummel, John D

Vising Scholar, Institute of Air & Space Law, McGill University, USA

Doctor John Rummel is a Senior Scientist with the SETI Institute and a Visiting Scholar at McGill University's Institute of Air and Space Law. He is a retired Professor of Biology from the East Carolina University, a former member of the NASA Advisory Council's Planetary Protection Subcommittee, and has been a planetary protection advisor for Mars One. He is the former (founding) Chair of COSPAR's Panel on Planetary Protection. Doctor Rummel previously worked at NASA Headquarters, both as Senior Scientist for Astrobiology and as Planetary Protection Officer. He also served as NASA's Exobiology Program Manager and Research Program's Branch Chief in the Life Sciences Division. He is a holder of eight NASA Group Achievement Awards, is a Fellow of the American Association for the Advancement of Science, and has received the Life Sciences Award from the International Academy of Astronautics and a NASA Exceptional Performance Award.

Sgobba, Tommaso

Executive Director, International Association for the Advancement of Space Safety, THE NETHERLANDS

Tomasso Sgobba is IAASS Executive Director and Board Secretary. He was IAASS first President between 2005-2013. He was also responsible for flight safety, including human-rated systems, spacecraft re-entries, space debris, use of nuclear power sources and planetary protection at the European Space Agency (ESA) until 2013, which he joined in 1989 following 13 years in the aeronautical industry.

Initially, Mr Sgobba supported the developments of the Ariane 5 launcher, several earth observation and meteorological satellites, as well as the early phase of the European Hermes spaceplane. Later, he became Product Assurance and Safety Manager for all European manner missions on Shuttle, MIR station, and for the European research facilities of the International Space Station. He also chaired the ESA ISSS Payload Safety Review Panel for 10 years and was instrumental in setting up the ESA Re-entry Safety Review Panel.

He is also the inventor (patent pending) of the R-DBAS (Re-entry, Direct Broadcasting Alert System), which alerts the air traffic of falling fragments from uncontrolled space system re-entry. Mr Sgobba has received the NASA recognition for outstanding contribution to the International Space Station in 2004, and the prestigious NASA Space Flight Awareness (SFA) Award in 2007.

Simpson, Michael

Executive Director of the Secure World Foundation, USA

Doctor Michael Simpson is Executive Director of the Secure World Foundation and former President of the International Space University. He currently holds an appointment as Professor of Space Policy and International Law at ISU. Following his graduation from Fordham University, Doctor Simpson accepted a commission as an officer in the US Navy, retiring from the Naval Reserve in 1993 with the rank of Commander. His service included Political –Military Action Officer at US European Command in Stuttgart. He is a Member of the International Institute of Space Law and a Senior Fellow of the International Institute of Space Commerce. His practical experience includes service as an observer representative to the UN Committee on the Peaceful Uses of Outer Space, participating organization representative to the Group on Earth Observations and Member of its Ministerial Working Group, the Executive Committee and Board of Directors of the World Space Week Association, and the Board of Governors of the National Space Society.

Sorgucu, Ayhan

Military Judge in the Turkish Airforce, TURKEY

Ayhan Sorgucu, a military judge in Turkish Air Force, graduated from Turkish Army Academy in 1993 and Ankara University Law School in 1998. He received his MD degree from the Institute of Strategic Researches in 2005, in Istanbul. He is still doing his doctoral work on Public Law at the Dokuzeylül University, in Izmir. He worked as Deputy Legal Advisor in Kosovo in 2011. He has also worked as a military judge in various courts in İzmir and Diyarbakır, Turkey. He authored "International Air and Space Law" and published some scientific papers and presentations.

Sourbès-Verger, Isabelle

Senior Researcher at the National Center for Scientific Research (CNRS), FRANCE

Isabelle Sourbès-Verger is Senior Researcher at the CNRS (National Center for Scientific Research) in Paris. She is one of the few French researchers specialised in the study of outer space activities and related national space policies. History and geography constitute her academic background. After she became a professor, she conducted research about the Geography of Outer Space, dealing with the different forms of occupation of Earth orbits and the corresponding national space policies of the Space Club members.

After working as a Junior Researcher at CNET (National Centre for Telecommunications Studies) during three years, she obtained a permanent position at CNRS in 1988. Since then, she belonged to different CNRS laboratories moving from Imageo (space cartography), to CREST (Centre for Research on Strategy and Technology, Ecole Polytechnique) and LCP (Laboratory on Political Communication as Deputy Director) before joining her current organisation, CAK (specialised in the history of sciences and technologies) as Deputy Director from 2009 to 2014. Through this multifaceted experience, she built up a global approach of the scientific, social science and political dimensions of the space conquest.

Her research focuses on the interface of national public policy and technological ambitions taking into account very different issues such as strategic matters and international security, the impact of public opinion and the role of media as support to space activities. Thus, Europe, Russia, Japan, China and India are the major space powers on which she developed extensive expertise.

Using comparative analysis of different national space policies, her research provides an original view on the various models of acquisition and development of national space competences. She is a member of different international networks.

Steer, Cassandra

Erin JC Arsenault Post-Doctoral Fellow, Institute of Air & Space Law, McGill University, AUSTRALIA

Doctor Cassandra Steer is an Erin JC Arsenault Post-doctoral fellow at the McGill Institute of Air and Space Law, Canada. Prior to this, she was a junior professor at the University of Amsterdam in the Netherlands from 2006-2014, teaching Criminal Law, International Criminal Law, Public International Law, and Legal Research Methods.

Dr. Steer interned at the International Criminal Court under Judge Navi Pillay in 2004, and was a researcher for the Dutch Council of State (Raad van State). She has been a Visiting Researcher at universities in Argentina, Canada, Germany and the USA, where she was also a Fulbright Scholar. Currently she is the member for Canada on the International Law Association Space Law Committee, the Secretary of the IAF Space Security Committee, and a member of the International Institute of Space Law, Women in Aerospace, Women in International Security, the American Society of International Law, the NATO Association of Canada, and the International Society for Military Law and the Law of War.

Stephens, Dale

Director, Research Unit on Military Law and Ethics, University of Adelaide, AUSTRALIA

Associate Professor Dale Stephens obtained his Arts degree (BA) from Flinders University in 1984 and his Law degree (LLB (Hons)) from Adelaide University in 1988. In 1989, he completed his GDLP at South Australian Institute of Technology and was admitted as a legal practitioner to the Supreme Court of South Australia. That same year also joined the Royal Australian Navy. He occupied numerous staff officer appointments throughout his 20 plus year naval career, including Fleet Legal Officer, Command Legal Officer (Naval Training Command), Director of Operational and International Law, Deputy Director of the Asia-Pacific Centre for Military Law (APCML) and Director of the Military Law Centre. In Feb 2013, he transferred to the Navy Reserve and took up a full time position as an Associate Professor at Adelaide University Law School. His operational deployments include East Timor in 1999 and 2000, and Iraq in 2005 and 2008. He has been awarded the Conspicuous Service Medal, the (US) Bronze Star and the (US) Meritorious Service Medal. Doctor Stephens is currently Director of the Adelaide Research Unit on Military Law and Ethics (RUMLAE). He is also an active board member of the Australian Yearbook of International Law and Chair of the South Australian Red Cross IHL Committee.

Su, Jinyuan

Associate Professor and Assistant Dean for International Affairs at Xi'an Jiaotong University School of Law

Doctor Jinyuan Su received BA, MA and PhD from Xi'an Jiaotong University, China. He is currently Associate Professor and Assistant Dean for International Affairs at Xi'an Jiaotong University School of Law. He was an Erin JC Arsenault Fellow at McGill Institute of Air and Space Law between 2014-2015, and a visiting research fellow at the Lauterpacht Centre for International Law, University of Cambridge between 2009-2010. Doctor Su's research interest lies in outer space law, international aviation law, and the law of the sea. He was a member of the Chinese delegation to the 56th Session of the UNCOPUOS.

Tepper, Eytan

Doctoral Candidate, Institute of Air & Space Law, McGill University

Doctor Tepper earned a double bachelor degree in Law and Economics from Tel-Aviv University, a Master's degree in law from the Hebrew University of Jerusalem and the degree of Doctor of International Law from China University of Political Science and Law, Beijing, China. Before returning to academia, Doctor Tepper practiced law in Israel working mainly for the Bank of Israel and the Ministry of Economy (Foreign Trade Administration). Doctor Tepper also served as Vice-Chairman of the Israeli Bar Association's Economic Forum.

Tronchetti, Fabio

Advisor, HowLyMo Law Firm, Beijing, CHINA

Fabio Tronchetti is an Associate Professor of Law at the School of Law of the Harbin Institute of Technology, People's Republic of China, where he also serves as Director of the International Law Department. Since January 2014 he is as an Adjunct Professor of Comparative National Space Law at the School of Law of the University of Mississippi, United States. Earlier in his career he was Lecturer and Academic Coordinator at the International Institute of Air and Space Law, Leiden University, the Netherlands. Professor Tronchetti's scholarly is primarily in the areas of International Space Law and Public International Law. He is the recipient of the 2007 Diederiks-Verschoor Award for best paper submitted by an author not older than 40 years to the International Institute of Space Law (IISL) during the 58th International Astronautical Congress of the International Astronautical Federation (IAF).

West, Jessica

Manager and Editor, Space Security Index, Project Ploughshares, CANADA

Jessica West is a PhD Candidate in the Global Governance program at the Balsillie School of International Affairs, pursuing a specialization in conflict and security studies. She has a Master's of Arts degree in International Affairs from the Norman Paterson School of International Affairs. Prior to beginning her doctoral studies, Jessica managed an international research project on space security and served as the editor of its annual publication as part of her role at Project Ploughshares, a peace and disarmament research and advocacy organization. She has also worked as a consultant on security and development at the Canadian International Development Agency and for the Stabilization and Reconstruction Task Force at the Department of Foreign Affairs. She obtained the Canada Graduate Scholarship, in support of graduate research at the doctoral level, 2010 (3-years); the Ontario Graduate Scholarship, in support of graduate research at the doctoral level, 2009; and the Top 40 Under 40 Award, for recognition as one of the top leaders in the Region of Waterloo, 2008.

Wouters, Jan

Director, Leuven Centre for Global Governance Studies - Institute for International Law, KU Leuven, BELGIUM

Jan Wouters is Jean Monnet Chair ad personam EU and Global Governance, Professor of International Law and International Organizations, and founding Director of the Institute for International Law and of the Leuven Centre for Global Governance Studies, an interdisciplinary centre of excellence, at the University of Leuven (KU Leuven). In Leuven, he teaches Public International Law, Law of International Organizations, the Law of the World Trade Organization, Space Law and International Humanitarian Law. As Visiting Professor at Sciences Po (Paris), Luiss University (Rome) and the College of Europe (Bruges) he teaches EU external relations law. As Adjunct Professor at Columbia University he teaches Comparative EU-US Perspectives on International Human Rights Law. Apart from his participation in international scientific panels and networks, he also advises various international organizations and governments. He is coordinator of a large-scale FP7 Programme FRAME, "Fostering Human Rights Among European (External and Internal) Policies", and of the InBev-Baillet Latour EU China Chair at KU Leuven.

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84.	Su	Jinyuan	Xi'an Jiaotong University	China
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86.	Tronchetti	Fabio	HowLyMo Law Firm	China
87.	Vanhonnaeker	Lukas	McGill University, Faculty of Law	Belgium
88.	Vermette	Patrick	Department of National Defense of Canada	Canada
89.	Welly	Nicholas	US Government	USA
90.	West	Jessica	Project Ploughshares	Canada
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