5th Manfred Lachs International Conference on
Global Space Governance and the UN 2030 Agenda
(Implementing a New Space Vision for Sustainable Development Goals)

5–6 May 2017
Best Western Ville-Marie, Montreal

Co-convened by
The Institute of Air and Space Law and the Centre for Research in Air and Space Law
Faculty of Law, McGill University, Montreal, Canada
and the International Association for the Advancement of Space Safety
Noordwijk, The Netherlands

In collaboration with
United Nations Office for Outer Space Affairs (UNOOSA), the Canadian Space Agency (CSA), the Secure World Foundation, ROOM-The Space Journal, and the CANEUS Organization

Sponsored by
The Erin J.C. Arsenault Fund at McGill University's Faculty of Law

Conference Co-Chairs

Ram Jakhu	Institute of Air and Space Law, McGill University, Canada
Joseph Pelton	International Association for the Advancement of Space Safety, USA

Conference Coordinator

Aram Daniel Kerkonian	Institute of Air and Space Law, McGill University, Canada

Conference Steering Committee

Eleanora Agnew	Canadian Space Agency, Canada
Kelly Anderson	Global Affairs Canada, Canada
Kimberly Chan	Canadian Space Agency, Canada
Paul Dempsey	Institute of Air and Space Law, McGill University, Canada
Marie-Soleil Fecteau	Global Affairs Canada, Canada
Steven Freeland	Western Sydney University, Australia
Niklas Hedman	United Nations Office for Outer Space Affairs, Austria
David Kendall	United Nations Committee on the Peaceful Uses of Outer Space, Canada
Aram Daniel Kerkonian	Institute of Air and Space Law, McGill University, Canada
Shouping Li	Beijing Institute of Technology, China
Lucien Rapp	Space Institue for Research on Innovative Uses of Satellites, France
Michael Simpson	Secure World Foundation, USA
Jinyuan Su	Xi'an Jiaotong University, China

General Information

Conference Venue
Hotel Best Western Ville-Marie
Mont Royal I, 20th Floor
3407 Peel Street
Quebec, Canada
H3A 1W7

Gala Dinner
Faculty Club
McGill University
3450 McTavish Street
Quebec, Canada
H34 0E5

OVERVIEW: FRIDAY, 5 MAY 2017

8:00 – 8:30
Registration:
Mont Royal I (20th Floor)

8:30 – 9:00
Opening Address:
Mont Royal II (20th Floor)

9:00 – 11:00
Session 1: *Pillars for Global Governance of Outer Space Activities in the 21 Century* (Organized by UNOOSA)
Mont Royal II (20th Floor)

11:00 – 11:20
Refreshment Break:
Mont Royal I (20th Floor)

11:20 – 13:00
Session 2: *National and Regional Perspectives on Space Governance* (Organized by the CSA)
Mont Royal II (20th Floor)

13:00 – 14:20
Lunch and Poster Presentations:
Mont Royal I (20th Floor)

14:20 – 16:00
Session 3: *Legal and Policy Foundations & Background*
Mont Royal II (20th Floor)

16:00 – 16:20
Refreshment Break:
Mont Royal I (20th Floor)

16:20 – 18:00
Session 4: *How to Improve Current Governance Models*
Mont Royal II (20th Floor)

19:00 – 22:30
Gala Dinner:
Faculty Club (Grand Ballroom)

OVERVIEW: SATURDAY, 6 MAY 2017

9:00 – 10:40
Parallel Session 5A: *Space Applications for Achieving SDGs - I*
Salon Ville-Marie (4th Floor)

9:00 – 10:40
Parallel Session 5B: *Space Applications for Achieving SDGs – II*
Mont Royal II (20th Floor)

10:40 – 11:00
Refreshment Break:
Mont Royal I (20th Floor)

11:00 – 12:40
Parallel Session 6A: *National Perspectives of Space Policies and Applications*
Mont Royal II (20th Floor)

11:00 – 12:40
Parallel Session 6B: *Space Natural Resources for Human Needs on Earth*
Salon Ville-Marie (4th Floor)

12:40 – 14:00
Lunch:
Mont Royal I (20th Floor)

14:00 – 15:40
Session 7: *Modes of Global Space Governance: Tools to Move Forward*
Mont Royal II (20th Floor)

15:40 – 16:00
Refreshment Break:
Mont Royal I (20th Floor)

16:00 – 16:40
Session 8: *An International Study of Global Space Governance: Input to UNISPACE+50*
Mont Royal II (20th Floor)

16:40 – 17:00
Closing Address and Adoption of Montreal Resolution
Mont Royal II (20th Floor)

DAY ONE – FRIDAY, 5 MAY 2017

Registration:
8:00 – 8:30
Mont Royal I (20th Floor)

Opening Address:
8:30 – 9:00
Mont Royal II (20th Floor)

	Name	Position and Affiliation
1.	Aram Daniel Kerkonian	Master of Ceremonies and Conference Coordinator
2.	Ram Jakhu	Conference-Co-Chair; Director, Institute of Air and Space Law, McGill University
3.	Richard Janda	Faculty of Law, McGill University
4.	David Kendall	Chair, United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS)
5.	Isabelle Rongier	President, International Association for the Advancement of Space Safety
6.	Joseph Pelton	Conference Co-Chair; International Association for the Advancement of Space Safety

Session 1: *Pillars for Global Governance of Outer Space Activities in the 21 Century*
(Organized by UNOOSA)
9:00 – 11:00
Mont Royal II (20th Floor)

	Name	Position and Affiliation
Chair: Simonetta Di Pippo, UNOOSA		
1.	Sylvain Laporte	President, Canadian Space Agency (CSA)
2.	Jean-Yves LeGall	President, Centre national d'études spatiales (CNES)
3.	Rosa Maria Ramirez De Arellano Haro	Director of International Affairs and Space Security, Mexican Space Agency
4.	Kenneth Hodgkins	Director, Office of Space and Advanced Technology, US State Department
5.	David Kendall	Chair, UNCOPUOS
Discussion		

Refreshment Break:
11:00 – 11:20
Mont Royal I (20th Floor)

Session 2: *National and Regional Perspectives on Space Governance*

(Organized by the CSA)

11:20 – 13:00

Mont Royal II (20th Floor)

	Name	Position and Affiliation
Chair: Elle Agnew, Canadian Space Agency		
1.	Mary Preville	Director General, CSA
2.	Kenneth Hodgkins	Director of Office on Advanced Technology, US State Department
3.	Mark Reynhardt	Deputy Director, Science and Technology, South African Department of International Relations and Cooperation
4.	Rosa Maria Ramirez De Arellano Haro	Director of International Affairs and Space Security, Mexican Space Agency
Discussion		

Lunch and Poster Presentations:

13:00 – 14:20

Mont Royal I (20th Floor)

Name	Title
Ali Aghahosseini	Sustainable Diplomacy for Sustainable Governance
Ali Golroo	Cooperation between Space Ferrying Nations and Emerging Space Nations A key to Environmental Sustainability on Earth and in Space
Andrew Butler	Freedom of Movement in Outer Space as an Individual Human Right
Huan Yu	To Promote Chinese Space Economic Development by Creating Domestic Space Legislation
Joseph Clift	Do Astronauts Dream of Catching Cosmic Sheep?
Robert Thomas	The Outer Space Treaty vs. Realpolitik: The Need for a New Treaty Framework

Session 3: *Legal and Policy Foundations & Background*

14:20 – 16:00

Mont Royal II (20th Floor)

	Name	Title
Chair: Melissa de Zwart		
1.	Barry Kellman	Space Capabilities for Enforcing Environmental Sustainability
2.	Audrey Allison	Unlocking the Potential of New Space Systems to Achieve SDG Goals
3.	Amit Maitra	Space Governance as a Driver for Sustainable Development
4.	Joe Pelton	Improved Legal and Regulatory Processes to Protect the Planet
5.	Philip De Man/ Ward Munters	Reciprocal Limits to the Freedom to Use Outer Space by All States, on a Basis of Equality: Common But Differentiated Responsibilities?
6.	Lena de Winne	Asgardia – The First Space Nation: Vision and Challenges
Discussion		

Refreshment Break:

16:00 – 16:20
Mont Royal I (20th Floor)

Session 4: *How to Improve Current Governance Models*

16:20 – 18:00
Mont Royal II (20th Floor)

	Name	Title
Chair: Theresa Hitchens		
1.	Tommaso Sgobba	Space Governance and Stakeholder's Rights
2.	Krystal Wilson	Challenges to Using Volunteered Geographic Information for Achieving the Sustainable Development Goals
3.	Melissa de Zwart	Domestic Space Legislation: Guidelines for Sustainability in Commercial Space
4.	Monica Mallowan and Maria Lucas-Rhimbassen	The 4th Estate at the Service of Sustainable Space Governance
5.	Gilles Doucet	National Incentives for Global Space Governance
6.	*Stuart Eves*	*The Legal Implications of Improved Space Situation Awareness and other Developments in Space Technology (**to be presented by Gilles Doucet**)*
Discussion		

Gala Dinner:

19:00 – 22:30
Faculty Club (Grand Ballroom)
Keynote Speaker: Paul Meyer: *Outer Space Treaty at 50*

DAY TWO – SATURDAY, 6 MAY 2017

Parallel Session 5A: *Space Applications for Achieving SDGs - I*

9:00 – 10:40

Salon Ville-Marie (4th Floor)

	Name	Title
Chair: Ken Hodgkins		
1.	Miguel Yagues	The Benefits of Space Cooperation in the Safeguard of Tropical Forests
2.	Juan Gonzalez Allonca	Privacy and Remote Sensing Satellites
3.	George Kyriakopoulos	Long-term Sustainability of Outer Space Activities: International Cooperation as a Fundamental Basis for a Comprehensive Space Traffic Management Regime
4.	Mark Skinner	Development of Distributed Space Object Tracking and Data Sharing as a Means to Achieving the UN 2030 Sustainable Development Goals
5.	Diane Howard/ Ruth Stilwell	GNSS and Sustainable Access to Space
6.	Don Flournoy	Space Governance Challenges re Space Solar Power
Discussion		

Parallel Session 5B: *Space Applications for Achieving SDGs – II*

9:00 – 10:40

Mont Royal II (20th Floor)

	Name	Title
Chair: Joe Pelton		
1.	Niklas Hedman	The UN Register on Objects Launched into Outer Space – TCBMs and Notification Procedures
2.	Upasana Dasgupta	Reconciling State Practice of On-Orbit Satellite Transfer with the Law of Liability and Registration in Outer Space
3.	*Attila Matas and Yvon Henri*	*Orbit/Spectrum ITU International Regulatory Framework – Integral Part of Global Space Governance* ***(to be presented by Ram Jakhu)***
4.	Steven Freeland and Ram Jakhu	Promoting Peace from Above? Utilising Space for the Prevention and Prosecution of Human Rights Violations
5.	Anne-Sophie Martin	Space Applications as Instruments to Face Terrorist Threats
6.	Rajeswari Pillai Rajagopalan	Global Governance of Space Security: Challenges and Prospects
Discussion		

Refreshment Break:

10:40 – 11:00
Mont Royal I (20th Floor)

Parallel Session 6A: *National Perspectives of Space Policies and Applications*

11:00 – 12:40
Mont Royal II (20th Floor)

	Name	Title
Chair: Niklas Hedman		
1.	Mukund Rao	Assessment for Space Governance – Collaborative Framework for SDG
2.	Li Shouping	Chinese Perspective on Space Sustainable Development Goals
3.	Isabelle Sourbes-Verger	Space Security Awareness and Global Space Governance: a European Perspective
4.	Sanat Kaul	UN 2030 Agenda and Indian Space Governance
5.	Bahar Ramazanova	The New Beginnings of Commercial Space Policy and Law in Post-Soviet Nations
6.	Venkataramaiah Jagannatha	Community Empowered Space Technology Role Models
Discussion		

Parallel Session 6B: *Space Natural Resources for Human Needs on Earth*

11:00 – 12:40
Salon Ville-Marie (4th Floor)

	Name	Title
Chair: Steven Freeland		
1.	Ricky Lee	Preservation of Life on Land: How Exploitation of Asteroid Resources Can Help Achieve Sustainable Development Goal #15
2.	Maria Manoli	Natural Resources Exploitation as an Apple of Discord: The Need for a Space Governance Mechanism Towards Effective Benefit Sharing
3.	Gordon Chung	An Incentivising Regime for Private Enterprises: The Enduring Benefits Derived From The Commercialization of Outer Space
4.	Lawrence Roberts	The Integral Contribution and Limitations of A Space Property Regime To Sustainable Development
Discussion		

Lunch:

12:40 – 14:00
Mont Royal I (20th Floor)

Session 7: *Modes of Global Space Governance: Tools to Move Forward*

14:00 – 15:40
Mont Royal II (20th Floor)

	Name	Title
Chair: Paul Meyer		
1.	Theresa Hitchens	The UN GGE on Transparency and Confidence-Building Measures in Outer Space Activities: How Middle Powers Can Overcome the Failure to Launch
2.	Duncan Blake	Manual on International Law Applicable to Military Uses of Outer Space
3.	Eytan Tepper	Time for Reform: Preparing UN-COPUOS for the Next 50 Years of Space Exploration
4.	Maria Lucas-Rhimbassen/ Lucien Rapp	Space Resilience 4.0: Contracting for Resilient Space Infrastructures
5.	Lorna Jean Edmonds/ Seth H. Baker	The Interconnection of Universalization and the UN2030 Agenda: The 21st Century Leadership Imperative
Discussion		

Refreshment Break:

15:40 – 16:00
Mont Royal I (20th Floor)

Session 8: *An International Study of Global Space Governance: Input to UNISPACE+50*

16:00 – 16:40
Mont Royal II (20th Floor)

1.	Ram Jakhu	Conference-Co-Chair; Director, Institute of Air and Space Law, McGill University
2.	Joseph Pelton	Conference Co-Chair; International Association for the Advancement of Space Safety

Closing Address and Adoption of Montreal Resolution

16:40 – 17:00
Mont Royal II (20th Floor)

	Name	Position and Affiliation
1.	Ram Jakhu	Conference-Co-Chair; Director, Institute of Air and Space Law, McGill University
2.	Joseph Pelton	Conference Co-Chair; International Association for the Advancement of Space Safety
3.	Aram Daniel Kerkonian	Master of Ceremonies and Conference Coordinator

ABSTRACTS – FRIDAY, 5 MAY 2017

Poster Presentations:
13:00 – 14:20
Mont Royal I (20th Floor)

	Name	Title
1.	Ali Aghahosseini	Sustainable Diplomacy for Sustainable Governance
2.	Ali Golroo	Cooperation between Space Ferrying Nations and Emerging Space Nations A key to Environmental Sustainability on Earth and in Space
3.	Andrew Butler	Freedom of Movement in Outer Space as an Individual Human Right
4.	Huan Yu	To Promote Chinese Space Economic Development by Creating Domestic Space Legislation
5.	Joseph Clift	Do Astronauts Dream of Catching Cosmic Sheep?
6.	Robert Thomas	The Outer Space Treaty vs. Realpolitik: The Need for a New Treaty Framework

1. Ali Aghahosseini

Governing Outer Space Activities More Effectively: Sustainable Diplomacy for Sustainable Governance?

The importance of outer space to the global economy and national interests has heightened the interest of the international diplomatic community in space sustainability. Diplomacy, from the beginning of the space age, has been at the center of efforts for the governance of outer space activities, especially through UNCOPUOS, which was created in a political environment. Since, space diplomacy has assisted in addressing the challenges of responsible behavior in space through the development of laws and regulations, non-binding mechanisms, voluntary transparency and confidence-building measures. Indeed, diplomatic efforts are focused on raising international understanding of the global consequences of irresponsible behaviour in outer space and includes specific engagements in both bilateral and multilateral efforts. Concerns about ensuring sustainability in outer space have led diplomatic efforts to pursue a range of governance initiatives such as the EU Code of Conduct, the UNCOPUOS Working Group on the Long-term Sustainability of Outer Space Activities, and the Group of Governmental Experts (GGE) on transparency and confidence-building measures. In this regard, the paper will first examine the interaction between global space governance and diplomacy, by looking not only at global space governance as the subject of diplomacy, but also at space governance as guiding diplomacy, explaining the victories and defeats in this area. The paper will then turn its attention to some critical issues regarding the impact of diplomacy on understanding and the application of space governance policies. Finally, the paper suggests some proposals to improve the sustainable global space governance policies through diplomatic tools.

2. Ali Golroo

Cooperation between Space Ferrying Nations and Emerging Space Nations: A key to Environmental Sustainability on Earth and in Space

The importance of space based technology applications to the daily functioning of humanity on Earth is so evident that in modern societies it is impossible to live without the use of such space based technologies. Although free access to outer space and the exploration and use of outer space by all States for the benefit of mankind is well recognized by international law, for the past 60 years multiple States, especially developing ones, have been dependent on the services provided by space faring nations. Lack of technology, knowhow and the high cost of investment are among the reasons for such dependency. The situation has changed since; more than 50 states are operating satellites in orbits and nearly 15 countries have launching capabilities.

This paper looks at emerging space nations and their space activities as well as the environmental effects of such activities in outer space. The author argues that the lack of international cooperation especially by the most advanced space faring States, leaves emerging space nations with no other choice but to start from scratch and which leads to more debris affecting the international community in its entirety. The International community should not only consider the mitigation and removal of space debris, but should also cooperate with emerging space nations to achieve a sustainable environment on Earth and in Space.

3. Andrew Butler

Freedom of Movement in Outer Space as an Individual Human Right

The ability to travel and cross State borders on Earth is almost entirely determined by the 'birthright lottery' of nationality. An individually held freedom of movement throughout outer space would be of profound significance when human settlement of this environment ultimately occurs, particularly for those who are largely excluded from lawful international migration today. This paper advances an evolutionary interpretation of Article I of the *Outer Space Treaty*, advocating that its guaranteed freedoms of exploration, use and access (all premised upon a non-discriminatory freedom of movement) are personally held by all human beings as an individual human right. As with all such rights, however, this should be balanced by the doctrine of proportionality. Although it is widely believed today that only States are guaranteed these freedoms and discretionarily transfer the benefits onto their citizens, support for an individual freedom of movement does exist within both the *travaux préparatoires* and the treaty's other equally authentic languages. Recognition of such an individual freedom would be a tremendous advancement towards cementing the UN Agenda for Sustainable Development Goals well beyond the year 2030, as mobility rights are essential for equality of opportunity and the achievement of true personal autonomy for all humans. With international migration at its most regulated in history, the eventual development of such an open border regime could become one of the most unique and important governance features of outer space.

4. Huan Yu

To Promote Chinese Space Economic Development by Creating Domestic Legislation

The lack of participation of the private space sector restricts the development of the Chinese outer space industry. It is essential to encourage and promote the private space sector to participate in, as well as cooperate with, entities from other countries at the level of domestic legislation. This is especially true considering China will enact its own domestic space law in 2020. In terms of participation, first it is necessary to improve the law to promote national and private entities to complete the space project together. Second, the law ought to transfer State-owned technology to private entities in an appropriate way. Third, the law ought to affirm the liability of private entities participating in outer space activities and improve the insurance system. For the promotion of cooperation, the law ought to make regulations regarding the qualifications and conditions of private entities to provide space products and services for other countries. For foreign entities cooperating with Chinese private entities, regulations with regard to the field, scale and procedures of space activities should also be established.

5. Joseph Clift

Do Astronauts Dream of Catching Cosmic Sheep?

Proper health for astronauts has been always at the forefront of space exploration. Negative effects of low gravity environments on human physiology have been well documented and studied. Less studied however, are the effects of sleep deprivation with regards to astronauts' health and mental stamina. The question that the author seeks to address is whether or not sleep insufficiency effects (deprivation) can be accurately quantified, modeled, and predicted for astronauts on long duration missions, so as to better monitor and track their health. Answering this question will involve the testing of multiple groups of volunteers with the UND Lunar Mars Habitat for a period of one week to simulate a mission on the surface of the Moon or other

distant extraterrestrial body of the Solar System with bio monitors. Various tests will be administered specific to crew duties (Captain, Pilot, Scientist, Engineer, etc.) and compared to baseline tests performed at the beginning and end of the study. Results from the tests and the data from the bio monitors shall then be quantified and analyzed. Mathematical equations shall then be derived to model and predict the effects of sleep deprivation.

6. Robert Thomas

The Outer Space Treaty vs. Realpolitik: The Need for a New Treaty Framework

The tremendous expansion in commercial, military, and scientific uses of space-based infrastructure since the negotiation of the Outer Space Treaty of 1967 has benefited global development, but has also resulted in unstable incentives and coordination problems that threaten that infrastructure. This paper proposes an updated treaty framework to govern outer space activity, beginning with an assessment of two relevant challenges: the risk of damage to orbital infrastructure posed by security competition between major powers reliant on space-based military systems; and the complications posed for orbital management, legal jurisdiction and liability, and exploitation of space-based resources posed by increasingly independent space launch capabilities of non-State commercial actors.

This paper argues that a new treaty framework must specify shared standards covering three interconnected issues: orbital traffic and debris management, delineation of jurisdiction and operational boundary areas for orbital and other space-based infrastructure, and legal governance of commercial exploitation of space-based natural resources. The proposed framework draws on aspects of prior space debris mitigation proposals, the UN Convention on the Law of the Sea, and contemporary appraisals of John Locke's theory on the original appropriation of property, arguing that an updated set of 'rules of the road' can reduce risks of conflict and secure continued use of space systems to promote global development and commerce. The paper concludes by briefly considering different paths for successfully negotiating such a treaty.

Session 3: *Legal and Policy Foundations & Background*
14:20 – 16:00
Mont Royal II (20th Floor)

	Name	Title
Chair: Melissa de Zwart		
1.	Barry Kellman	Space Capabilities for Enforcing Environmental Sustainability
2.	Audrey Allison	Unlocking the Potential of New Space Systems to Achieve SDG Goals
3.	Amit Maitra	Space Governance as a Driver for Sustainable Development
4.	Joe Pelton	Improved Legal and Regulatory Processes to Protect the Planet
5.	Philip De Man/ Ward Munters	Reciprocal Limits to the Freedom to Use Outer Space by All States, on a Basis of Equality: Common But Differentiated Responsibilities?
6.	Lena de Winne	Asgardia – The First Space Nation: Vision and Challenges
Discussion		

1. Barry Kellman

Space Activities and Environmental Sustainability

The author proposes to explore the relationship between emerging space capabilities and enforcing global environmental sustainability goals (ESGs). This relationship is two-fold: (1) space activities can track and provide evidence of actions that contradict or impede achievement of ESGs; and (2) ESGs should apply to space activities. Exploring ongoing global challenges through the prism of this two-way relationship can reveal pathways to progress.

Specifically, the paper focuses on three challenges to achieving ESGs: poaching & trading endangered and threatened species of wildlife; unauthorized or improper disposal of hazardous wastes; and unauthorized or improper natural resource drilling & mining. There are multiple legal arrangements that specify obligations and prohibitions pertaining to prevention of and accountability for actions that enable or contribute to these challenges. Some of these obligations and prohibitions establish criminal responsibility for violations; other obligations and prohibitions establish civil or regulatory responsibility for violations; yet others establish bases for State responsibility for violations.

The problem, however, is less with the content of any of these obligations and prohibitions than with their enforcement. Various reports of the United Nations and other international organizations testify to the enforcement difficulties that pertain to each of these challenges. There are difficulties associated with: detecting violations, establishing causation of harm, and in building a case against criminal or corrupt enterprises, whether in the private or public sphere.

The paper's thesis is that emerging space activities are relevant to solving these enforcement difficulties. The paper will set forth progressive policy and legal reforms that can strengthen that relevancy.

2. Audrey Allison

Unlocking the Potential of New Commercial Space Systems to Achieve SDG Goals

Broadband connectivity has long been recognized as a key enabler for social and economic development. The International Telecommunication Union (ITU), a specialized agency of the United Nations, considers telecommunications a facilitator to the achievement of the Sustainable Development Goals (SDBs), including those on education, health, governance, agriculture, commerce, finance, and disaster risk reduction.

Despite many decades of ongoing effort by multilateral bodies and national actors, a "digital divide" persists in provision of telecommunications, including broadband connectivity, to populations in remote and rural areas in both developed and developing countries. Satellite-delivered broadband is one potential solution to finally close this digital divide and enable the achievement of the SDGs.

The ITU facilitates the efforts by States, satellite operators, and other organizations to bridge the digital divide, including concluding treaties addressing use of radiofrequency spectrum and satellite orbits that are foundational to the implementation of all satellite systems. Specifically, the ITU's next World Radiocommunication Conference to be convened in 2019 will consider amendments to the international Radio Regulations to accommodate newly proposed low earth orbiting satellite constellations that hold great promise for delivering high speed data to the entire planet and finally closing the digital divide.

This paper will describe how existing space governance mechanisms can facilitate the introduction of proposed new "mega-LEO" systems and contribute to the fulfillment of the SDGs. Moreover, the ITU's long history of providing a stable and foundational legal regime upon which major space systems can be supported and sustained affords the world a notable example of space governance solutions.

3. Amit Maitra

Space Governance as a Driver for Sustainable Development

Space development is characterized by the rise of new space-faring nations, the advent of commercial and private space actors, and the reliance of modern societies on space infrastructure. This suggests evolving opportunities in space development. It also underscores the importance of a global space governance system for effective communication and exchange among the growing number and variety of stakeholders and players in the space arena. A robust system for global governance of outer space requires dynamic understanding and integration of ideas and varied interests that reflect current and anticipated needs of a growing industry and sphere of activity important to the sustainability of space so that it can be used by all – now and in the future. This paper proposes a framework for space governance using ideas borrowed from cybernetics and engineering control theory. The author posits that this framework will play a major role in bringing together civil society, academia, governments, the private sector and other stakeholders for the development of an effective global governance regime for peaceful and sustainable exploration, use and exploitation of outer space for the benefit of all.

4. Joe Pelton

Improved Legal and Regulatory Processes to Protect the Planet

This paper seeks to define an improved legal and regulatory framework for "Space and Sustainability". Of the 17 goals for sustainable development for 2030 that have been adopted by the United Nations, the one related to the protection is too limited. The "Protection of the Planet" (Goal 13) is presently stated as one which looks only to "land" rather than "the Planet".

Protection of the Planet involves: (i) Clean Water (Goal 6); Affordable and Clean Energy (Goal 7); Industry, Innovation and Infrastructure (Goal 9); Sustainable Cities and Communities (Goal 11); Responsible Consumption and Production (Goal 12); Climate Action (Goal 13); and Life below Water (Goal 14); (ii) It is essential to see environmental sustainability as including the stratosphere, near space (or the so-called Protozone), and concerns over orbital debris, sustainable use of the Earth Orbit and cosmic hazards and planetary defense. Earth is a finite 6 sextillion ton space ship with fixed resources that run out if over consumed and this reality has not yet been faced.

Space is essential to achieving "sustainability goals", but the first step is to see planetary protection in a holistic way. This paper has two aspects. On one hand, it defines and itemizes space systems that can provide assistance with regard to all 17 goals. On the other hand, it outlines an "Environmental Biosphere Mandate" for consideration by UNISPACE + 50. This mandate notes the essential environmental limits to growth vital to long term sustainability of space ship Earth. It also provides possible remedial legal, regulatory or soft law actions that could be taken on a global scale to address these sustainability and holistic environmental issues.

5. Philip De Man and Ward Munters

Reciprocal Limits to the Freedom to Use Outer Space by All States, On a Basis of Equality: Common but Differentiated Responsibilities

The principle of common but differentiated responsibilities (CBDRs) imputes common responsibility for global problems to all States, while recognising that variegated levels of responsibility exist for different groups of countries. While CBDRs are explicitly recognised in international environmental law, they may also be implicitly contained in treaties that establish identical treatment for all parties, while allowing for divergences in the application of their key principles for different States.

The present paper wishes to initiate a discussion on the question of whether the fundamental principles of international space law may be interpreted as an implicit codification of the principle of CBDRs. In particular, it aims to determine the relation between the concept of variegated levels of responsibility as a core component of CBDRs and the reciprocally phrased limits to the freedom to use outer space 'on a basis of equality' for the benefit of all countries, 'irrespective of their economic and scientific development', all the while avoiding potentially harmful interference in their activities.

Further, the paper aims to assess the basis on which different levels of responsibility may be attributed to different groups of States in space law. In so doing, it will identify a number of indicators in the relevant UN and ITU conventions that appear to support a flexible system of variegated responsibilities, in line with the pragmatic approach to CBDRs in the 2015 Paris Agreement. These indicators will focus on possible applications of the CBDR principle in the areas of space debris and resource exploitation, specifically.

6. Lena de Winne

Asgardia – The First Space Nation: Vision and Challenges

As science and technology evolve, humankind expands further into space, taking for granted human spaceflight and use of space infrastructure for daily life on Earth. At the same time the world order is not in the best shape; many former dreams of social justice and world peace are proving to be in vain. Threats (natural and man-made) from space are topping the list of potential events which might bring catastrophic consequences to the entire planet. What is the way to help humankind survive?

The answer to this question is Asgardia – The Space Nation. It is open to every person to join; it will work towards the development of a legal frame that would prevent the propagation of military conflicts into space; it will build a shield that will protect the entire Earth from natural space threats; it will provide equal access to space to any interested scientists, regardless to whether they come from a space faring nation or otherwise; its long-term vision is human settlements in space.

Session 4: *How to Improve Current Governance Models*
16:20 – 18:00
Mont Royal II (20th Floor)

	Name	Title
Chair: Theresa Hitchens		
1.	Tommaso Sgobba	Space Governance and Stakeholder's Rights
2.	Krystal Wilson	Challenges to Using Volunteered Geographic Information for Achieving the Sustainable Development Goals
3.	Melissa de Zwart	Domestic Space Legislation: Guidelines for Sustainability in Commercial Space
4.	Monica Mallowan and Maria Lucas-Rhimbassen	The 4th Estate at the Service of Sustainable Space Governance
5.	Gilles Doucet	National Incentives for Global Space Governance
6.	*Stuart Eves*	*The Legal Implications of Improved Space Situation Awareness and other Developments in Space Technology (**to be presented by Gilles Doucet**)*
Discussion		

1. Tomasso Sgobba

Space Governance and Stakeholders Roles

For the past half century, humans have flown to space on systems developed by national space (research) agencies, while unmanned launch and satellite operations have been carried out either by government organizations or by few specialized commercial operators. In the near future, privately owned and operated vehicles will begin suborbital and orbital operations with paying passengers on board, while a variety of newcomers are swelling the small group of satellite and launch operators on a scale never seen before. The long and sometimes painful process through which safety rules and processes mature in space agencies leads to the need for separate organizations and at times even requires access to independent highly specialized technical teams. The same applies to space operations, namely in the fields of space debris mitigation/remediation, and collision avoidance procedures.

Traditionally, when licensing commercial risky activities, a government regulatory body is responsible for levying safety requirements, performing surveillance activities, and certifying compliance. However, considering the ever-widening technical competence gap between high-tech industry and traditional government regulatory organizations, such way of operations is becoming impractical in many technological fields. A different set up is advisable in which the space industry collectively takes the lead in systems and operations certification, while the government keeps responsibility for overall policies, direction, and international coordination. This paper will discuss how such set-up can be implemented for commercial space developments and operations, based on examples from other fields, like classification societies in ship and offshore structures, IAQG in aerospace third-party quality certification, and taking into account trends in establishing middle-man space operations services (*e.g.*, CARA). The paper will also discuss possible expansions and integrated roles of United Nations space and aviation organizations (UNCOPUOS / ICAO).

2. Krystal Wilson

Using Volunteered Geographic Information for Achieving the Sustainable Development Goals

One important space application in support of the UN 2030 Agenda for the Sustainable Development Goals (SDGs) is using earth observation data together with crowdsourced geographic information, or volunteered geographic data, for improved decision making by national governments and others working on the SDGs.

Across a variety of levels, governments are providing their geospatial data in a free and accessible manner. This, in turn, opens up the possibility for citizens to contribute back to those data sets. In some cases, volunteers are actually creating data where governments don't have data sets to start with. Despite numerous successful projects and a growing body of use cases with proven results, there is still a lot of uncertainty about how best to ensure this type of geospatial data can be used effectively for decision making. Governmental practices, regulations and other legal issues can slow or even stop the adoption of these technologies and uses.

This paper will explore how VGI can be used in support of the Sustainable Development Goals and some of the current legal mechanisms for integrating publically created geospatial data together with "official" government data. It will look at challenges, such as data quality and ownership of data, to integrating volunteered geographic data with government geospatial datasets and provide an overview of potential solutions both at the national and international governance level.

3. Melissa de Zwart

Domestic Space Legislation: Guidelines for Sustainability in Commercial Space

This paper will consider the appropriate domestic legislative and regulatory frameworks to mandate sustainable uses of space. It will consider existing and proposed domestic space legislation and how this may effectively deal with sustainability issues, including environment, good governance, access to space resources, educational and other benefits.

With the increasing involvement of private, profit-seeking entrepreneurs in space, questions arise regarding how the benefits, including sharing and co-operative arrangements, built into the UN Space Treaties may effectively be carried forward into civilian, commercial space operators. For example, what obligations can exist in terms of sharing of discoveries, technology and limited resources. Do the obligations track meaningfully across to multinational corporations? Is space in danger of being 'privatised'?

These are key practical issues and ones which must be addressed in the context of the 2030 Agenda for Sustainable Development. This work will form the foundation for the development of a 'good practice' guide for commercial space, addressed to both regulators and space industry participants.

4. Monicao Mallowan and Maria Lucas-Rhimbassen

The 4th Estate at the Service of Sustainable Space Governance

In recent years, the space sector has gradually shifted towards increased privatization and commercialization; in doing so, it has become increasingly permeated with the business culture and managerial frames of reference, including some limitations inherent to management. Obstacles such as short-term thinking, lack of vision and transparency, technological barriers, aversion to change and diverging political agendas raise new questions as to what the role of global space governance should be, and how it could be used to implement sustainable development. Global space governance must address these challenges, but doing so requires us to take a step back and look at the bigger picture while re-examining some basic assumptions on the way, in order to reframe the overarching strategy along sustainable principles. In attempting to address this issue, at this stage, the authors examine a corpus of press articles and media sources. The findings provide a picture of the publication intensity on the subject of sustainable development and global space governance, and reflect the degree of visibility of these efforts, which gives us fresh insight into the critical importance of communication strategy for the field.

The issues raised by this study bear an additional symbolic relevance which is particularly germane, as 2017 marks the 50th anniversary of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967, as well as the 30th anniversary of the Brundtland Report (1987).

5. Gilles Doucet

National Incentives for Global Space Governance

Despite the emergence of problematic issues in global space governance, such as space debris, no binding international treaty has been concluded for almost four decades. All of the instruments since 1979 have taken the form of non-binding measures and statements of principle: so called soft law that States may ignore with little consequence. The lack of developments in space governance is attributed to the fact that there is little national incentive for countries to enter into binding instruments, which may impose limits on their freedom of action. Key issues such as space debris and space traffic management do not immediately threaten national interest; however, they threaten the collective interest in the long term. Successful international treaties often strike a "bargain" whereby States are incentivized to accept limits in exchange for the cooperation of other States. Noteworthy examples are: the Non Proliferation Treaty, the Chemical Weapons Convention, the Constitution and Convention of ITU and the Chicago Convention. This paper proposes a national incentive based model for outer space governance, whereby acceptance of certain norms is a condition of cooperation with other States. In a model analogous to the Annexes of the Chicago Convention an outer space convention could be concluded in which technological cooperation would be contingent on conformity to a set of standards. This would initially be focused on sustainability of the space environment (*i.e.*, minimizing debris, to manage space traffic), but the model could be applied to other space issues.

6. Stuart Eves

The Legal Implications of Improved Space Situation Awareness and Other Developments in Space Technology

In the coming years, the new US Space Fence radar system is expected to detect and track more space objects than those already included in the current catalogue. Space surveillance assets operated by the ComSpOC and other commercial entities are also likely to contribute to our understanding of the "chaff cloud" in Earth's orbit. Most of these additional objects are likely to be "anonymous"; retrospective assignation of newly-tracked small debris to a specific progenitor object will be challenging, as the majority of these fragments are likely to have been in orbit for many years.

The paper will consider the challenges posed by this radically different future space catalogue in which most of the tracked objects have no identifiable owner, and consequently there is no-one to hold liable in the event of a collision. The paper will also consider the very different scenario that might develop if it were possible to view space debris as an asset, rather than a liability. Specific technologies which are currently under development may lead to this radical change in our perspective on the population of objects in Earth's orbit. These technologies, their potentially positive commercial impact, and their possible legal implications will be outlined.

ABSTRACTS – SATURDAY, 6 MAY 2017

Parallel Session 5A: *Space Applications for Achieving SDGs - I*
9:00 – 10:40
Salon Ville-Marie (4th Floor)

	Name	Title
Chair: Ken Hodgkins		
1.	Miguel Yagues	The Combination of a Multi-Sensor Approach Under an Intra- and Extra-Regional Strategy for Tropical Forest Monitoring
2.	Juan Gonzalez Allonca	Privacy and Remote Sensing Satellites
3.	George Kyriakopoulos	Long-term Sustainability of Outer Space Activities: International Cooperation as a Fundamental Basis for a Comprehensive Space Traffic Management Regime
4.	Mark Skinner	Development of Distributed Space Object Tracking and Data Sharing as a Means to Achieving the UN 2030 Sustainable Development Goals
5.	Diane Howard/ Ruth Stilwell	GNSS and Sustainable Access to Space
6.	Don Flournoy	Space Governance Challenges re Space Solar Power
Discussion		

1. Miguel Yagues

The Combination of a Multi-Sensor Approach Under an Intra- and Extra-Regional Strategy for Tropical Forest Monitoring

Despite the enormous work done to date aimed at slowing the loss of tropical forests, tropical deforestation has not been reduced. The consequences have been devastating and have greatly affected the forest biodiversity, soil erosion, extinction of animals and plants, and climate change. Biodiversity studies have traditionally used the fieldwork for research. However, this technique falls short of obtaining a broader view of ecosystems. To remedy this situation, satellites can, through remote sensing instruments, get high-resolution images to provide more detailed data on the diversity of tropical areas and to establish environmental protection and conservation strategies. But they can also serve as early warning strategies for detecting illegal activities, such as illegal mining or arson attacks, which not only decimate tropical diversity but also release immense amounts of carbon. Indeed, the release of carbon particles have negative effects on global warming and consequently on the tropical sustainability by triggering droughts or the emigration of native species. Through space cooperation in the field of 3D mapping from satellite imagery of tropical forests, it would be possible to alleviate the negative impacts to which ecosystems are subjected and to draw up regional development plans. A plausible option would be the promotion of intra- and extra-regional cooperation. The intra-regional cooperation would focus on the synergies of space applications of the countries involved to improve their socioeconomic status. And the extra-regional cooperation would be developed through the participation of the major space-faring nations by offering their technological expertise to tropical actors.

2. Juan Gonzalez Allonca

Privacy and Remote Sensing Satellites

Many significant changes are taking place in the specific field of Earth Remote Sensing. The new generation of satellite sensors brings us the possibility of generating and delivering information at such a level of detail

that it could become a threat to people's privacy. Moreover, its capacity to process, associate and communicate those images on multiple platforms, mainly the Internet, more such hazards more potent.

Given that Earth Remote Sensing is one of the main commercial activities and given the constant growth of the activities of private businesses (especially smaller scale innovative enterprises as start-ups) in space, it becomes necessary to study the International Principles on Earth Remote Sensing since they remain silent about certain significant aspects such as distribution, dissemination and promotion of the data obtained by Earth observation satellites.

The current context with new advances on remote sensing (especially on high resolution monitoring) and high volumes of information on the Internet brings many benefits at low costs such as access to information in real time, so as to make daily decisions in industry, government, natural resources management, etc. On the other hand, this can generate significant risks for people´s privacy. In this context, we should begin to analyze possible solutions within an international legal framework in which the legitimacy of the collection of images of the country sensed by third-party sensing countries in the light of the right to privacy and the principles of personal data protection treatment.

3. George Kyriakopoulos

Long-term Sustainability of Outer Space Activities: International Cooperation as a Fundamental Basis for a Comprehensive Space Traffic Management Regime

Traffic management constitutes a crucial and decisive factor for good order, regularity, safety and efficiency in every sector within which transportation of persons and objects occurs. In traditional spaces of common use such as the sea or the air, integrated traffic control systems (VTS at sea, ATS in airspace) of legal/technical nature have long been established, on the basis of which navigation and aviation are carried out efficiently.

The evolution and proliferation of human activities in outer space, as well as the stronger-than-ever involvement of the private sector in this area have brought to the forefront of international consultations the issue of Space Traffic Management (STM). It is now obvious that an effective regulation of space traffic can contribute to an optimal space situational awareness, which is closely related to the safety of spaceflight and the protection of the space environment. In this regard, the Legal Sub-Committee of UNCOPUOS, in its 55th Session (2016), not only mentioned that STM was "of growing importance for all nations", but also pointed out that STM required "a multilateral approach".

The purpose of this article is, first, to show and record the factors and causes that make international cooperation imperative for an effective administration of traffic in outer space and, second, to indicate which methods and mechanisms should be implemented in the context of such multilateralism, taking into due account the existing experience of the regulation of traffic over and within the aquatic and air environment.

4. Mark Skinner

Development of Distributed Space Object Tracking and Data Sharing as a Means to Achieving the UN 2030 Sustainable Development Goals

Access to space remains difficult and expensive, even with the advent of small, low-cost satellite platforms (*e.g.,* CubeSats). This high barrier to entry may impede would-be actors in the space arena from participation and development in space-related activities, and associated benefits from such participation. Yet there exist less expensive endeavors that may be undertaken even before initial satellite deployment that would allow actors to develop technically, while in addition making a significant contribution to the long-term sustainability of outer space.

This paper outlines potential governance mechanisms related to global outer space activities that could contribute to achieving the UN 2030 agenda for sustainable development goals. We outline our ideas for aligning the UN Office of Outer Space Affairs (UNOOSA) with the International Astronomical Union Office of Astronomy for Development (IAU OAD), to bring together interested parties for the furtherance of

ground-based space object tracking along with international space object data sharing. Ground-based efforts of this nature offer a much lower barrier to entry for developing countries (and non-governmental organizations) to participate in the space enterprise, while at the same time furthering international cooperation, the development of educational and economic opportunities, environmental sustainability in space, as well as peace and security via transparency and confidence building measures.

5. Diane Howard and Ruther Stilwell

GNSS and Sustainable Access to Space

Space-based precision navigation and timing systems (GNSS) have and will continue to improve agile decision-making in aviation and maritime traffic management. Certainly, the use of GNSS represents one of the most relied upon space applications with ubiquitous impact on our daily terrestrial lives. A prime example is the usage of GPS included in our smartphones. This positive impact is consistent with the 2030 Sustainable Development Goals. However, GNSS has capabilities that are not fully exploited in national airspace and may provide a path to integration of all airspace users, including space operators. Environmental sustainability on Earth and in space by necessity includes a stable environment in the NAS. Current international GNSS governance provides some guidance in developing stronger space governance to protect the terrestrial, airspace and outer space environments and secure the long-term sustainability of all activities therein.

The paper discusses the historic background of GNSS, its current applications in the aviation and maritime sectors, and its inherent potentials for integrating multiple users of national airspaces and beyond. The paper also examines the current international frameworks governing GNSS applications and the guidance now under discussion in international fora, concluding with high-level recommendations to better utilize GNSS capabilities through increased cooperation and coordination.

6. Don Flournoy

Here Comes the Sun! Opportunities and Challenges in Implementing Space Solar Power

Space Solar Power (SSP) involves the gathering of sun's energy beyond the atmosphere of our planet and delivering it to Earth as a clean and sustainable source of electrical power. Its implementation is predicted to be a huge economic stimulus for space and related industries, since it will require more robust and reliable transport systems, larger and more sophisticated platforms in space, as well as more specialized earth receivers, storage and distribution systems.

Successful implementation will also require development of new global standards, cooperative agreements and rules for policing. As with the launching and implementation of communication satellites(ComSat) and services, there will be a need for a new space solar (SunSat) global regulatory regime that is mutually acceptable and that is followed so as to protect emerging and established players.

As a new player in space, the SunSat industry will inherit the negotiated rules of those already in place. This is both a good thing in that most of LEO and GEO space will be familiar territory. But it will present an obvious challenge in that SunSat providers will be disruptive innovators and competitors for increasingly scarce frequencies and orbital locations. There may also be conflicts related to SSP technical and operational standards. For example, energy beaming may or may not present a new level of threat *i.e.*, interference to the communications signals to and from Earth. And of course, the addition of these new energy-related enterprises will increase traffic to and from space and add to the prospect of additional space collision and debris.

Parallel Session 5B: *Space Applications for Achieving SDGs – II*
9:00 – 10:40
Mont Royal II (20th Floor)

	Name	Title
Chair: Joe Pelton		
1.	Niklas Hedman	The UN Register on Objects Launched into Outer Space – TCBMs and Notification Procedures
2.	Upasana Dasgupta	Reconciling State Practice of On-Orbit Satellite Transfer with the Law of Liability and Registration in Outer Space
3.	*Attila Matas and Yvon Henri*	*Orbit/Spectrum ITU International Regulatory Framework – Integral Part of Global Space Governance* ***(to be presented by Ram Jakhu)***
4.	Steven Freeland and Ram Jakhu	Promoting Peace from Above? Utilising Space for the Prevention and Prosecution of Human Rights Violations
5.	Anne-Sophie Martin	Space Applications as Instruments to Face Terrorist Threats
6.	Rajeswari Pillai Rajagopalan	Global Governance of Space Security: Challenges and Prospects
Discussion		

1. Niklas Hedman

The UN Register on Objects Launched into Outer Space – TCBMs and Notification Procedures

The paper will address the role of the United Nations Office for Outer Space Affairs (UNOOSA) in discharging the responsibilities of the Secretary-General under the legal regime of outer space, including by maintaining the United Nations register on objects launched into outer space, and in facilitating the implementation of transparency and confidence-building measures in outer space activities. The starting point will be the report of the Group of Governmental Experts on Transparency and Confidence-building Measures in Outer Space Activities (A/68/189) and the special report of UN-Space (A/AC.105/1116). The Office performs a major function as a facilitator and repository of key information for States and international intergovernmental organizations to ensure trust and confidence in space operations. UNOOSA additionally provides administrative, logistical, legal and capacity-building activities in this field in support of information exchange and notification procedures under the responsibility of the Secretary-General.

2. Upasana Dasgupta

Reconciling State Practice of In-Orbit Satellite Transfer with the Law of Liability and Registration in Outer Space

Satellites are useful means for ensuring welfare of mankind in the areas of education, socio-economic parameters, peace and security and environment protection. Thus, satellites can play a significant role in bringing sustainable development. However, only a few States have developed the technology to launch and manufacture satellites. Hence, it is prudent for new entrants to purchase or lease already functional in-orbit satellites as it avoids the legal and logistical hassles of obtaining launch licenses. The buyers do not need to wait for operation pending launch, may enter into multiple contracts and would be able to avoid the risk of launch failure. For existing operators too, in-orbit satellite transfer helps in dealing with sudden demand for satellite services.

However, the State practice in this regard has been inconsistent and often in violation of laws regarding liability and registration in outer space. For example, in some instances, transferee States have denied being the launching State and State of registry, yet have claimed jurisdiction and control over the satellites, whereas under space law only the State of registry can have jurisdiction and control and such State has to be a

launching State. One reason behind the latter is that the current space law framework is inadequate to address the issue of in orbit satellite transfer. The paper expounds on the legal issues that arise due to State practice in such cases, the need to reconcile State practice with international law and proposes pragmatic solution(s) in the current circumstances, including immediate and long-term solutions.

3. Attila Matas and Yvon Henri

The ITU Regulatory Framework of Orbit and Spectrum – Integral Parts of Global Space Governance

The ITU Member States have established a legal regime related to satellite orbit/spectrum resources which is codified through the ITU Constitution/Convention, including the Radio Regulations. These instruments contain the main principles and lay down the specific regulations governing the following major elements: frequency spectrum allocations to different categories of radiocommunication services; rights and obligations of Member administrations in obtaining access to the spectrum/orbit resources; international recognition of these rights by recording frequency assignments and, as appropriate, orbital information for a space station on board a geostationary-satellite or for space station(s) on board non-geostationary satellite(s), used or intended to be used in the Master International Frequency Register or by their conformity, where appropriate, with a plan.

Specific procedures have been established to ensure international recognition of the frequencies used and to safeguard the rights of administrations when they comply with those procedures. The fact that the ITU Constitution and Convention and the Radio Regulations that complement them are intergovernmental treaties ratified by governments means that those governments undertake: to apply the provisions in their countries; and to adopt adequate national legislation that includes, as the basic minimum, the essential provisions of this international treaty.

4. Steven Freeland and Ram Jakhu

Promoting Peace from Above? Utilising Space for the Prevention and Prosecution of Human Rights Violations

The promotion of peaceful and inclusive societies is one important component upon which the UN 2030 Agenda for the Sustainable Development Goals is founded, specifically SDG 16. Armed conflicts, military activities and the perpetration of acts constituting gross violations of human rights represent significant impediments towards the eradication of poverty, the provision for better health, gender equality, economic growth and equality, in addition to the human and environmental costs that they bring. We are witnessing an increasing number of conflict situations, many of which involve crimes that 'deeply shock the conscience of humanity'. A number of mechanisms of international criminal justice, established with the goal of 'ending impunity', now operate to prosecute those responsible for these acts, and to deter others from committing them in the future. Given the complexity of the trials before these courts and tribunals, the utilisation of satellite Earth observation imagery represents a vital tool to help these mechanisms as far as possible achieve these laudable aims. However, both the law and ethical guidelines concerning the veracity, admissibility and use of such images as credible evidence are in only a gradual state of development, compounding the complexity of their use as evidence in both legal proceedings and in the public sphere. This paper seeks to discuss the legal issues associated with the use – both at present and into the near future – of space infrastructure to promote the peacemaking and peace-restoring functions of international courts and tribunals. It will start with a brief description of the means and challenges in satellite evidence gathering and will offer some thoughts as to further areas worthy of detailed research with respect to this important role that space can play in the furtherance of the UN 2030 Agenda.

5. Anne-Sophie Martin

Space Applications as Instruments to face Terrorists Threats

The UN 2030 Agenda for Sustainable Development mentions in Goal 16 the strengthening of relevant national institutions, including international cooperation to prevent violence and combat terrorism and crime. Space capabilities are inherently international in character and play a seminal role in enabling the communication, coordination and networking of everybody, including terrorists. The Outer Space Treaty of 1967 highlights promotion and international cooperation in the use and exploitation of outer space (Article I, III and VI of the Outer Space Treaty). States need to be cautious and may consider stronger supervision and control to prevent the misuse of space capabilities.

Space assets such as SATCOM, GNSS and Remote Sensing, can play an important role in detecting, preventing and mitigating the damage done by terrorism. This could be undertaken under the auspices of an internationally recognised body like the United Nations. In June 2016, during the Committee on the Peaceful Uses of Outer Space, some delegations expressed the view that the Committee should introduce a new agenda item entitled "Combating terrorism using space technology". (A/AC.105/2016/CRP.18) Combating terrorism is an issue of utmost importance for international peace and security, and concerns all nations across the world.

6. Rajeswari Pillai Rajagopalan

Global Governance of Space Security: Challenges and Prospects

In this paper, the author initially outlines some of the key challenges facing the global governance of space. These challenges include the lack of consensus among major spacefaring powers and the crisis in decision-making that has paralysed the development of an effective outer space regime. Though there are a few legal instruments in place, they have been proven ineffective. This means old rules have to be reviewed or new rules of engagement need to be developed. There are new actors including non-State actors, new challenges including space debris, over-populated orbits, radio frequency interferences and issues of spectrum allocation, development of counter-space capabilities including anti-satellite weapons, and access to space especially for new entrants.

The author thus suggests some steps that could alleviate some of the challenges and build greater cooperation. These include, first, expanding and strengthening Space Situational Awareness (SSA) cooperation. SSA coverage must be expanded and strengthened to include more players. Major spacefaring powers must make efforts to establish a global initiative, possibly under UNCOPUOS. Second, better space traffic management measures to take care of the expansion of outer space activities in terms of more players and activities and capabilities. The growing density in the outer space environment calls for better traffic management practices and regulations. Third, given that political hurdles have come in the way of developing new rules of engagement, efforts must be made to strengthen dialogues to encourage openness, greater transparency and information-sharing. Fourth, while legally binding and verifiable measures are ideal, they are almost impossible in the current international political context. Hence, States should focus on norm creation, approaching space from a more pragmatic perspective to start with the least common denominator in the form of voluntary, non-legal measures that could enable better understanding, potentially reduce wariness, competition and rivalry.

Finally, urgent steps ought to be taken so as to limit the weaponisation of outer space. After a gap of more than two decades, there are early signs of space competition today. Militarisation of space is already a reality given that militaries use outer space assets for several passive military applications but the early trends towards space weaponisation must be stemmed.

Parallel Session 6A: *National Perspectives of Space Policies and Applications*
11:00 – 12:40
Mont Royal II (20th Floor)

	Name	Title
Chair: Niklas Hedman		
1.	Mukund Rao	Assessment for Space Governance – Collaborative Framework for SDG
2.	Li Shouping	Chinese Perspective on Space Sustainable Development Goals
3.	Isabelle Sourbes-Verger	Space Security Awareness and Global Space Governance: a European Perspective
4.	Sanat Kaul	UN 2030 Agenda and Indian Space Governance
5.	Bahar Ramazanova	The New Beginnings of Commercial Space Policy and Law in Post-Soviet Nations
6.	Venkataramaiah Jagannatha	Community Empowered Space Technology Role Models
Discussion		

1. Mukund Rao

Assessment for Space Governance – Collaborative Framework for SDG

The UN 2030 Sustainable Development Goals (SDG) aims to end all forms of poverty and promote prosperity of all nations (irrespective of economic status) while protecting the planet. The SDG emphasises on social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection. Each nation has primary responsibility for follow-up and programmes of SDG goals, the integration to regional and global measures is important.

Space technologies like earth observation (EO), satcom, positioning systems, etc. have tremendous potential in achieving the objectives of the SDGs. A key imperative is how "collaboration" would spur space technology for SDGs – this is the focus of this paper. As part of our study, we have looked at the space programmes, application and policy regimes in India, Japan, China, Malaysia, Thailand, Philippines, Singapore, etc. and have made assessment of the programmatic and cooperation framework in the Asia Pacific (AP) region. In specific, we have dug deep into the Indian and Japanese space programmes, as a test-be, for defining potentials of international cooperation and furthering space technology and applications in the region. We have been able to identify key programmatic elements of a "collaborative regime" that can emerge in the AP region.

This paper will discuss our assessment of AP region space programmes in the context of a collaborative framework for meeting SDG goals and emergence of a new model for regional/global space governance. It is envisaged that specific collaborative framework steps in EO applications, especially for disaster management, national geospatial programs, national and global security, environmental management, climate change, integrated high-bandwidth communications for data infrastructure and good positioning systems will help every nation to achieve and fulfil SDG goals. Even a spurt for space science and planetary habitation collaboration will be impactful – in particular at global level cooperation. More so, it is important to recognise that there will be those who will be "providers" of space technology and there will be nations who will be "users" of space applications/services. A collaborative framework is required so that all nations can partake and benefit from space and help achieve the SDGs. This is what our study, through the AP region evaluation, will outline.

2. Li Shouping

Chinese Perspectives on the Sustainable Development of Space

"Sustainable development of outer space" indicates that humans' space activities should meet both the needs of the present space-faring countries and the needs of other countries in the future; a State should be free to explore and use outer space, and should not impede the free exploration and use of outer space by other states. This paper includes three parts.

The first part insists that peaceful use is the basis for the sustainable development of outer space and the weaponization and arms race of outer space is one of the most serious threats to the sustainable development of outer space. The inherent meaning of peaceful use of outer space should include that states should not place, deploy and test any weapons in outer space, threat or use force against outer space objects. The second part, the core issue for the sustainable development of outer space, is to achieve the safety and security of outer space which includes not only defense security, but also the safety of the space environment and space assets. The third part examines how the rule of law in outer space guarantees the sustainable development of outer space. The rule of law in outer space first requires that states should conduct their activities consistently with the UN Charter and relevant outer space treaties. It also requires the system of outer space law and rules should be constantly improved and kept up with the times. At the same time, "soft law" concerning outer space should be developed steadily, and play an effective role in realizing the rule of law in outer space.

3. Isabelle Sourbes-Verger

Space Security Awareness and Sustainable Development - a French/European perspective

Almost 60 years after the launch of Sputnik, and while the weaponisation of space seems unavoidable to some, it is worth recalling that the Space Age began under favourable omens of scientific collaboration with the International Geophysical Year (1957-1958). The images of Earth, by giving a new vision of our planet, were essential to the development of the concept of sustainable development. In parallel, the diversification of space systems has contributed to fundamental knowledge, education, and telemedicine as well as the management and security of territories. Recently, the crucial role of space systems in societies' activities was reinforced, as shown by the inauguration of the NewSpace age with its impressive multiplication of constellations.

Sustainability and safety are now concerns at the heart of global governance in order to preserve the space environment and the use of its resources for future generations. Europe has clearly shown its involvement, whether at the state level, at the agency level or through the European Union. Concrete initiatives are implemented, in particular, by the ESA and National Space Agencies. Yet the more political question of monitoring aggressive actions in space is still implicit and a European Space Security Awareness is slow to emerge. The European case is thus particularly informative to think through the challenges of a global governance that needs to become operational as fast as possible if we want to respect the aims of the OST, while meeting its commitments towards a guaranteed universal use of space, indispensable to the implementation of sustainable development.

4. Sanat Kaul

UN 2030 Agenda and Indian Space Governance

The Indian Space Research Organisation (ISRO) was established in 1969 with a very clear objective of enhancing the quality of life of its poor people. ISRO has since made great strides in achieving its goals. However, in order to reach the Sustainable Development Goals (SDG) India needs to do much more in the next 13 years. India's bureaucracy is unable to cope with the pressures of its population. The cost of achieving these goals also appear on the high side by using traditional methods. Therefore, innovative methods must be found. The Government already has the 'Digital India' and 'Start-up India' missions with which the possibility of reaching many people for many of the SDGs is possible. Even though there are

multiple good development schemes being implemented, the problems of mass deficiency of medical facilities, quality of education in primary and secondary schools and lack of professional skills training, amongst others, persists.

The solution to meeting these goals lies in adopting Space Apps with appropriate software. Telemedicine, tele-education, space based apps for improved agriculture practices, use of UAVs for land mapping, disaster management, etc. are all methods that could help bypass the tedious and expensive method of meeting SDG targets. This paper will analyse what India can do to meet these targets as well as touch upon India's current achievements. The main advantage for India is that it is ready and able to revolutionise the method of delivery to achieve the SDGs of 2030 due to its established space infrastructure. As such, it can leapfrog the traditional stages by leveraging its existing space infrastructure.

5. Bahar Ramazanova

The New Beginnings of Commercial Space Policy and Law in Post-Soviet Nations

The commercialization of space activities has recently come to the fore in former USSR States. States of the post-soviet era have enacted their own space policies as a result of the development of the global space market. As such, the concentration of this paper is mostly the political and regulatory factors for a new space industry in the fifteen countries. In terms of that goal, the paper's first section is focused on the States' historical space activities as part of the Soviet Union and their legal issues and response measures taken. Subsequently, the paper touches on each individual country's domestic policy and laws with enlightening details. Additionally, the applicable laws for the new space activities will be analyzed by giving more attention to comparative research on the existing commercial laws of other nations with developed space industries.

6. Venkataramaiah Jagannatha

Community Empowered Space Technology Role Models

A review of Earth Summit Agenda 21 targets by UNCED signatory nations reveal mixed results. India's 73rd and 74th constitutional amendments in 1992 focussed on rural and urban development in the form of new laws: Panchyat Raj Act and Nagarapallika Act. Agenda 21 confirmed participation as a key to sustainability and decentralized governance as a strategy. Taking clues from the various best practices in India, it is revealing that space technology has started to breakthrough self reliance by empowering communities. Telecommunication and resource management have been able to provide advantages in the dual use of space technology in India, especially in human development. The founding fathers of Indian space programmes and the successive leadership has been able to facilitate an irreversible integration of space technology into human welfare activities.

This paper reports on the best practices of space technology that affects community life in India. Projects and missions such as the 1995 Integrated Mission on Sustainable Development and the Sujala Watershed Projects are role models and a focus is made on village resources centers. An attempt is made to capture the good space technology practices of resource management and environmental data based on village resource centers. It is inferred that space governance mechanisms need to evolve based on the UN Sustainable Development Goals 2030 and national priorities. A specific vision, agenda and timeframe are vital to such bottom-up planning strategies at the community level.

Parallel Session 6B: *Space Natural Resources for Human Needs on Earth*
11:00 – 12:40
Salon Ville-Marie (4th Floor)

	Name	Title
Chair: Steven Freeland		
1.	Ricky Lee	Preservation of Life on Land: How Exploitation of Asteroid Resources Can Help Achieve Sustainable Development Goal #15
2.	Maria Manoli	Natural Resources Exploitation as an Apple of Discord: The Need for a Space Governance Mechanism Towards Effective Benefit Sharing
3.	Gordon Chung	An Incentivising Regime for Private Enterprises: The Enduring Benefits Derived From The Commercialization of Outer Space
4.	Lawrence Roberts	The Integral Contribution and Limitations of A Space Property Regime To Sustainable Development
Discussion		

1. Ricky Lee

Preservation of Life on Land: How Exploitation of Asteroid Resources Can Help Achieve Sustainable Development Goal #15

The doomsday predictions of the eventual exhaustion of mineral resources on Earth have been around for some time. Just as Malthus predicted that population growth would require the cultivation of lower-quality fields that require more capital and labour for less food output, the world is now investing more capital and labour for reduced mining productivity, as we are compelled to exploit lower grade mines to maintain continual supply. The recent dispute in the WTO between China, which controlled around 97% of the world's production of the 17 rare earth elements, and the EU, Japan, and the US, the largest consumers, is symptomatic of the imminent onset of resource scarcity and exhaustion.

Mining activities pose a serious environmental threat by causing erosion, damage, or destruction to natural ecosystems and biodiversity, as well as soil, groundwater and surface water contamination. Examples of environmental catastrophes from mining activities abound, of which the Bento Rodrigues iron ore mine in Brazil is only the most recent example of disaster. The drive to exploit lower grade ores poses a serious threat to the Earth's environment, particularly pristine areas such as the Arctic tundra or the Amazon rainforest, which only jeopardises our ability to achieve UN Sustainable Development Goal #15.

This paper explores the possible onset of resource scarcity and exhaustion, the economic, mineralogical, and commercial case for the exploitation of asteroid resources, and the present state of domestic and international law applicable to such activities, that are an essential part of a sustainable human future.

2. Maria Manoli

Natural Resources Exploitation as an Apple of Discord: The Need for a Space Governance Mechanism Towards Effective Benefit Sharing

Space technology applications are considered the most advanced facet of human-driven technological achievements by simultaneously contributing to the preservation of the biggest part of human activity as well as to the advancement of humankind's existence itself. Technology is also considered a tool of power; one that can become dangerous if not used wisely. Indeed, Marxist theory illustrates such a reality by qualifying technology as a driver between social structure and forces of production: the more technology allows for further advancement and new types of production, the bigger the gap between those who benefit from it and those who cannot afford it. Departing from the microcosm of a State's society (as described in Marxist philosophy) and heading towards the macrocosm of the International Community with States as actors, a similar situation can be observed: the more technology-advanced a State is, the higher the possibility

that similar 'stratification' will exist on the international scene: if one considers the power that would accompany the exploitation of space natural resources, one would also realize that the formation of inter-State layers of stratification is not unreasonable.

On the other hand, the use of such space natural resources exploitation technologies entails the potential of advancing – and to a significant extent achieving – the sustainable development goals of the UN 2030 agenda: such applications can reduce poverty and hunger by contributing to economic growth and aiding the establishment of sustainable cities and affordable and clean energy through the promotion of industry in an innovative manner as well as through the establishment of partnerships. Yet, the appropriate use of space resources exploitation technology is a multifaceted issue with philosophical and practical dimensions, both of which depend on space governance models. In fact, governing our commons has never been an easy task: in this instance, the problem does not consist of the exploitation of space natural resources by technology-holders, but rather in sharing the profit with those without such capability. It is in this context that this paper explores (i) the appropriate governance model for the exploitation of space natural resources and (ii) the appropriate way in which, and forum where, it should be discussed and agreed to. Whether this model should entail an element of multilateralism or a case per case bilateralism is one of the issues to be addressed. All in all, the paper attempts to prove that the solution to the issue of outer space natural resources exploitation is far from a mere interpretation of the 'non-appropriation' principle, but rather one of governance.

3. Gordon Chung

An Incentivising Regime For Private Enterprises: The Enduring Benefits Derived From The Commercialisation Of Outer Space

In November 2015, the passage of the US Commercial Space Launch Competitiveness Act (Space Act of 2015) represented a pivotal step in the commercialization of outer space, by explicitly granting US citizens' property rights over asteroid resources mined in outer space. Despite this bold step taken by the US, the legitimacy of this act has been questioned. Although the existing international regime governing commercial space activities remains largely uncertain, a close reading of the Outer Space Treaty revealed that the Space Act of 2015 was enacted in full compliance with, particularly, the "common interest" principle (Art. I), the "non-appropriation" principle (Art. II), and the "due regard" principle (Art. IX) enshrined in the Treaty.

The Space Act of 2015, whose legitimacy is justifiable both in theory and practice, potentially serves as a "model" legislation incentivising States and their private enterprises to actively engage in space exploitation. This is particularly so when considering that, in reality, the incentive for space exploration is predominately driven by the incalculable potential for making a profit. The emergence of an international regime is, therefore, warranted to unambiguously legitimise the assertion of property rights by private enterprises over lunar resources and to officially place our imprimatur on the commercialisation of outer space. The increased exploitative activities, arising from the proposed regime, are anticipated to confer enduring benefits on the scientific, economic and environmental development of the Earth, especially in view of the fact that terrestrial resources are rapidly depleting.

4. Lawrence Roberts

The Integral Contribution and Limitations of A Space Property Regime To Sustainable Development

It has been nearly 60 years since the dawn of the space age and 50 years since the completion of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty). In that time, tremendous strides have been made in overcoming the daunting challenge of advancing development in a sustainable manner not merely among developed nations but across the developing world as well. Space technologies have played an essential role in that process. Space based weather and climate forecasting, remote sensing, and communications have proven invaluable in saving lives in the face of natural disasters, recovering resources in an environmentally sound manner more efficiently and equitably, providing mechanisms for even the most impoverished to gain

access to the global community for quality of life enhancement and profit and giving all States a better long-term understanding of challenges facing humanity.

For all these successes, the sustainable development of space and the distribution of the benefits of such development have been severely limited by the absence of a comprehensive property regime in the Outer Space Treaty. This lacuna has discouraged the development of a broad, robust space infrastructure that would lower the cost of space operations and result in less expensive and more varied space-based data products. Properly designed and limited with sensible regulatory oversight, a space property regime would, through redistributive mechanisms, promote development among all nations and contribute to an adaptive, sustainable developmental model for the high frontier.

Session 7: *Modes of Global Space Governance: Tools to Move Forward*
14:00 – 15:40
Mont Royal II (20th Floor)

	Name	Title
Chair: Paul Meyer		
1.	Theresa Hitchens	The UN GGE on Transparency and Confidence-Building Measures in Outer Space Activities: How Middle Powers Can Overcome the Failure to Launch
2.	Duncan Blake	Manual on International Law Applicable to Military Uses of Outer Space
3.	Eytan Tepper	Time for Reform: Preparing UN-COPUOS for the Next 50 Years of Space Exploration
4.	Maria Lucas-Rhimbassen/ Lucien Rapp	Space Resilience 4.0: Contracting for Resilient Space Infrastructures
5.	Lorna Jean Edmonds/ Seth H. Baker	The Interconnection of Universalization and the UN2030 Agenda: The 21st Century Leadership Imperative
Discussion		

1. Theresa Hitchens

The UN GGE on Transparency and Confidence-Building Measures in Outer Space Activities: How Middle Powers Can Overcome the Failure to Launch

The 2013 Report of the UN Group of Governmental Experts on Transparency and Confidence-Building in Outer Space Activities – a landmark agreement on steps to improve space security – has essentially suffered from a failure to launch. The GGE Report, approved by consensus and subsequently adopted by the UN General Assembly, was aimed at reducing threat perceptions, misperceptions, miscalculations and risks of conflict escalation in space, and laid out a basic framework for multilateral actions towards the goal of maintaining peace and security both in space and on Earth.

Unfortunately, increasing geopolitical tensions between the United States, China and Russia, and advances by each in space-related technologies that could enable the development and deployment of weapons systems, have relegated the GGE Report to gathering dust on diplomats' shelves. But the recommendations have never been more important, as the three major space actors slide slowly toward military confrontation in space that could disrupt strategic stability and imperil the use of space for economic growth and development.

This paper will review the GGE recommendations, and elucidate ways that Middle Powers, such as Canada, can forward their progress. These countries have an opportunity to lead on implementation activities, such as the establishment of national focal points for data exchange, and the development of incentives for fuller compliance with the UN Registry of Space Objects. It will also consider additional steps at the multilateral level for establishing a foundational space governance framework; for example, development of a baseline global space situational awareness network.

2. Duncan Blake

Manual on International Law Applicable to the Military Uses of Outer Space

The regulatory framework for the use and exploration of outer space is very much international, and even supra-national, by nature and touches upon regulatory frameworks in many other contexts (for example: arms control, the electromagnetic spectrum, communications, armed conflict). The interaction between international humanitarian law (IHL), international law on the use of force (ILUF) and international space law (ISL) are emblematic of this broader issue and warrants investigation. Whatever the framework for

global space governance, the unfortunate reality is that the possibility of hostilities involving outer space cannot be dismissed. It would undoubtedly be disruptive of global space governance, but norms of the laws of war do put some boundaries on collateral effects of hostilities. Unfortunately, there is a current lack of clarity with regards to legal rules applicable to circumstances of conflict involving outer space

The MILAMOS Project seeks to address this lack of clarity. However, the rules in each of ISL, ILUF and IHL were drafted or established in a disparate fashion, independent from one another resulting in a 'fragmentation' of potentially conflicting rules. Yet, international law does not provide a hierarchy of rules; therefore, resolving conflicts between rules is left to ad hoc legal reasoning. This is especially true for military uses of space, including in periods of tension and hostilities. This Project will inevitably involve preferences between rules from disparate areas of international law. How are those preferences made and what does this mean for how the regulatory framework for outer space relates to other areas of international law?

3. Eytan Tepper

Time for Reform: Preparing UN-COPUOS for the Next 50 Years of Space Exploration

Space law, and with it the governance of space activities, has stagnated for nearly four decades, with no sign of change, leaving even major challenges, like weaponization and resource-mining, un-addressed. UNCOPUOS, which during its first 20 years gave birth to all the space treaties we have today, has long since stood practically paralyzed. In the absence of international regimes, States are going at it alone whether by developing space weapons or by national legislation, notably the 2015 US law granting US companies property rights in space resources they obtain. This is a worrying trend of retreat from multilateral arrangements. UNCOPUOS is at a crossroads – over the next decade it will reform or lose relevance. UNCOPUOS must use UNISPACE+50 first and foremost to reflect and reform.

This paper suggests a reform in the structure of UNCOPUOS that will make it more inclusive on the one hand, and more efficient on the other hand, by: (i) inclusive-opening UNCOPUOS to membership of all States who express interest in space exploration and accept the basic principles of space law; (ii) efficiently-modernize the work-procedure of UNCOPUOS' assembly and have smaller, dedicated, issue-specific forums that will prepare rules, procedures and guidelines, each in its assigned issue. The forums will be comprised of stakeholders, *i.e.*, the States, non-State actors and professionals (*e.g.*, engineers) that directly engage in the said issue. Each forum will submit a report to UNCOPUOS' assembly and each State will then have the option to accept the report and the measures it suggests (*e.g.*, treaty, guidelines, etc.). The best gift we can bring to UNCOPUOS' 50th birthday, and to all humankind, is a reform that reclaims its space in global space governance.

4. Maria Lucas-Rhimbassen and Lucien Rapp

Space Resilience 4.0: Contracting for Resilient Space Infrastructure

While the 2030 UN Agenda focuses on sustainable development, several States and agencies focus in their respective space security policy on *resilient infrastructures*. Resilience is a transdisciplinary term derived from ecology and gradually incorporated in other fields such as psychology, engineering, and risk management. This paper suggests that it is time to continue its transition and to include resilience within law; more specifically within space law, from a micro-legal perspective. Indeed, we will consider contractual clauses. The purpose of this paper is multi-faceted and centers on the core notion of demystifying the concept of resilience and to propose a new contractual instrument addressing it by means of a definition, accompanied by a corresponding clause. For academic purposes, we will also provide a series of recommendations for a proper *resiliensis spatialis*, comprising of a model of soft and hard resilience, respectively referring to organizational governance (process) and contractual recommendations (outcome). The rationale behind our thinking is that space infrastructures must acquire a critical status as society relies increasingly on space systems which are vulnerable to traditional (natural) but also new (man-made) sources of threat. We will

identify sources of risk and determine whether contractual practice as is (based on different clauses such as warranties, force majeure, cross-waivers, etc.) responds to current and emerging security and sustainable development imperatives or not. Our findings convince us of the contrary, meaning that it is time to take an innovative and proactive stance in the legal field. Since space is undergoing a transition towards commercialization, we consider that the private sector can take the lead and urge the public sector to act consequentially. Indeed, the space context is crossing risky times and resilience can help maintain both a sustainable development and dialogue as technology is now not only borderless, but "spaceless", meaning crossing not only physical, hardware and terrestrial boundaries, but also intangible and outer space limits with relative obscurity and uncertainty.

5. Lorna Jean Edmonds and Seth H. Baker

The Interconnection of Universalization and the UN2030 Agenda: the 21st century leadership imperative

As we witness the exponential investment in space development, exploration and security, we must pause to think collectively about the governance and sustainability of Earth as control extends into the universe. We need to prepare the next generation of citizens for this emerging field. We are experiencing a shift from globalization to 'universalization' as this century's paradigm. Universalization asserts that we are living in 'one world within the universe' and that universal sustainability requires a cooperative and inclusive approach to development for the benefit of all. The United Nations 2030 Agenda for Sustainable Development (UN2030 Agenda) speaks to "a broad and universal policy agenda … devoting ourselves collectively to the pursuit of global development and of "win-win" cooperation which can bring huge gains to all countries and all parts of the world". The core values of universalization and the UN2030 Agenda are aligned and timely, given the mounting pressures for effective governance of 'universal' issues. This presentation aims to contribute to 1) the dialogue of including space activities in the UN2030 Agenda; and 2) the imperative for more students, scholars, citizens and policy makers to be engaged in space development and its implications for Earth's governance. It is essential that higher education prepare the next generation of citizens with skills and tools so that they are confident and competent to live in the new paradigm and lead this development agenda. The presentation contends that the 21st century leaders be culturally astute, globally discerning, and internationally connected for creating an atmosphere of cooperation for sustainability.

PRESENTER BIOGRAPHIES

Audrey L Allison is Senior Director, Frequency Management Services for The Boeing Company. Her organization provides radiofrequency spectrum acquisition and policy support for Boeing technology, products, services, and operations worldwide – and to Boeing's commercial and government customers. She is based in Boeing's Washington D.C. Government Operations office, having previously worked for the Federal Communications Commission's International Bureau, Iridium LLC and the Department of Defence. Ms Allison is Boeing's representative to the International Telecommunication Union (ITU), having chaired Committee 6 of the 2015 World Radiocommunication Conference and elected as Vice-Chairman of the ITU's Radiocommunication Advisory Group (2008-2015). Ms Allison is a member of four Federal Advisory Committees on international and national spectrum management and telecommunications matters. Allison is an attorney with a Master of Business Administration, *cum laude,* from the International Space University, a Master of Laws in international law from Georgetown University, and a *Juris Doctor* from Catholic University of America's Institute for Communications Law Studies. She is the author of *The ITU and Managing Satellite Orbital and Spectrum Resources in the 21st Century* (Springer, 2014), is adjunct faculty to the International Space University in Strasbourg, France, and a visiting lecturer at McGill University's Institute of Air and Space Law.

Andrew Butler is an Australian Lawyer, Australian Registered Migration Agent, New Zealand Licensed Immigration Adviser and will be receiving his call to the Ontario Bar this coming June. He has worked in the immigration field for the past decade, first for the Australian Government and later for immigration firms in London (UK), Melbourne, Sydney and Toronto. Having completed a *Master of Research* from Macquarie University in 2016 examining the future intersection of international migration law and international space law, Mr Butler has also received *LLM*s from both the University of Melbourne and the Australian National University. An alumni of the International Space University, he holds a *Graduate Certificate in Space Studies* from the University of South Australia and has completed McGill University's Strategic Space Law Program. He is currently employed in a research capacity by both the Melbourne Social Equity Institute and Melbourne Law School at the University of Melbourne.

Gordon Chung is a final year law student at the City University of Hong Kong. As a young legal scholar, Mr Chung's articles have been accepted for publication by international law journals, including the European Review of Private Law, Asia Pacific Law Review and Hong Kong Law Journal. He has participated in the 2017 Manfred Lachs Space Law Moot Court Competition (Asia-Pacific Regional Round) and has developed strong interest in space law. In recognition of his academic excellence and community service, Mr Chung is honoured to have won over 10 academic and volunteering awards. Alongside his extensive internship experiences in the Chinese court, LexisNexis and law firms, Mr Chung is currently a contributor to the Ford's International Commercial Reports & Review. He also served as a Research Assistant to various law professors at his university.

Joseph Clift holds a BS in Bioengineering from the University of California, Riverside. He is currently pursuing his MS degree in Space Studies, with a focus on Human Factors and Spaceflight. Mr Clift hopes to enter the NASA Astronaut Corps after his studies.

Upasana Dasgupta is a DCL Candidate at the Institute of Air and Space Law, McGill University with the Erin JC Arsenault and Robert E Morrow, QC Fellowships. She is also a student researcher for the Space Security Index and a research assistant of the Institute of Air and Space Law. She pursued her Master in Air and Space Law from Institute of Air and Space Law with an Erin JC Arsenault Fellowship and her basic law degree from Dr Ram Manohar Lohiya National Law University, Lucknow, India. She was a recipient of the Emerging Space Leaders Grant to attend the International Astronautical Congress, 2016. Prior to this, she used to work in the capital markets

division of Amarchand & Mangaldas and Cyril Amarchand Mangaldas, one of the biggest law firms in India. She has also worked in the corporate law division of Udwadia Udeshi & Argus Partners in India.

Philip De Man is currently working as a postdoctoral fellow of the Research Foundation - Flanders. He teaches courses on international and European space law in the Master of Science in Space Studies at the University of Leuven, Belgium. In addition, Mr De Man is part of the Belgian delegation at the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space in Vienna, Austria. His recent publications include the monograph *Exclusive use in an inclusive environment - The meaning of the non-appropriation principle for space resource exploitation* as part of the Springer Space Regulations Library. Mr De Man's other areas of expertise include international criminal law, international humanitarian law, the law of international organisations.

Lena De Winne holds an MSc in engineering from Moscow Power Engineering University, an MBA from European University in The Hague, and a PhD in psychology from California Southern University. After fifteen years of a successful career at the European Space Agency (ESTEC, The Netherlands), where she worked in business development, liaison, promotion and education, she published several popular books in English and Russian on the topic of space for children and adults, and hosted a television program in Belgium. In 2014, she joined Aerospace International Research Centre (AIRC, www.airc.at) as a Director. One of the flagship projects of AIRC is "ROOM – The Space Journal", where Ms De Winne is a Director. From mid-2016, Ms De Winne has been actively involved in the build-up and development of Asgardia – The Space Nation. She holds the position of the CEO in the NGO Asgardia.

Professor Melissa de Zwart (PhD, LLM, LL B (Hons), BA (Hons)) is Dean of the Adelaide Law School and Deputy Director, Research Unit on Military Law and Ethics. She has published and consulted widely on issues relating to law and new technology, particularly in the digital environment. Prior to joining academia, she was the Manager, Corporate Legal Services, CSIRO, providing advice on commercialisation of novel technology. She is a member of the Advisory Council of the Space Industry Association of Australia and the International Space Law Group of MILAMOS.

Gilles Doucet is an independent space security consultant with expertise in satellite technologies, military space applications, space regulatory frameworks and international space security cooperation. Mr Doucet recently retired from the Canadian Department of National Defence after 35 years as a DRDC scientist, where he held numerous positions researching and assessing space capabilities relevant to military applications. He headed multidisciplinary scientific teams providing expertise to the Canadian Armed Forces for operations and threats, DND for policy and Global Affairs Canada for technology exports and international engagement. Mr Doucet's experience also includes a diplomatic role, serving as Counsellor for Defence R&D at the Canadian Embassy in Paris, France from 2008 to 2010. Mr Doucet holds Bachelor & Masters degrees in Mechanical Engineering (Ottawa, 1981 & 1993) and a Graduate Certificate of Air and Space Law (McGill -2017).

Dr Lorna Jean Edmonds is the Vice Provost for Global Affairs and International Studies and Professor, College of Health Sciences and Professions, at Ohio University (OHIO). Before joining OHIO in 2013, she worked in four of Canada's research-intensive universities, including the University of Toronto, Queen's University, Western University and the University of Ottawa. Dr Edmonds has more than 25 years of leadership experience in international development and the globalization of higher education. She has collaborated with partners and implemented programs in more than 60 countries in Asia, the Americas, Europe and Africa. Over this period, her academic interests have shifted from global health to the health of the globe and Earth's sustainability with a particular interest in space governance and the need for talent and scholarship in this emerging field. She has a Ph.D. at the University of East Anglia, UK; MHA at the University of Ottawa, CAN; and BA (Sciences) at Queen's University, CAN.

Dr Stuart Eves is Lead Mission Concepts Engineer for Surrey Satellite Technology Limited. He has worked in the space industry since 2004, following a 16-year career with the UK MOD. Dr Eves has worked on a variety of satellite missions, including Skynet 4, Skynet 5, and TDS-1. The highlight of Dr Eve's career to date was the initiation of the TopSat imaging satellite programme, which established a new world record for "resolution per mass of satellite", and was the subject of a display in the Science Museum in London. He has been writing on the subject of space security for several years, and is currently the industry chair of the UK's Space Information Exchange (SPIE) forum. He has also recently completed a book entitled *Space Traffic Control*. Dr Eves has an MSc in Astrophysics, a PhD in constellation design, and has been a Fellow of the UK's Royal Astronomical Society for more than 25 years

Don M Flournoy, Editor, Online Journal of Space Communication; Telecommunications Professor Emeritus, Scripps College of Communication, Ohio University, Athens, Ohio. He is an Advisor to the National Space Society, launched the www.spacejournal.org website in 2002 (in a collaboration between Ohio University and The Society of Satellite Professionals International (SSPI)) and is author of *Solar Power Satellites* (Springer 2012). Under his leadership, Ohio University was designated an NSS Centre of Excellence in Space Solar Power and Power Beaming.

Steven Freeland is Professor of International Law at Western Sydney University. He is also Visiting Professor at the University of Vienna; Permanent Visiting Professor of the iCourts Centre of Excellence for International Courts, Denmark; Member of Faculty of the London Institute of Space Policy and Law; Visiting Professor at University Toulouse1 Capitole; Adjunct Professor at University of Adelaide; and a former Marie Curie Fellow (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 represented the Australian Government at United Nations Conferences and Committee Meetings, and has been appointed to advise 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 International Institute of Space Law, and a member of the Space Law Committee of the International Law Association. Mr Freeland sits on the Editorial Board of a number of international journals and is also Co-Editor of the book series *Annotated Leading Cases of International Criminal Tribunals*.

Juan Cruz Gonzalez Allonca is a professor in the National University of La Matanza (UNLaM), researcher in the Study Group on Software Engineering Methodologies (GEMIS) at National Technological University (UTN) in Buenos Aires and Coordination Council Member of the NETmundial Initiative. Having graduated from the Faculty of Law, University of Buenos Aires, Mr Gonzalez Allonca is a lawyer developing a specialization in Systems Engineering Information by completing a Master's thesis at the National Technological University. Mr Gonzalez Allonca also holds a postgraduate diploma in Management of Information Security by the Faculty of Engineering of the Universidad Austral. In turn, he is a researcher in the field of cyberlaw and space law.

Niklas Hedman is Chief of Committee, Policy and Legal Affairs Section (CPLA) of the United Nations Office for Outer Space Affairs (UNOOSA). He serves as Secretary of the Committee on the Peaceful Uses of Outer Space (UNCOPUOS) 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 the Office's capacity-building programme 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).

Theresa Hitchens is a Senior Research Scholar at CISSM, where she focuses on space security, cyber security, and governance issues surrounding disruptive technologies. Prior to joining CISSM, Hitchens was the director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva from 2009 through 2014, serving as a consultant to the UN Group of Governmental Experts on Transparency and Confidence Building Measures in Outer Space Activities, provided expert advice to the Conference on Disarmament regarding the prevention of an arms race in outer space (PAROS), and launched UNIDIR's annual conference on cyber security. From 2001 to 2008, Ms Hitchens worked at the Centre for Defence Information, where she served as Director, and headed the centre's Space Security Project. She was also previously Research Director of the Washington affiliate of the British American Security Information Council (BASIC). Ms Hitchens previously worked for *Defense News* of Springfield, Virginia, serving as International Editor on security. Hitchens's latest publications include, "Space Security-Relevant International Organizations: UN, ITU, ISO", 2014 and "Saving Space: Threat Proliferation and Mitigation", 2009. Hitchens holds a Bachelor of Science in journalism from Ohio University in Athens, Ohio.

Professor Dr Diane Howard is Assistant Professor in the Commercial Space Operations program at Embry-Riddle Aeronautical University in Daytona Beach, Florida, USA. She is responsible for curriculum development and teaching space law and policy courses that are core to the program. Dr Howard has long been involved in commercial space issues. After working as a staff attorney in the Florida Appellate courts, she took the decision to specialize in space law and attended McGill University's Institute of Air and Space Law. Her LLM thesis centred upon private space law issues and her doctoral work focused upon effective spaceport regulation. Dr Howard serves as Executive Secretary of the International Institute of Space Law and participates in numerous legal projects, both domestically (within the US) and internationally. In addition to the IISL, Dr Howard is a member of the AIAA, the International Association for the Advancement of Space Safety, the American Society of International Law, and the Florida Bar. She chairs Embry-Riddle's annual space traffic management conference.

Venkataramaiah Jagannatha brings eco-literacy individuals and communities based on UNEP/UNESCO/IEEP 1977 objectives, which are vital for the UN Sustainable Development goals. As an environmental engineer with 59 years experience, a scholar in harnessing water resources for urban settlements and working as a Dy. Manager in the Indian Space Program (ISTRAC and ISRO), Mr Jagannatha is based out of Bengaluru, India. He also acts as a trainer and communicator to drive community empowerment activities as a science activist in India. Mr Jagannatha is an alumni of International Space University in 2011, an innovator of zero cost space environmental models such as using trees as ground water recharge points, a recipient of IIED UK Sustainable Development Library Gift of the UNCED in 1992 and an environmentalist by the National Institute of Quality Assurance, India in 1987. He was a professor and HUDCO Chair for Capacity Building of Urban local bodies from 2008 to 2012, a Planning Member of UN University in 2000 and Panel Member of UN University's Internet Conferences in 2003.

Professor Dr Ram S Jakhu is Director of, and a tenured Associate Professor at, the Institute of Air and Space Law, McGill University, Montreal, Canada. He teaches and conducts research in international space law, law of space applications, law of space commercialization, space security, national regulation of space activities, and public international law. He served as Director, Centre for the Study of Regulated Industries, McGill University, during 1999-2004. He also served as the First Director and Faculty Member of the Master of Space Studies Program of the International Space University, Strasbourg, France, during 1995-1998. Professor Jakhu has taught Space Law and Policy in several countries, convened and participated numerous international interdisciplinary space law

and policy related conferences and workshops around the world, and currently heads a multi-million dollar research and outreach program for space law and policy. Professor Jakhu is the Chair of the Management Board of the McGill Manual on International Law Applicable to Military Uses of Outer Space Project (MILAMOS), co-editor of International Study on Global Space Governance, and Member of the World Economic Forum's Global Agenda Council on Space. In 2016, he received the "Leonardo da Vinci Life-Long Achievement Award" from the International Association for the Advancement of Space Safety and in 2007 the "Distinguished Service Award" from International Institute of Space Law for significant contribution to the development of space law. Professor Jakhu has co-authored three books, about 100 articles and 20 research reports and edited 9 books, including the one that received the 2011 Book Award from the International Academy of Astronautics. A Canadian citizen for over 40 years, he has visited over 70 countries in the world and has often been interviewed by the global media regarding matters related to space policy, law and programs. He holds Doctor of Civil Law (Dean's Honours List) and Master of Law (LLM) degrees from McGill University, Canada, as well as LLM, LLB, and BA degrees from Panjab University, India.

Dr Sanat Kaul was a civil servant in India until 2007. During his career, he was in the Ministry of Civil Aviation as a Joint Secretary and on the boards of Air India and Airports Authority of India. He was also involved with the abortive divestment of Air India and setting up of Greenfield Airports in India. From 2002 to 2005 he was India's Permanent Representative to the Council of ICAO. He initiated and advocated the need for ICAO to look into air and space management issues with the advent of sub-orbital flights and space tourism. Since 2007, he has been the Chairman of the International Foundation for Aviation, Aerospace and Development (IFFAAD), India Chapter. He holds a masters degree from the London School of Economics, a PhD from London University and has completed a Certificate Course in Air and Space Law from the Institute of Air and Space Law, McGill University.

Professor Barry Kellman is a law professor at DePaul University College of Law, currently teaching Environmental Law, Criminal Law, International Criminal Law, International Law of Peace and Security and International Environmental Justice and Sustainability. He was the 2014 Fulbright Distinguished Chair in Public International Law at the Wallenberg Institute, Lund University, Sweden. Professor Kellman works on the law of weapons and international security, focusing for 25 years on the control and eradication of chemical, biological, nuclear and conventional weapons. Professor Kellman has consulted for the United Nations, the OPCW, and the US Departments of State, Defense, Energy and Homeland Security. Professor Kellman holds a JD from Yale University Law School (1976) and a BA from the University of Chicago (1973). He is the author of *Bioviolence – Preventing Biological Terrorism and Crime* (Cambridge University Press, 2007) and more than two dozen law review articles, as well as numerous essays, monographs, book chapters and reviews.

Dr George Kyriakopoulos was born in Athens, Greece. He holds a BA in Law Studies, Faculty of Law, University of Athens, a DEA in International Law, a DEA in Political Science, Paris 2 University, France and a PhD in International Law, Paris 2 University and earned a *Prix de thèse* of the French Society of Air and Space Law. Dr Kyriakopoulos is an Attorney at Law and a member of the Athens Bar Association. From 1998-2002, he was a Professor of International and Air Law, Military Aviation Academy; from 2005-2006, Legal adviser of the Minister of National Defence (Greek Government) in Air Law and International Law matters; from 2008-2010, Member of the Greek Air Accident Investigation and Aviation Safety Board; from 2009-2010, Lecturer in International Law, University of Athens; from 2010-2014, Guest Lecturer in International Law, Law of International Institutions, Air Law, Space Law, Aristotle University of Thessaloniki, Faculty of Law and University of Macedonia, Department of International and European Studies, Greece; from 2011-present, Member of the Board of Directors of the Hellenic Society of International Law and International Relations; from 2014-present, Visiting Professor in Air & Space Law, Panteion University, Athens, Greece; from 2014-present, Visiting Professor in Space Law, Université Nice Sophia Antipolis, Faculté de droit et science politique, France. He is also the point of contact (Greece) for the

European Centre of Space Law (ECSL), a member of the International Institute of Space Law (IISL) and a member of the Space Law Committee of the International Law Association.

Dr Ricky J Lee is the Managing Partner of Globalex Tax + Legal, and an Adjunct Professor of Law at the University of Notre Dame Australia. Dr Lee has worked in international commercial legal practices since 1998, specialising in air and space law, commercial law, international business law, and technology law. He is the author or co-author of a number of books and monographs and over 100 chapters, articles, and conference papers, including *Law and Regulation of Commercial Mining of Minerals in Outer Space*, published by Springer in 2012. He is a chapter author of the upcoming title, *Outer Space Law: Legal Policy and Practice*, and the lead author of *Doing Business under the China-Australia Free Trade Agreement: Insights for Australian Businesses*, both to be published in 2017.

Prof Dr Li Shouping is a professor of international law, the Dean of Beijing Institute of Technology's law school, the General Director of BIT's Space Law Institute. He is the editor in chief of the *Chinese Yearbook on Space Law*. He was a visiting scholar at the National Center for Remote Sensing, Air and Space Law at the University of Mississippi in 2010 and the Space Policy Institute at George Washington University in 2013. Dr. Li is an executive director of the Chinese Institute of Space law, a vice president of the Chinese Institute of EU law and the General Secretary of the Beijing Society of International law.

Mrs Lucas-Rhimbassen is a space law and business researcher at the University Toulouse 1 Capitole, France (Chaire SIRIUS funded by CNES, TAS and ADS) and focuses on national space legislation, resilient critical space infrastructures and space contracts. She is involved in several working groups such as the IAA Study Group on Critical Space Infrastructures, the IAF Security Committee, and is a member of both the IISL and ECSL. Her topics of interest are national space legislation, space infrastructure resilience, long-term contracts, and both space and cyber security. Prior to working in the space sector, Mrs Lucas-Rhimbassen was working as an Innovation Counsellor at HEC Montreal, specializing in creative industries, entrepreneurship and business model innovation. Mrs Lucas-Rhimbassen holds a JD from the University of Moncton (2010), an MM from HEC Montreal (2015) and has participated in the HEC Summer School on Creativity Management (2014) and in the ISU Summer Program (2015). As of September 2017, she will start a PhD in space law in Toulouse.

Dr Amit K Maitra is the Chairman and CEO of the Foundation for Emerging Solutions, established to "strengthen the capacity of people throughout the world to evaluate the challenges, operations, and solutions facing governments as they formulate national strategies to keep their defensive and offensive cyber capabilities current and in line with the international community". As a global operations strategist and vital liaison to the US Departments of Defence (DoD), Air Force, and NASA, Dr Maitra offers extensive experience in governance processes for multiple forums. During 1986-1991, Dr Maitra advised NASA Space Station FREEDOM Program (SSFP) and was awarded the Highest Merit Citation 'Superior' for his central role in the conceptualization and development of electronic knowledge networks that linked policy consultants, program/project managers, engineers, and scientists from NASA and 14 international partner countries. During 1972-1986, he served as advisor to The World Bank, Korean Information Technology Association, Japanese Aerospace Industry Association, IBM, and RCA on a broad spectrum of satellite and terrestrial communications systems. In 1977, Dr Maitra was nominated by the United Nations Conference on Science and Technology for Development to advise Trinidad and Tobago and Sri Lanka on objective, long-term, market-based national strategies for infrastructure development.

Dr Monica Mallowan, Associate Professor, teaches Strategic Information Management at the University of Moncton (New Brunswick, Canada) and conducts her scientific research as a research fellow at the Management Research Centre (CEREGE), University of Poitiers (France). Dr Mallowan holds a Doctorate and a Master's degree from the University of Poitiers and a Master's degree from the University of Montreal. Her research interests lie

within the field of the strategic positioning of organizations in the information society, the relationships between the economy and the circulation of knowledge, and the practical applications of strategic competitive intelligence. As the founder and current director of the Observatory for Foresight and Information Watch (PROVIS), at the University of Moncton, as well as the initiator and co-president of the International Colloquium "Communication, Organization, Knowledge Society and Information" (COSSI), Dr Mallowan is actively involved in the cross-cultural dialogue between the North-American and European approaches to Information Science.

Maria Manoli is a doctoral candidate at the Institute of Air and Space Law (IASL), Faculty of Law, McGill University, where she is also an Erin JC Arsenault doctoral fellow in space governance, and a Robert E Morrow fellow. She is also working as a research assistant for the McGill Centre for Research in Air and Space Law. She holds a Bachelor's Degree in Laws from the National and Kapodistrian University of Athens, two LLM's from the same University in Civil Law and Public International Law, and a LLM from the IASL. Maria Manoli is also a registered lawyer of the Athens Bar Association, Greece. She has delivered presentations on space law related topics at a number of conferences, and has worked for several governmental and non-governmental entities. Her current doctoral research focuses on the legal perspectives of space natural resource exploitation and their sharing. She has been coaching the McGill Manfred Lachs Space Law Moot Court team for three consecutive years.

Anne-Sophie Martin is currently pursuing a PhD in Space Law at the University of Rome. She graduated in 2010 from the University of Paris-Sud in the Master *Droit des activités spatiales et des télécommunications* supervised by Professor Philippe Achilleas. Previously she worked at the Centre National d'Etudes Spatiales (CNES) in Toulouse, at the European Commission in Brussels and at Thales Alenia Space in France and in Italy. Last year, she presented a paper relating to "French Space Law" at the International Astronautical Congress in Guadalajara, Mexico. On March 2017, she participated to the Young Lawyers' Symposium in ESA (Paris) where she delivered a speech on "Space Mining: Towards a New Legal Framework". In addition to being an ECSL member, she is also an observer at "The Hague Space Resources Governance Working Group" in Leiden (The Netherlands), and a member of the *Space Law and Policy Group*, and the *Space Safety and Sustainability Group* of the Space Generation Advisory Council.

Ward Munters (Master of Laws, MSc in Space Studies) is a Doctoral Researcher at the Leuven Centre for Global Governance Studies and Institute for International Law, University of Leuven, Belgium. In addition to his duties as an academic teaching assistant at the university, Ward is pursuing a PhD in international space law on legal definitional and related aspects of space debris and active remediation. With a view to delineate these concepts more clearly in a manner consistent with the general international legal framework, and with international space law and international environmental law in particular, his research aims to identify and assess important elements for a legal definition of 'space debris' and the status of active remediation.

Dr Joseph N Pelton is the former Vice President of Academic Programs, Dean and Chairman of the Board of Trustees of the International Space University of Strasbourg, France. He is also the Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University. Dr Pelton is a Co-Editor of the newly completed book *Global Space Governance: An International Study*. He is currently on the Executive Board of the International Association for the Advancement of Space Safety and chair of its International Academic Committee. He is the award-winning author and editor of some 50 books and over 300 articles in the field of space, satellite communications systems, future technologies and urban planning. Dr Pelton has also served as Director of the Interdisciplinary Telecommunications Program at the University of Colorado-Boulder. He has also served in a number of executive capacities at Intelsat and the Comsat Corporation earlier in his career, including as Director of Strategic Policy and Director of Project SHARE at Intelsat.

Bahar Ramazanova was awarded her Bachelor of Law with Honours degree from the Academy of Public Administration under the president of the Republic of Azerbaijan. She worked as a lawyer at "Baku Law Service" LLC after graduation, focussing on civil and family law. From 2012, she worked as a part-time English language trainer at "London School of Azerbaijan" LLC. Since 2013 she has been an LLM student in the private law department at Istanbul University with a Turkish Government Scholarship. During her studies in Turkey, she spent six months preparing and defending a thesis on space transportation agreements at Dresden Technical University on an ERASMUS scholarship. Her Turkish thesis concerns private human space travel contracts and applicable laws. She presented her article "If an Oil Power Becomes a Launching State" at the Canadian Space Society's 15th Annual Space Conference. Currently, Ms Ramazanova is volunteering on the topic of space law with the "Astronomy and Space Studies" faculty of Istanbul University. She is also a member of the Space Generation Advisory Council and their Space Law and Policy Group. As an artist, Ms Ramazanova promotes space education through art.

Dr Mukund Kadursrinivas Rao is an expert in earth observation (EO), geographical information systems (GIS) and space technology. He holds an MSc in Geology, MPhil in remote sensing (RS) and GIS and a PhD in RS and GIS. Dr Rao served the Indian Space Research Organisation (ISRO) for 24 years and led the Indian Remote Sensing applications programme, defined national policies for EO/GIS and defined National GIS. Dr Rao has also led the EO/GIS industry to develop unique GIS solutions in India, Singapore, the Middle East and the USA. Presently, Dr Rao is with the National Institute of Advanced Studies (NIAS), Bangalore and is working on a national GI Policy, Indian Space Policy, India-Japan Space Collaboration studies, Asia-Pacific academia networks on space policy research, national GIS standards and is incubating an intellectual property-oriented RS and GIS initiative. Dr Rao has provided leadership to many international fora/programmes, has been honoured with many awards and has 200+ publications to his credit.

Dr Rajeswari Pillai Rajagopalan is Senior Fellow and Head of the Nuclear and Space Policy Initiative at the Observer Research Foundation (ORF), New Delhi. Dr Rajagopalan joined ORF after five-years at the National Security Council Secretariat (2003-2007), where she was an Assistant Director. Prior to joining the NSCS, she was Research Officer at the Institute of Defence Studies and Analyses, New Delhi. She is the author of five books: *Locating India within the Global Non-Proliferation Architecture: Prospects, Challenges and Opportunities* (2016), *Nuclear Security in India* (2015), *Clashing Titans: Military Strategy and Insecurity Among Asian Great Powers* (2012), *The Dragon's Fire: Chinese Military Strategy and Its Implications for Asia* (2009). She has also co-authored and edited five other books, including *Space India 2.0: Commerce, Policy, Security and Governance Perspectives* (2017) and *Awaiting Launch: Perspectives on The Draft ICoC for Outer Space Activities* (2014). Her research articles have appeared in edited volumes, and in peer reviewed journals such as India Review, Strategic Studies Quarterly, Air and Space Power Journal, International Journal of Nuclear Law, Strategic Analysis and CLAWS Journal. She has also been invited to speak at international fora including the UNCOPUOS (Vienna), Conference on Disarmament (Geneva), UNIDIR (Geneva), ASEAN Regional Forum (ARF) and the European Union. She has also lectured at Indian military and policy institutions such as the Defence Service and Staff College (Wellington), National Defence College (New Delhi), Army War College (Mhow), and the Foreign Service Institute (New Delhi).

Lawrence Roberts is an academic specializing in space law and policy. He has taught at a number of institutions of higher education including NYU School of Law, Seton Hall Law School and most recently at Fordham University's Graduate School of Business. The author of numerous scholarly works, Mr Roberts has served on the board of the X Prize Foundation where he chaired the foundation's Law & Policy Committee. He has also served as Chair of the American Bar Association's Committee on International Aerospace Law, the Committee on United States Aerospace Law and Policy and the National Space Society's Policy Committee.

Isabelle Sourbès-Verger is a Senior Researcher at the CNRS (National Centre for Scientific Research) in Paris. She works extensively on the Geography of Outer Space, focusing on the interaction between national public policy and technological ambitions. Using a comparative analysis of multiple case studies (Europe, Russia, Japan, China and India), her research provides an original view on the various models of acquisition and development of national space competences taking into account issues such as international security, decision-making and the role of media. She has authored or co-authored, in French and English, a number of books, including *The Cambridge Encyclopedia of Space*, more than 50 chapters or articles, and about 25 research reports. She holds an annual seminar at the EHESS and gives courses on space geopolitics at the Ecole de Guerre in Paris. She also contributes to different advisory panels at the national and international level. She is a member of international networks such as the European Space Policy Institute Network and has recently been appointed to the ESA History Project Academic Council.

Tommaso Sgobba is the Executive Director and Board Secretary of the International Association for the Advancement of Space Safety and was its first President from 2005-2013. Until October 2012, Mr Sgobba was responsible for flight safety at the European Space Agency (ESA), including human-rated systems, spacecraft re-entries, space debris, use of nuclear power sources, and planetary protection. He joined the European Space Agency in 1989, after 13 years in the aeronautical industry. Initially he supported the developments of the Ariane 5 launcher, several earth observation and meteorological satellites, and the early phase of the Hermes spaceplane. Later he became product assurance and safety manager for all European manned missions on Shuttle, MIR station, and for the European research facilities for the International Space Station. He chaired for 10 years the ESA ISS Payload Safety Review Panel and was also instrumental in setting up the ESA Re-entry Safety Review Panel. Mr Sgobba holds an MS in Aeronautical Engineering from the Polytechnic of Turin (Italy), where he was also professor of space system safety (1999-2001). He has published several articles and papers on space safety, and co-edited the text book *Safety Design for Space Systems*, published in 2009 by Elsevier, that was also published later in Chinese. He co-edited the book entitled *The Need for an Integrated Regulatory Regime for Aviation and Space*, published by Springer in 2011. He is member of the editorial board of the Space Safety Magazine. Mr Sgobba 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.

Dr Mark Skinner joined Boeing in 1999 (Maui Space Surveillance System). In 2015, he transitioned to Boeing Research & Technology (Albuquerque NM) as a senior scientist and technical manager. Dr Skinner specializes in space object characterization; his current research focus is orbital debris, with an emphasis on debris in GEO. He is currently PM of Boeing's Commercial ground-based SSA team, supporting Boeing's commercial satellite customers. For the last six years, he has served on the US delegation to UNCOPUOS, as an expert on space debris and SSA. Dr Skinner has a BS in Physics and a BS Humanities and Science from MIT, a PhD in Astrophysics from UW-Madison and an MBA from International Space University.

Dr Ruth Stilwell is the Executive Director of Aerospace Policy Solutions LLC, and adjunct faculty at Norwich University. Prior to this position, she served as the industry expert representing air traffic controllers on the International Civil Aviation Organization (ICAO), Air Navigation Commission in Montreal. The Air Navigation Commission serves as the technical body serving the ICAO Council. Her experience in air traffic control includes 25 years of operational duty at the Miami Air Route Traffic Control Centre, two years as liaison to the FAA Requirements Service and six years as Executive Vice President of the National Air Traffic Controllers Association. In addition, for four years she served as founding chairperson of the Air Traffic Services Committee of the International Transport Workers Federation. She is a current member of the technical committee on Sub Orbital Human Space Flight of the International Association for the Advancement of Space Safety. Her academic background includes research in projecting controller retirement and staffing requirements, the risk cost of ATC

facility consolidation, and air traffic control financing. She earned her BA in Labour Studies at the National Labor College and her MPA and DPA at the University of Baltimore

Dr Eytan 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, Dr Tepper practiced law in Israel working mainly for the Bank of Israel and the Ministry of Economy (Foreign Trade Administration). Dr Tepper also served as Vice-Chairman of the Israeli Bar Association's Economic Forum.

Robert Thomas is completing a Master of Arts in Philosophy with a concentration in Ethics and Public Affairs at George Mason University and currently serves as a 2017 Asia-Pacific Fellow for Young Professionals in Foreign Policy. His thesis research examines the relationship between organizations and moral character in conflict settings. His other areas of research include comparative ethics and political theory, ethical dimensions of international affairs, space policy, and the intersection of international economics and security. He has worked as a government contractor and is a past managing editor of the journal Ethics, Policy & Environment. He served as a delegate to the 2011 Space Generation Congress in Cape Town, South Africa.

Krystal Wilson is a Project Manager at Secure World Foundation where she heads the Human and Environmental Security portfolio, which focuses on promoting the efficient and effective use of space. Prior to joining SWF, Ms Wilson was a satellite policy consultant at Access Partnership and a project manager at Bryce Space and Technology (formerly the Tauri Group), providing research, analysis, strategic planning, and regulatory assessment to government and commercial clients. Ms Wilson has also worked in the field of international development, managing projects throughout the world.

Miguel Yagues is a PhD candidate in International Security at Instituto General Gutiérrez Mellado (Universidad Nacional de Educación a Distancia) in Madrid, and whose research is titled "The Spread of Exoatmospheric Kill Vehicles and the Threat to Satellites and Space Security".