Space Regulations Library

Patricia Margaret Sterns
Leslie I. Tennen *Editors*

Private Law, Public Law, Metalaw and Public Policy in Space

A Liber Amicorum in Honor of Ernst Fasan

Springer

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Foreword 1

Dr. Ernst Fasan is among the longest active members of the International Academy of Astronautics (IAA). Elected a corresponding member of the IAA in 1971, at a time when corresponding members were not yet considered a temporary transitional class of membership, he took a very active part in the new Social Sciences section consisting of lawyers, historians, managers and economists. He devoted his life to law and banking that made him recognized by the International Institute of Space Law (IISL), first as a member and later as a Board member and Secretary, and finally as an Honorary Director. Elected a full member of the International Academy of Astronautics in 1986 he has supported numerous IAA activities and attended each year the Academy Day in various countries throughout the world.

Among other activities, in 1989 Dr. Ernst Fasan urged the IISL to support with the IAA the Search for Extraterrestrial Intelligence (SETI) Committee to prepare a position paper on the declaration of principles concerning activities following the detection of extraterrestrial intelligences. This led to the presentation of these principles to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) and later with the impetus of Dr. Ernst Fasan, the UN General Assembly endorsed in 2000 the report of the COPUOS at its 43rd session.

Dr. Ernst Fasan has shown during his entire career a rare very broad expertise in many fields covering technical, juridical, economical and policy making, with a special mention of the numerous articles, papers and manuscripts he published over the years. He has served his country and the international community as a renowned expert and I am proud to honor him. I am very pleased to write this foreword to celebrate a Liber Amicorum in Honor of Ernst Fasan.

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Dr. Jean-Michel Contant

Foreword 2

The Space Law community is a strange collection. There are academics, some committed to its study, while others dabble. There are civil servants engaged in government or inhabiting international organisations. Then there are the practitioners, including employees of private companies engaged in the space business, and those in private practice who earn their crust through advising and acting for such clients as may come to them. Then there is also a group who make their living in what I might call the practice of 'ordinary law', but who maintain a strong interest in Space Law. Their value is that, among other things, specialising in varieties of terrestrial law, they have their feet on the ground and as a result can offer valuable insights into Space Law, which others, too immersed in the subject, may not have seen. Dr. Ernst Fasan is one such.

I encountered Ernst – 'met' would be such an anodyne word to apply to him – when I re-entered the world of Space Law. In 1963 I had gone to McGill's Institute of Air and Space Law with only a limited understanding of what that might entail. There, through the late Ivan A. Vlasic, I came across Space Law and found it intriguing. An LL.M. followed, but so did a lectureship back at Aberdeen where Public Law filled my vision for the next few years. In the late 1980s an invitation to a symposium from Bin Cheng to speak about INTELSAT brought me to the attention of Messrs Bourely and Lafferranderie, and through them I got to know of the International Institute of Space Law. And there, there was Ernst.

Ernst had been in at the beginning of the IISL. Although in private practice in law in Neunkirchen in Austria he was also interested in space matters and the nascent International Astronautical Federation, becoming one of the founders of the International Institute of Space Law and, soon after, one of its Directors. His writings are many, his terse style identifying and occasionally solving many problems of the emergent concepts of Space Law. His book *Relations with Alien Intelligences: The Scientific Basis of Metalaw* of 1970 of course remains a standard for those working on SETI. Elaborating the concept first expounded by Andrew Haley and basing itself on Kant's Categorical Imperative, Ernst's book identifies eleven aspects of general validity for sentient entities, not just humans.

When we met, Ernst was friendly and supportive of the new recruit. His interest in the thoughts and thought processes of others was stimulating. Others, including many of the contributors hereafter, have had the same experience. At the IISL Board his interventions often cut through clutter, identifying the essentials of a discussion to the benefit of all. And, apart from all that, he is a delightful companion.

It is good that this festschrift celebrates the life and accomplishments of someone who has contributed so much to our common field of interest. But I would add that it is also a tribute to his wife, Gerti, who keeps him going. We salute you both.

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Preface

As we travel through the avenues of life, we sometimes are privileged to encounter individuals who cause us to reflect and examine new paths that we may not even have been aware existed. Ernst Fasan is such an individual. We first became acquainted with Ernst through his writings while we were attending law school. Whether by chance or fate, we happened to find a handful of books on space law, which happened to be in our law school library. Included among them was a small and unassuming book by Ernst Fasan with the title *Relations With Alien Intelligences The Scientific Basis of Metalaw*. Not only was the subject of space law intriguing, but here were serious articles by respected authorities from around the globe examining subjects that literally were out of this world. And there was the book that made much of this look mundane by comparison – on metalaw, an analysis of the rules to apply to interplanetary relations.

That was all it took. Life was changed forever. To say we devoured these writings would be an understatement. We were children of the space age, and grew up watching the first rocket launches, and failures, on live television, and followed each manned space flight with awe. The attraction to space law for these young law students was natural, and in hindsight, probably inevitable.

What followed led to communications with Professors Stephen Gorove and Carl Q. Christol, who were very supportive and invited Les to present a paper he was co-authoring at the upcoming IISL Colloquium during the International Astronautical Congress (IAC), which happened to be in Anaheim, California. For a third year law student, this was an almost unbelievable opportunity. There were, in person, many of the very authorities whose writings had been so intriguing, discussing contemporary issues of space law, within the larger context of the IAC with astronauts, cosmonauts, diplomats, and the engineers, scientists, and administrators that launched satellites and put men on the moon.

We both attended the next IAC in 1977, and became regular participants at the IAF Congresses. We actually befriended Ernst's wife Gerti first, as she and Les sat next to each other at a crowded lunch counter at the IAC in Tokyo. The four of us quickly became close friends. When Patricia was writing her first paper on metalaw, she no longer had access to our law school library and was not able to locate a copy

of Ernst's book, which was out of print. When she asked Ernst if he knew if a copy of the book may be available, he sent his original, personal library copy personally inscribed to her. This magnanimous gesture is indicative of Ernst's caring for younger space lawyers and their growth in the field.

We are pleased to be the editors of this Liber Amicorum as a way to express our appreciation to Ernst and Gerti for their many years of friendship and support. The authors to this Liber Amicorum include legal practitioners, members of academia, and the scientific community. These contributors come from every continent save Antarctica, and represent the second and third generation of space lawyers as a means of underscoring the global influence Ernst has had that extends far beyond his generational contemporaries.

We are especially pleased to be able to include the republication of Relations With Alien Intelligences The Scientific Basis of Metalaw, first published in 1970, so that it is again available to today's space lawyers, scientists and other interested parties. The relevance of Metalaw was underscored as this book was in preparation, as the Breakthrough Prize Foundation announced a $100 million funding effort to search for evidence of intelligent extraterrestrial beings.

We would like to acknowledge and thank Ram Jakhu for his support of this project. We also would like to thank Neil Olivier and Diana Nijenhuijzen of Springer for all of their assistance in bringing this book to a reality. Finally, we would like to thank all of the contributors to this Liber Amicorum, each of whom enthusiastically join us in honoring our good friends Ernst and Gerti Fasan.

Phoenix, Arizona
October, 2015

Patricia Margaret Sterns
Leslie I. Tennen

Contents

List of Abbreviations

ABSCICON	Astrobiology Science Conference
ATA	Allen Telescope Array
BSTI	Basic Space Technology Initiative (of the UN)
BUSTIND	National Bureau of Science, Technology and Industry for National Defense
CASC	China Aerospace Science and Technology Corporation
CCL	Commerce Control List
CD	Conference on Disarmament
CETI	Communication with Extraterrestrial Intelligence
CGWIC	China Great Wall Industry Corporation
CISSM	Center for International & Security Studies at Maryland
CNSA	Chinese National Space Administration
COSPAR	Committee on Space Research
COSTIND	State Commission of Science, Technology and Industry for National Defense
COTS	Commercial Orbital Transportation Services Demonstration program
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSLA	Commercial Space Launch Act
DFH-1	Dongfanghong-1
DLR	German Aerospace Center
DoD	Department of Defense
EANA	European Astrobiology Network Association
EARs	Export Administration Regulations
ELV	expendable launch vehicles
ESA	European Space Agency
ET	Extraterrestrial
ETI	Extraterrestrial Intelligence
EWCH	High Court of Justice of England and Wales
EU	European Union
FAA	Federal Aviation Administration

FAST	Five hundred meter Aperture Spherical Telescope
FCC	Federal Communications Commission
FFT	Fast Fourier Transform
FP7	Seventh Framework Programme on research and innovation of the EU (2007–2013)
GA	United Nations General Assembly
GEO	Geostationary Earth Orbit
GSO	Geosynchronous Orbit
HRMS	High Resolution Microwave Survey
IAA	International Academy of Astronautics
IAC	International Astronautical Congress
IAF	International Astronautical Federation
ICAO	International Civil Aviation Organization
ICC	International Chamber of Commerce
ICJ	International Court of Justice
ICSID	International Centre for the Settlement of Investment Disputes
IISL	International Institute of Space Law
ILM	International Legal Materials
ISM	industrial, scientific, medical
ISS	International Space Station
ITARs	International Traffic in Arms Regulations
ITU	International Telecommunication Union
KESE	Kepler Energy and Space Engineering
KLT	Karhunen-Loève Transform
LEO	Low Earth Orbit
LIAB	Convention on International Liability for Damage Caused by Space Objects
MCSA	Million Channel Spectrum Analyzer
MEO	Medium Earth Orbit
METI	Messaging to Extra-Terrestrial Intelligence
MPL	Maximum Probable Loss
NARSDA	National Space Research and Development Agency
NASA	National Aeronautics and Space Administration
NPC	National People's Congress
NRAO	National Radio Astronomy Observatory
OECD	Organization for Economic Cooperation and Development
OPEC	Organization of the Petroleum Exporting Countries
OSETI	Optical SETI
OST	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies
P3	Public-Private Partnership
PAROS	Prevention of an Arms Race in Space
PCA	Permanent Court of Arbitration
PCA	Advisory Group of Experts

PLA	People's Liberation Army
PPP	Public – Private Partnership
PPWT	Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects
PRC	People's Republic of China
P/V	photovoltaic
REG	Convention on Registration of Objects Launched into Outer Space
RFI	radio frequency interference
RLV	reusable launch vehicles
RpK	Rocketplane Kistler
SASTIND	State Administration for Science, Technology and Industry for National Defense
SBSP	space-based solar power
SETI	Search for Extraterrestrial Intelligence
SPS	solar power satellite
SRT	Sardinia Radio Telescope
SSA	space situational awareness
SSL	Berkeley Space Sciences Lab
STM	space traffic management
TCBMs	Transparency and Confidence Building Measures
U.K.	United Kingdom
UKTS	United Kingdom Treaty Service
UNCITRAL	United Nations Commission on International Trade Law
UNCOPUOS	United Nations Committee on Peaceful Uses of Outer Space
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNIDIR	United Nations Institute for Disarmament Research
UNIDROIT	International Institute for the Unification of Private Law
UNTS	United Nations Treaty Series
US	United States of America

Biography of Ernst Fasan

Ernst Leo Albin Fasan was born August, 1926, in Vienna, Austria, as the only child of the physician Dr. Leo Fasan and the philologist Dr. Irmgard Fasan, nee Taigner. He grew up in the house of his parents in Neunkirchen, Lower Austria. There he attended grade school, and then high school in the nearby city of Wr. Neustadt. At the age of 16, together with his entire class, he was conscripted into the military. He was captured and became a prisoner of the Soviet Army, and was transported to the district of Wladimir. He was held for more than 2 years after the end of the war, and finally returned home in November, 1947.

Ernst immediately started law studies at the University of Vienna and earned his Doctor of Law degree in 1950. He practiced at the Vienna Courts and formed his own Law Office in Neunkirchen in 1955, where he continued to practice, together with several junior partners, until his retirement in 1994. He has been an examiner of applicants of young judges and lawyers at the High Court in Vienna, and has served as a judge at several Moot Courts.

In 1960 he was a founding member of the International Institute of Space Law (IISL). He became Secretary, and then Honorary Director of the Institute. He is a full member of the International Academy of Astronautics. From 1994 to 2001 he was the Coordinator of the Annual Symposia at the UN Committee on the Peaceful Uses of Outer Space in Vienna. He was a member of the Editorial Board of the *Journal of Space Law*, edited by the University of Mississippi. He is the author of two books, *Weltraumrecht* in 1965, and *Relations with Alien Intelligences The Scientific Basis of Metalaw* in 1970, as well as dozens of papers and addresses on space law since 1960.

He served as a member of the Hermann Oberth Society – Internationaler Förderkreis W.v. Braun, H. Oberth, and as Chairman of its Space Law Section.

He has been awarded the Golden Hermann Oberth Ring, the Golden Wernher von Braun Medal, the Andrew Haley Award, and the IISL Lifetime Achievement Award.

Ernst Fasan is married to Gertrude, nee Albrecht, and is the father of three children and grandfather of two grandchildren.

About the Authors

Tare Brisibe, LL.B., (Hons) (Jos) B.L., M.S.S., (ISU) Ph.D. (Leiden), Barrister and Solicitor of the Supreme Court of Nigeria, began a career in 1991 practicing in civil litigation, general commercial law, mergers and acquisitions with two leading Nigerian law firms. A former Director of Regulatory Affairs at SITA OnAir (subsidiary of airline consortium, Société Internationale de Télécommunications Aéronautiques) he served as Deputy Director (Legal Services & International Cooperation) with the National Space Research and Development Agency of Nigeria (NASRDA). He also held appointments with a Luxembourg based law firm focused on space and satellite communications law, as well as with Inmarsat plc. (the privatized International Maritime Satellite Organization – INMARSAT). Dr. Brisibe participated at the Third United Nations Conference on the Peaceful Uses of Outer Space (UNISPACE III) and as a Delegate at sessions of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) including its Legal and Scientific & Technical Subcommittees. He was a member of the Committee of Governmental Experts at the International Institute for the Unification of Private Law (UNIDROIT) for preparation of a Space Protocol to the Cape Town Convention. He has participated at International Telecommunication Union (ITU) World Radiocommunications Conferences, ITU Development Sector Study Groups, International Civil Aviation Organization (ICAO) Aeronautical Communications Panel, and Asia Pacific Telecommunity (APT) Wireless Forum. He was an Observer at the Association of Southeast Asian Nations (ASEAN) 14th Telecommunications Regulatory Council, and has been involved with the African Leadership Conference (ALC) on Space Science and Technology for Sustainable Development. He was appointed, by the Secretary General of the Permanent Court of Arbitration (PCA), member of the Advisory Group on Optional Rules for Arbitration of Disputes Relating to Outer Space Activities, and elected Chairman of the UNCOPUOS Legal Subcommittee for the biennium 2012 to 2014.

José Monserrat Filho, Head of the International Cooperation Office of the Brazilian Space Agency. Former Head of the International Affairs Office of the Ministry of Science and Technology (2007–2012). Former Director of Communication of the

Ministry of Science and Technology (1985–1987). Former Director of the Magazine "Ciencia Hoje" (Science Today), published by the Brazilian Society for the Advancement of Science (SBPC) – 1984–1994. Former Editor of the newspaper "Jornal da Ciência", also published by SBPC (1991–2007). Member of the Brazilian official delegation at the Legal Subcommittee of the United Nations Committee for Peaceful Uses of Outer Space (COPUOS) since 1997. Master of Law, specialized in international law and particularly in the Space Law, by the Peoples' Friendship University, Moscow (1961–67). Student of the Academy of International Law (1977), The Hague, Netherlands; the International Space University (1989), France, and the European Center for Space Law (1993). Vice-President of the Brazilian Association for the Air and Space Law (SBDA); Coordinator of the Center for Studies of International Space Law of this Association. Honorary Director of the International Institute of Space Law (IISL), full member of the International Academy of Astronautics (IAA) and member of the Space Law Committee of the International Law Association (ILA). Member of the Scientific Advisory Board of the *Cologne Commentary on Space Law* of the Institute of Aeronautical and Space Law at the University of Cologne, Germany. Author of *Introduction to Space Law* (SBDA/Brazilian Space Agency, 1998) and *Law and Policy in the Space Age – Can we be fairer in space than on Earth?* (Vieira & Lent, 2007). Author of dozens of papers on political and legal problems related to space activities, including foreign publications, such as the British magazine *Space Policy*. José Reis Award of Scientific Journalism, CNPq (Brazilian National Council for Scientific and Technological Development), 1994.

Steven Freeland is Professor of International Law at the University of Western Sydney. He is also a Visiting Professor at the University of Vienna, Permanent Visiting Professor of the iCourts Centre of Excellence for International Courts, Denmark, a Member of Faculty of the London Institute of Space Policy and Law, and was a Marie Curie Fellow in 2013–2014. He has taught courses at Universities in The Netherlands, Austria, Belarus, China, Italy, Germany, Bulgaria, Estonia, Slovakia, United Kingdom, New Zealand, Denmark, United States, Australia, Turkey, France and Singapore. 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. Among other appointments, he is a Director of the Paris-based International Institute of Space Law, a member of the Space Law Committee of the London-based International Law Association, and a member of the Advisory Board of the Australian Centre for Space Engineering Research. He sits on the Editorial Board of a number of international journals, including the Australian Journal of Human Rights, the Australian International Law Journal, the Canada-based Annals of Air and Space Law, the German-based German Journal of Air and Space Law / Zeitschrift fur Luft- und Weltraumrecht and the China-based Space Law Review, and on the Advisory Board of the India-based Asian Journal of Air and Space Law and the UK-based Journal of Philosophy of International Law, as well as a series of books entitled Studies in Space Law. He is also Co-Editor of Annotated Leading Cases of the International

Criminal Tribunals, a long-established series of casebooks annotating the jurisprudence of the International Criminal Court, the International Criminal Tribunals for the former Yugoslavia and for Rwanda, the Special Court for Sierra Leone, the Extraordinary Chambers in the Courts of Cambodia, the Special Tribunal for Lebanon and the Special Panels for Serious Crimes in East Timor. He has authored approximately 300 publications on various aspects of International Law and has been invited to present over 700 expert commentaries by national and international media outlets worldwide on a wide range of legal and geopolitical issues. He is also a frequent speaker at national and international conferences, having been invited to present conference papers and keynote speeches in Australia, Austria, Belarus, Belgium, Bulgaria, Canada, China, Denmark, Estonia, France, Germany, India, Italy, Japan, Mexico, The Netherlands, New Zealand, Norway, Romania, Singapore, Slovakia, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States and Vietnam.

Andrea Harrington is currently a doctoral candidate and Erin JC Arsenault Fellow in Space Governance at the McGill University Institute of Air and Space Law, where she has served as an Aisenstadt Teaching Fellow and been the recipient of the International Aviation Women's Association Scholarship, the Setsuko-Ushioda-Aoki Prize, and a P.E.O. Scholar Award. She is also an attorney admitted to the bar in the Commonwealth of Massachusetts. Andrea holds an LLM in Air and Space Law, also from McGill, as well as a JD from the University of Connecticut School of Law, a Master of Science in European Politics and Governance from the London School of Economics, and a Bachelor of Arts in International Relations and History from Boston University. Andrea has held a short-term contract position at Secure World Foundation as a Jr. Project Manager and, prior to seeking her doctorate, has worked in the financial compliance and insurance fields (at Bank of America and Beazley Group, respectively). Andrea's LLM thesis focused on the protection of cultural heritage in space, while her doctoral thesis is centered on insurance and liability issues for the commercial space industry.

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. Diane first became involved in space initiatives in 2004, participating in citizen lobbying efforts to facilitate the passing of the Commercial Space Law Amendments Act of 2004, a critical piece of US legislation that has made possible the development of innovative technologies and a burgeoning commercial space transportation industry. Dr. Howard has retained her interest in commercial space issues. After working as a staff attorney in the Florida Appellate courts for a number of years, she took the decision to specialize in space law and attended McGill University's Institute of Air and Space Law. Her LLM thesis centered upon private space law issues and her doctoral work focused upon effective spaceport regulation. Diane serves as Executive Secretary of the International Institute of Space Law and participates in numerous legal projects,

both domestically (within the US) and internationally. She works with COMSTAC Working Groups when invited. The US Department of State named her a private sector advisor and subject matter expert in Expert Group D of the UN COPUOS STSC Long Term Sustainability of Space Activities Working Group, hoping to soon conclude its work. Dr. Howard was legal lead for the International Association for the Advancement of Space Safety Suborbital Safety (IAASS) Technical Committee, which recently finalized its guidelines. She continues to publish her research and speaks at space conferences and events throughout the world. In addition to the IISL and the IAASS, Diane is a member of the AIAA and the Florida Bar.

Dr. Ram S. Jakhu possesses professional experience of over 30 years in the field of international and national Space Law and Policy as well as in providing consultation to several private and governmental entities and drafting national laws and regulations in various countries. Currently, Dr. Jakhu is holding a tenured position of Associate Professor at the Institute of Air and Space Law, Faculty of Law, McGill University in Montreal, Canada. He is also Associate Director of Centre for Research in Air and Space Law of McGill University. He teaches and conducts research in international space law, law of space applications, law of space commercialization, space security, space safety, national regulation of space activities, law of telecommunications, and public international law. Currently he heads a multi-million dollars space law and policy research and outreach program. He served as Director, Centre for the Study of Regulated Industries, McGill University, during 1999–2004. He served as the First Director of the Master of Space Studies Program of, and held other senior positions at, the International Space University, Strasbourg, France, during 1995–1998. Dr. Jakhu has taught Space Law and Policy in several countries; made presentations to the United Nations Committee of Peaceful Uses of Outer Space (UNCOPUOS); participated in the drafting of Space Law Curriculum for the United Nations Office for Outer Space Affairs (UNOOSA); advised several countries in the preparation of national laws and policies, including National Space Law and Policy for South Africa and India; convened and participated numerous international interdisciplinary space law and policy related conferences and workshops around the world. Prof. Jakhu is a Member of the Global Agenda Council on Space of the World Economic Forum; Member of the Governance Group of the Space Security Index; and Fellow as well as the Chairman of the Legal and Regulatory Committee of the International Association for the Advancement of Space Safety. He is Managing Editor of the Space Regulatory Series, member of the Editorial Boards of Space and Evolution, Annals of Air & Space Law, Astropolitics, and German Journal of Air & Space Law. He was member of the Advisor Group of Legal Experts on Optional Rules for Arbitration of Disputes Relating to Outer Space within the Permanent Court of Arbitration, and member of the Board of Directors of International Institute of Space Law for 14 years. In 2007, he received a "Distinguished Service Award" from the International Institute of Space Law for significant contribution to the development of space law. Prof. Jakhu has co-authored two books, over 80 articles and 20 research reports and edited 6 books, including the one that received the 2011 Book Award from the International Academy of

Astronautics. Dr. Jakhu is the founder and President of *Cyber & Space Telecom Inc.,* a Montreal-based consulting firm, specializing in space and telecom business, law and policy. During the last about twenty years, the firm has undertaken over 25 consulting assignments for various governments, organizations (including the Canadian Space Agency and European Space Agency) and private companies from around the world. A Canadian citizen for about 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 Honors List) and Master of Law (LL.M.) degrees from McGill University, Canada, as well as LL.M., LL.B., and B.A. degrees from Panjab University, India.

Claudio Maccone, Ph.D. is an Italian SETI astronomer, space scientist, Fulbright scholar, and mathematician. He is Technical Director of the International Academy of Astronautics (IAA) for Scientific Space Exploration. In 2001 he was elected "Full Member" of the IAA, and the Asteroid 11264 was named "Claudiomaccone" in his honor by the International Astronomical Union (IAU). Since 2012, he has chaired the IAA SETI Permanent Committee. In 2002 he was awarded the Giordano Bruno Award by the SETI League, "for his efforts to establish a radio observatory on the far side of the Moon". Claudio earned his BSc in Physics from the University of Turin, Italy, in 1972, and his MSc in Physics at the University of Turin in 1974. He earned his Ph.D. at the Department of Mathematics of the University of London King's College in 1980, then joined the Space Systems Group of Aeritalia in Turin as a technical expert for the design of artificial satellites. In 2012, he became a founding member of the Advisory Council of the Institute for Interstellar Studies. He has published over 100 scientific and technical papers, most of them in *Acta Astronautica*. He is the author of four books: *Telecommunications, KLT and Relativity* IPI Press, 1994; *The Sun as a Gravitational Lens: Proposed Space Missions* IPI Press, 1998, which was awarded the 1999 Book Award for the Engineering Sciences by the IAA; *Deep Space Flight and Communications* Praxis-Springer, 2009; and *Mathematical SETI* Praxis-Springer, 2012.

Irmgard Marboe is Professor of International Law at the Department of European, International and Comparative Law at the Law Faculty of the University of Vienna. She is the head of the Austrian National Point of Contact for Space Law of the European Centre for Space Law since 2009. From 2008 to 2012 she was the chair of the working group on "National Space Legislation" of the Legal Subcommittee of UN Committee for the Peaceful Use of Outer Space which led to the adoption of the UN General Assembly Resolution No 68/74 of 11 December 2013 on "Recommendations on national legislation relevant to the peaceful exploration and use of outer space". In the academic year 2014/2015 she was a visiting scholar at The Europe Center at Stanford University, CA (USA) where she conducted a study on Earth observation data policy and law. Her publications in the area of space law include articles on telecommunication and space, national space legislation, the return of space objects and the rescue and return of astronauts, and soft law in outer space. She has been invited as a speaker at numerous international symposia and

workshops on space law, including by the European Centre for Space Law, the European Space Policy Institute, the International Institute of Space Law, the United Nations Office of Outer Space Affairs, the University of Nebraska-Lincoln and Stanford University. She was involved in the drafting of the Austrian Outer Space Act of 2011 and the implementing regulation of 2015. She teaches courses on space law at the University of Vienna and at other European universities. She has also taught at the Space Studies Program of the International Space University.

Patricia Margaret Sterns graduated from Arizona State University in May 1974, with a Bachelor of Arts in Philosophy and a minor in Fine Arts; she then graduated from the University Of Arizona in May 1977, obtaining a Juris Doctor degree. Dr. Sterns is an attorney, being a member of the State Bar of Arizona. She is a partner in the Law Firm of Sterns and Tennen, and has focused on space law for more than 35 years. She formerly served for many years as a Judge Pro Tempore of the Superior Court of Maricopa County, in and for the State of Arizona. She is admitted to practice by the Supreme Court of the State of Arizona, the United States District Court, and the United States Supreme Court. She was elected as a lifetime member of the International Institute Of Space Law (IISL) in 1978, and served as a Director until her colleagues voted her to hold the lifetime position of Honorary Director. She also serves on the Membership Committee of the IISL. She is a full member of the International Academy of Astronautics (IAA), and an associate member of the Committee on Space Research (COSPAR). She is a former member of the American Institute of Aeronautics and Astronautics (AIAA), the International Law Association (ILA), as well as a former member of the Aviation Space Writers Association (ASWA). Dr. Sterns has published in legal, scientific, and technical journals more than 50 manuscripts on the subject of space law, both alone and in partnership with Leslie I. Tennen, as well as other distinguished space authorities. These papers range in topic from Planetary Protection, to SETI, property rights, commercial uses of space, and a series of papers on living and working in space. She has served as a judge in many Moot Court Competitions. Dr. Sterns frequently has participated in, and lectured at, numerous national and international symposia, workshops, colloquia, and congresses throughout the world. She has served as co-chair for many sessions of the IISL colloquia, and two scientific sessions (SETI and Planetary Protection) of the International Astronautical Congress (IAC). In 1998, Dr. Sterns was the co-recipient with Leslie I. Tennen of the IISL Award of Appreciation for their work in and for the Institute. Dr. Sterns, in cooperation with Leslie Tennen, annually sponsor an award for the Best Oralist of the distinguished Manfred Lachs Space Law Moot Court Competition. For the World Space Conference in 2002, Dr. Sterns, in cooperation with a colleague from NASA/COSPAR, co-organized and co-chaired a Symposium on the diverse and controversial topic of Planetary Protection of the Earth, Moon, and other Celestial Bodies. She attended the Third United Nations Conference on the Peaceful Uses of Outer Space (UNISPACE III). Dr. Sterns has been a frequent lecturer, consultant and advisor on space matters to both private and public organizations, on the State, National and International levels. She lives in Arizona with her Husband, Les Tennen, on her family Ranch. They

raise cows, chickens, bees, mesquite trees, cats, exquisite peacocks, and a dog named Farfel, as well as a calico house cat named Ophelia.

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Institute of Space Law in France, the first winner of Isa Diederiks-Verschoor Prize in the Netherlands, and also first winner of SATA Prize by the Foundation of Development of International Law in Asia (DILA). He has published widely on various topics including particularly Dispute Resolution and Space Law. His recent publications include Dispute Resolution in Electronic Commerce (Martinus Nijhoff, 2005), Liberalization of Electronic Commerce and Law (Peking University Press, 2005), Space Commercialization and the Development of Space Law (Intellectual Property Press, 2008), Mediation Practice and Skills (Tsinghua University Press, 2011), National Space Legislation in China: An Overview of the Current Situation and Outlook for the Future (Brill/Nijhoff, 2015).

Introduction

One of the central foci of the life of Austrian lawyer Ernst Fasan has been his participation in and sustained support of the International Institute of Space Law (IISL) associated with the International Astronautical Federation. Because Dr. Fasan was one of the founders, and the history is so little known, we should recall briefly the initial period of formation of the IISL.

Following the historic launch of Sputnik by the USSR on October 4, 1957, two well qualified practicing attorneys, Welf Heinrich, Prince of Hanover, and Andrew G. Haley, with a profound interest in the law of outer space, undertook two tours in October/November 1957, visiting multiple universities in the United States[1] and in Europe,[2] as well as numerous learned societies, technical institutes and specialty groups interested in astronautics. The attendance at the lectures was evidence of a great interest in space law and the need for an international forum at which opinions concerning the newly required law might be exchanged. As a result, a decision was made to convene the first colloquium on the law of outer space. It was decided to meet at The Hague, August 29, 1958, and to invite lawyers from around the world.

The record of that historic meeting is set forth in *First Colloquium on the Law of Outer Space*, published originally by Springer-Verlag in 1959, and reprinted with permission by the IISL in 1997. That document contains the papers presented and selected records of commentary on those papers. A committee was formed at that time under the auspices of the International Astronautical Federation, known as "The Permanent Legal Committee of the International Astronautical Federation." The original committee roster was published as an appendix to the First Colloquium. The roster listed 153 members from 37 countries. The committee grew with time as more interested persons learned of its existence, and joined.

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[1] Schools visited included the Universities of California (Berkley and UCLA), Chicago, Colorado, Detroit, Georgetown, Gonzaga, Harvard, Maryland, Michigan, Minnesota, Montana, Montana State, Northwestern, Princeton, St. Lewis, Utah, Washington, and American University.

[2] One or the other of the two attorneys visited universities in Belgrade, Berlin, Copenhagen, Leningrad, Lisbon, Madrid, Moscow, Munich, Paris, Prague, Stockholm, Stuttgart, Warsaw and the Evangelical Academy at Loccum.

From the outset, the space law colloquia were held in conjunction with the annual International Astronautical Congresses (IACs) of the International Astronautical Federation (IAF). Thus, when scientists and engineers gathered from around the world to discuss developments in astronautics, it was possible for lawyers also to gather and discuss developments in the relevant law. The proceedings of the *Second Colloquium on the Law of Outer Space*[3] not only contain individual papers brought by experts in their fields, but also included the statements of work and membership of eleven special international working groups established by the IAF to address issues in space law.

During the Xth Congress of the IAF, in London, on the motion of Eugène Pépin, the IAF plenary unanimously adopted a resolution providing that "The General Counsel of the IAF [A. G. Haley] is authorized to establish immediately such working groups as are necessary to consider the legal problems of space, which are today considered perhaps capable of resolution, for example, space radio allocation frequencies, now being considered by the International Telecommunication Union in Geneva, Switzerland." This proposal was prompted by Andrew G. Haley, former President of the IAF, and a strong supporter of international radio frequency allocations for safe and efficient space craft operation.

A summary of the Working Group topics established at the Xth International Astronautical Congress included:

1. The upper limit of national airspace and legal status of vehicles in the airspace and beyond.
2. The legal definition of space rockets, space vehicles and artifacts intended for use in space.
3. The legal status of celestial bodies other than Earth and the status of activities in outer space.
4. Identify the treaties applicable to space activities and address liability for damages done by such activities.
5. The nature and scope of regulations to relate to registration, pre-flight inspection, flight rules, safety, search and rescue, emigration and immigration, prevention of forward and back contamination, collection and dissemination of data on matters such as weather, radiation, meteorites and similar conditions encountered in space.
6. The roles of extant or newly required international organizations, provisions for arbitration, and the role of the International Court of Justice.
7. The requirements for new international radio laws and treaties, national and international. Is the ITU properly configured to meet the needs of space communications?
8. The extent of private rights, property rights, and state authority over areas in outer space.
9. How shall injury or damage to life and property by spaceflight activities be managed?

[3] Originally published by Springer-Verlag in 1960, reprinted with permission by the IISL in 1995.

10. What governmental and non-governmental international organizations are presently concerned with space activity and what new organizations are required.
11. Explore proper arrangements required for a specified range of space activities.

Ernst Fasan, who had joined the IAF's Permanent Legal Committee, was assigned to work with a number of colleagues on Working Group 5 under the chairmanship of Christopher Shawcross of the UK. During the Third Colloquium, held in Stockholm August 14–15, 1950, Dr. Ernst Fasan appears in the record urging priority attention to the issues of the status of celestial bodies, particularly the moon, and how it may be used and defined in international law. During the First Plenary Meeting of Delegates to the XIth Congress of the IAF, a draft of *Statutes of the International Institute of Space La*w was approved on August 15, 1960. The IISL was born and Ernst Fasan attended the birth. Following the Third Colloquium Dr. Fasan developed an abiding interest in and an involvement in the meetings, planning, and affairs of the International Institute of Space Law. His record of participation is documented in the Proceedings of subsequent colloquia, which he rarely if ever missed.

In 1962, Dr. Fasan was elected to the Board of Directors of the IISL and has been an officer or Institute Representative continually for more than 50 years. In 1963 the IISL conferred upon Dr. Fasan the Andrew G. Haley Gold Medal for his work in space law.

Since the early 1960s Dr. Fasan has contributed tirelessly to the work of the IISL and to the expanding literature on space Law. He has organized and served on Scientific/Legal roundtables, jointly sponsored by the IISL and the International Academy of Astronautics during annual IACs. Dr. Fasan has also been a diligent organizer and participant in informational symposia, sponsored by the IISL, and convened in conjunction with meetings of the United Nations Committee on the Peaceful Uses of Outer Space. Since the early 1990s he has supported and served in annual competitions of law faculties in the Manfred Lachs International Space Law Moot Court Competitions, all the while maintaining a thriving practice in law and continually contributing to commentary on the Law of Outer Space.

Dr. Fasan has justifiably been described as "one of the most visionary space lawyers of the 20th and 21st centuries." This is a well deserved distinction which sets this man apart from many in the field of space law as a pioneer, an enabler, a contributor and a mentor to many younger lawyers entering the field. It is to this special and renowned jurist that this book of friendship and appreciation is dedicated.

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Small Is Beautiful? Legal Challenges of Small Satellites

Irmgard Marboe

Abstract The development and operation of small satellites for various purposes is a recent phenomenon that poses new challenges to the regulatory framework of outer space activities. On the one hand, the involvement of more actors, including private entities and universities, in the area of space technology is welcome as it helps more countries and people to benefit from outer space as the "province of all humankind". On the other hand, small satellites are prone to aggravate the problem of space debris. This is not only due to the increased number of space objects, which is the inevitable consequence of the success of small satellites, but also because of their particular qualities. They often do not have maneuvering capability that would allow them to evade an obstacle or to de-orbit after the end of mission. Furthermore, their limited scale and scope of activity – sometimes even regarded as "amateur" activity – leads to a relatively high failure rate. The regulatory challenges include issues of authorization, registration, frequency allocation, risk, liability, and insurance, as well as space debris mitigation.

Introduction

Does size matter in respect of legal and regulatory issues of space activities? This is perhaps a surprising question. Generally, we would answer it in the negative. The UN space treaties only relate to "space objects" and do not distinguish between small and large ones. The same is true for the ITU regulations on frequency allocation. However, in more practical terms, size is an issue. The evolvement of technology has made it possible to construct satellites at relatively low cost. This has made space activities more accessible for a variety of actors, not only for new and emerging space faring nations but also for universities, research institutes, and small and medium size commercial companies. As a consequence, small satellites missions

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are becoming more and more popular. In the last years, approximately 100 small satellites were launched annually.[1]

On the one hand, this development is welcome since it helps more countries and actors to benefit from outer space as the "province of all humankind".[2] While in the early years of the space age, only large and powerful countries were able to engage in the exploration and use of outer space, nowadays, more and more countries and private entities may enter the scene and often start with small satellites projects.[3] The UN has even prompted a dedicated initiative to support States and other actors in the development of small satellites programmes.[4] The European Union supported the development of 50 CubeSats to be launched together under its Seventh Framework Programme (FP7).[5] NASA has started a CubeSat initiative inviting interested researchers to submit experiment proposals which can obtain sponsorship by NASA.[6]

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[1] Otto Koudelka, Regulatory Aspects of Small Satellite Missions, Presentation made at the Global Space Applications Conference, 2–4 June 2014, available at www.glac2014.org, ISSN 1995-6258. The record month was November 2013, when 29 satellites were launched on Minotaur-1, and 32 satellites on DNEPR; see also Jordi Puig-Suari, Small Sats: Present and Future, Presentation made at the ITU Symposium and Workshop on Small Satellite Regulation and Communication Systems, 2–4 March 2015, available at http://www.itu.int/en/ITU-R/space/workshops/2015-prague-small-sat/Pages/agenda.aspx

[2] Art. I Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of January 27, 1967, 610 UNTS 205 (hereinafter OST).

[3] In Brazil, the program to build small satellites started in 2003 by researchers at the National Institute for Space Research (INPE) with support from the Brazilian Space Agency (AEB). In 2014, it launched the first NanoSatC-BR1. On Vega's first flight, ESA issued a call that led to a flood of proposals from universities all over Europe. Seven university teams made it in time, including UniCubeSat-GG and e-st@r from Italy, XaTcobeo from Spain and Robusta from France. They were launched in 2012; see http://www.esa.int/Education/Central_and_eastern_Europe_make_history_with_small_satellites. See also the BRITE Constellation of Austria, Canada, and Poland launched in 2013, http://www.brite-constellation.at/

[4] The Basic Space Technology Initiative (BSTI) in the framework of the United Nations Program on Space Applications undertakes capacity building in basic space technology and promotes the use of such technology and its applications for sustainable development. It consists of "Basis Activities", such as symposia and technical assistance missions, "International Space Technology Symposia", which were held in Japan (2012), Dubai (2013) and Mexico (2014), the development of a "Space Technology Education Curriculum", a long-term Fellowship Program and specific "BSTI Projects", such as the Humsat-D. See United Nations Office for Outer Space Affairs, http://www.unoosa.org/oosa/en/SAP/bsti/

[5] QB50, https://www.qb50.eu/index.php/project-description. FP7 was the multi-annual research program of the European Union administered by the European Commission in the years 2007–2013. See Regulation (EC) No 1906/2006 of the European Parliament and of the Council of 18 December 2006 laying down the rules for the participation of undertakings, research centers and universities in actions under the Seventh Framework Program and for the dissemination of research results (2007–2013), OJ L 391/1.

[6] See the NASA CubeSat Launch Initiative, http://nasa.gov/directorates/heo/home/CubeSats_initiative.html

On the other hand, small satellites are prone to aggravate the problem of space debris. This is not only due to the increased number of space objects which is the inevitable consequence of the success of small satellites but also to some of their particular qualities. They often lack maneuvering capability that would allow them to evade an obstacle or to de-orbit after the end of mission. Furthermore, their limited scale and scope of activity frequently leads to their consideration as "amateur" activities by the people involved. They often believe that small satellites projects do not require compliance with the complex regulations applied to larger space missions, including the conditions regarding safety and reliability.[7] This results in a relatively high failure rate of such projects of about 52 %.[8]

In the following, some regulatory challenges in the context of small satellite missions will be addressed. Starting from a brief overview of the main characteristics of small satellites and their use, the issues of authorization, registration, frequency allocation, risk, liability, and insurance as well as space debris mitigation will be discussed.

Main Characteristics and Uses of Small Satellites

There is no generally accepted definition of a "small satellite". However, the categorization proposed in an International Academy of Astronautics (IAA) Study on cost-effective Earth observation satellites[9] has been rather influential. Consequently, small satellites are generally recognized as satellites with a mass less than 1000 kg, mini satellites (mini-sats) less than 500 kg, micro satellites (micro-sats) less than 100 kg, nano satellites (nano-sats) less than 10 kg, pico satellites (pico-sats) less than 1 kg, and femto satellites (femto-sat) less than 100 g.[10] Furthermore, standardized nano satellites in the shape of a small cube are referred to as "CubeSats".[11]

The design and capability of small satellites vary considerably. Larger satellites in the range of several hundred kilograms are usually equipped with power generation by solar arrays, stabilization and positioning systems. Smaller satellites in the range of only a few kilograms often lack these capabilities. In the production, small

[7] Neta Palkovitz and Tanja Masson-Zwaan, *Orbiting under the Radar: Nano-satellites, International Obligations and National Space Laws*, *in* Proceedings of the International Institute of Space Law 2012 (2013) 566.

[8] Ram Jakhu and Joseph Pelton, *Small Satellites and Their Regulation*, Springer Briefs (Springer New York 2014) 61.

[9] *See* Rainer Sandau, *International Study on Cost-Effective Earth Observation Missions Outcomes and Visions*, 36 Int'l Soc'y Photogrammetry Remote Sensing Commission Symp. pt. 1, *available at* http://www.isprs.org/proceedings/XXXVI/part1/Papers/T04-15.pdf

[10] *See* Jakhu and Pelton, *Small Satellites and Their Regulation*, *supra*, fn 8, 2; Werner Balogh, *The Role of Binding and Non-binding Norms in the Implementation of Small Satellite Programmes*, *in* Soft Law in Outer Space (Irmgard Marboe ed, Böhlau 2012) 325, 326.

[11] Paul Muri and Janise McNair, A Survey of Communication Sub-systems for Intersatellite Linked Systems and CubeSat Missions, 7 J. of Comm. 290, 295 (2012).

satellites need less material and usually less development costs. This makes them cheaper and more accessible to a larger number of users. Launching costs can be drastically reduced by the launch of multiple satellites on one launch vehicle or the use of hosted payloads.[12] In addition, standardized solutions are now available which reduce development and production costs even further.[13]

Small satellites may serve different purposes. At the outset, they were mainly designed for scientific research and education. Scientific questions about the Earth, its atmosphere and the universe have driven astronomers, geologists and other scientists to cooperate closely with space technology experts and researchers.[14] Other projects included the sending of satellites to the ISS where experiments were controlled from the ground.[15] The CubeSat platform created at Cal Poly in California by professors and students has turned out to be very successful for the development of small satellites for a large variety of research and educational purposes.[16]

Furthermore, the testing of innovative space technology is increasingly done by small satellite missions. The development of microtechnology may bring important achievements for larger and more comprehensive missions.[17] The successful testing of experimental components can also be useful for subsequent commercial development.[18]

Earth observation has turned out to be an important area where small satellites can help developing countries to become more independent and avoid relying on input from major space-faring nations.[19] The use of numerous small satellites in constellations can bring about greater Earth coverage and good resolution results with less sophisticated and less expensive technology than larger Earth observation satellites. Out of the CubeSat community, SkyBox Imaging, Inc., a satellites platform was founded to take images of the Earth and sell them.[20] This seems to be a

[12] Milton Smith and Stephen Smith, Legal Issues Presented by Hosted Payloads, *in* Proceedings of the International Institute of Space Law 2011 (2012) 495.

[13] See, for example, the standardized off-the-shelf solution offered by the Dutch startup company Isis in Space, http://www.isispace.nl/cms/

[14] One recent example is the BRITE mission in which Austrian, Polish and Canadian scientists and researchers cooperate to investigate the brightness variations of highly illuminous bright stars for the purpose of finding out more about the origins and the composition of the universe. See http://www.brite-constellation.at/

[15] See, for example, the external platform program and small satellite deployment by Nanoracks, http://nanoracks.com

[16] See CubeSat, http://www.cubesat.org/

[17] See Balogh, supra, fn 10, at 325, 327.

[18] See the NASA CubeSat Launch Initiative, http://nasa.gov/directorates/heo/home/CubeSats_initiative.html

[19] Rainer Sandau, Int'l Acad. of Astronautics, Presentation at the Fourth African Leadership Conference on Space Science and Technology for Sustainable Development, *Small Satellites for Capacity Building in Space Technology Development* 6 (Sept. 26 2011), http://www.oosa.unvienna.org/pdf/bst/ALC2010/02_Sandau_ALC-Mombasa.pdf

[20] SkyBox Imaging, http://www.skyboximaging.com/technology. See also Michael Dornik and Milton Smith, Small Satellite Industry and Legal Perspectives in the US, in: Irmgard Marboe (ed.), Small Satellites – Chances and Challenges (forthcoming).

promising business model, as it has recently been purchased by Google for 500 million USD.[21]

Small satellites are also used for communication purposes. Although, in general, communication satellites are large and powerful, often operating in the Geostationary Orbit (GEO), several systems exist that use small satellites in Low Earth Orbit (LEO).[22] Well-known examples include the Iridium and Globalstar constellations which are used by the US military for mobile communications services.[23] Iridium consists of 66 satellites with a mass of about 680 kg, Globalstar operates with 40 satellites of about 550 kg.[24] In addition, the Orbcomm constellation can be mentioned which uses 18 satellites with masses between 42 and 115 kg.[25] Also the CubeSat educational projects include simple communication satellites.[26]

Finally, it may be noted that also the military is increasingly using small satellites for particular services. The advantage of being able to launch such satellites on relatively short-term notice can play a role in cases of unexpected outbreaks of hostilities, terrorist attacks, or emergency situations.[27] The applications needed in such situations, in addition to mobile communication services, include the collection of data from the ground and meteorological data.[28]

Authorization

According to Article VI OST, each State party is responsible for its national activities in outer space and has to authorize and continuously supervise them, whether they are conducted by governmental agencies or non-governmental entities.[29] This means that space activities involving small satellites need authorization and supervision by the appropriate State. Many States have enacted national laws that ensure that space activities, whether involving small or large satellites, are appropriately

[21] Dornik and Smith, supra fn 20; see also James O'Toole, Google Buys Satellites Startup Skybox Imaging, http://www.money.cnn.com/2014/06/10/technology/innovation/google-skybox/

[22] There are, however, also ideas on small communication satellites in GSO, see A. E. Buravin, Small communication satellites on the GSO: niche and prospects (2006) 3 Technologies and Communications, http://tssonline.ru/articles2/bypub/tss-3-2006

[23] Jakhu and Pelton, *Small Satellites and Their Regulation*, supra, fn 8, 15.

[24] See Dornik and Smith, Small Satellite Industry and Legal Perspectives in the US, *supra*, fn 20.

[25] Jakhu and Pelton, *Small Satellites and Their Regulation*, supra, fn 8.

[26] CubeSat, http://cubesat.org/index.php/missions/past-launches

[27] Jakhu and Pelton, *Small Satellites and Their Regulation*, supra, fn 8, 14.

[28] Ibid.

[29] Article VI OST reads: "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of nongovernmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. […]"

authorized and supervised.[30] However, as the OST does not define what an "activity in outer space" is, some room remains for the argument that not all phases of the small satellite's lifetime need authorization and supervision. While there is no doubt that the launch of a small satellite is considered an activity that needs authorization and supervision, it has sometimes been questioned whether this is also the case for the in-orbit phase. The main argument against is that many small satellites can not be maneuvered any longer during their orbital lifetime and thus cannot be "operated".

The uncertainty about this question has triggered the Belgian legislature to amend the national space law of Belgium of 2005 only a few years after its entering into force.[31] The purpose was to ensure that small satellites in orbit are authorized and also continuously supervised by the State. The main reason for the elaboration of a national space act and its amendment was the concern to be held liable for activities beyond the State's supervision and control according to Article VII of the OST.[32] The objective was to avoid that small satellites which pose a not inconsiderable risk of collisions in orbit are not properly regulated and that the Belgian State could be held responsible. Consequently, the new provision in the Belgian law which entered into force in January 2014 provides new wording in respect of the terms "operator", "effective control", "flight operation" and "guidance", such as:

> …'operator' means the person that carries out or undertakes to carry out the activities referred to in this law, by ensuring, alone or jointly, the effective control of the space object. The activity carried out by an operator may be carried out pursuant to a specific contract for that purpose. In the case of a space object whose flight cannot be operated or which cannot be guided once it has been positioned in orbit, the operator is deemed to be the person who has ordered the delivery in orbit of the space object.[33]

Uncertainty also existed in other countries, such as the Netherlands. The intended interpretation of the national space law was not entirely clear, so that it was uncertain whether the Dutch State required authorization of small satellites that are not maneuverable.[34] Similar uncertainties existed with regard to the French Space Operations Act of 2008.[35] In other countries, the scope of application of the respective space law may lead to the non-applicability of the duty to obtain an authorization. For example, the Canadian space legislation requiring authorization for Earth remote sensing satellites was not applied to small satellites that detected and tracked man-made and natural objects in space.[36]

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[30] See Irmgard Marboe, *National Space Legislation*, in: Christian Brünner and Alexander Soucek (eds.), Outer Space in Society, Politics and Law (Springer, Vienna-New York 2012) 439, 444 ff.

[31] Irmgard Marboe and Karin Traunmüller, Small Satellites and Small States: New Incentives for National Space Legislation, in 38 Journal of Space Law (2012) 289, 305–307.

[32] Jean-François Mayence, *Introduction to Belgian Law on the Activities of Launching, Flight Operations or Guidance of Space Objects*, *in* 5 *Space Law: Basic Legal Documents* E.X (Karl-Heinz Böckstiegel et al. eds., 15th ed. 2011).

[33] (new) Article 3, No 2, of the Belgian Space Act.

[34] See Palkovitz and Masson-Zwaan, Orbiting under the Radar, *supra* fn 7.

[35] See Sa'id Mosteshar and Irmgard Marboe, Authorization of Small Satellites under National Space Legislation, in: Irmgard Marboe (ed.), Small Satellites: Chances and Challenges (forthcoming).

[36] Ibid.

On the other hand, there are national space laws which clearly include the in-orbit phase of small satellites in their scope of application. The Austrian Outer Space Act of 2011 was enacted precisely to address the need for the regulation of small satellites.[37] The Swedish act dating back to 1981 has always been interpreted in a way to include small satellites.[38] Some States intend to alleviate the burden that comes with the authorization of small satellites and support the respective national activities, for example by waiving the obligation to obtain insurance for small satellites.[39]

A large number of States, however, do not have national space legislation at all. It follows that space activities may be initiated by researchers, universities, or other private entities without any authorization. The respective State may thus not be informed about the space activity but is nevertheless responsible.

In any case, whether the scope of application is unclear or whether there is a total absence of national space law, the responsible State under Article VI OST risks to become internationally responsible for not having sufficiently authorized and supervised its national activities. The State may thus be liable for damage and may have to compensate the damage, even in cases in which the State is not the launching State as will be seen in the following. It is therefore in the interest of States to include small satellites in the scope of application of the national regulatory framework of authorization and supervision of space activities. Such national framework could also provide for a right of recourse against the operator, in case the State had to pay compensation under international law.

Liability, Risk and Insurance

As is well known, under international space law, the launching State is liable for damage caused by a space object.[40] While Article VII OST does not qualify this any further, the Liability Convention differentiates between absolute liability for damage caused on Earth and to aircraft in flight, and fault liability for damages

[37] See the English translation of the Explanatory Report by the government to the Austrian parliament to the draft of the new Outer Space Act in: Irmgard Marboe, The New Austrian Outer Space Act, 61 Zeitschrift für Luft- und Weltraumrecht (2012) 26, 42 ff. See the German original at the website of the Austrian parliament, http://www.parlament.gv.at/PAKT/VHG/XXIV/I/I_01466/fname_232781.pdf

[38] See Niklas Hedman, Swedish Legislation on Space Activities, in *National Space Law* (Eds. C. Brünner & E. Walter)(2008) 74; Niklas Hedman, Vertices of an Administrative Procedure/Costs: The Swedish Experience, in *Project 2001 Plus – Towards a Harmonised Approach for National Space Legislation in Europe* (Eds. S. Hobe, B. Schmidt-Tedd & K.U. Schrogl)(2004) 75.

[39] See Article 4, para. 4 of the Austrian Outer Space Act; in the UK, a consultation process has started pursuing a similar goal. See Mosteshar and Marboe, *supra* fn 35.

[40] See Principle 8 of the Declaration of Legal Principles, GA Res of 1963; Art. VII OST; and Articles II and III of the Convention on International Liability for Damage Caused by Space Objects of March 29, 1972, 961 UNTS 187 (hereafter LIAB).

caused elsewhere.[41] As small satellites are by definition small in mass, the risk that they cause damage on Earth or to aircraft in flight is rather minimal. They usually burn up when they re-enter the Earth atmosphere. However, there is some remaining risk, in particular, if hazardous material, such as toxic or radioactive material, is used that survives the de-orbiting phase.

Considerably higher is the risk that a small satellite causes damage in outer space, namely by a collision with another space object. In this case, the State is liable if its "fault" or that of persons for whom it is responsible can be established. It is difficult to determine the degree of care that is necessary in outer space as no clear rules, such as traffic management, exist in this regard.[42] However, certain factors do allow an evaluation whether a State has acted negligently. One factor could be that the State has not authorized the small satellite activity although it should have done so under Article VI OST. Another factor could be whether the State has diligently performed its duty to supervise. If the small satellite was operating on a scheme that is not compatible with international technical standards and good practices, including space debris mitigation standards, it is possible that "fault" of the State can be established.[43]

In addition to international liability, civil/tort law liability of the respective operator of the small satellites under national law has to be borne in mind.[44] Such liability under the general rules usually required fault in the sense of intent or negligence. "Strict" liability for hazardous activities is also possible, if it is provided for by national law. Such strict liability is normally limited by a ceiling and often combined with compulsory insurance.[45] Unlike the liability of the launching State under international law, liability of the operator under national law includes third-party damage to citizens of the launching State.[46] Finally, product liability also can play a role when it comes to establishing liability caused by a space object.

In order to protect the liable entity, be it a State or the operator of the space object, from liability for third party damage, the insurance industry offers insurance schemes that allow the payment of the damage without delay and in full. The availability of insurance against claims for damages related to space objects has proved to be conducive to the rapid commercial development of the space application business.

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[41] Art. II and III LIAB supra fn 40.

[42] The concept of "space traffic management" encompasses the development of "rules of the road" for space objects in various orbits. See the IAA Study on the topic, http://iaaweb.org/iaa/Studies/spacetraffic.pdf

[43] Irmgard Marboe, The importance of Guidelines and Codes of Conduct for Liability of States and Private Actors, in: Irmgard Marboe (ed.), Soft Law in Outer Space. The importance of non-binding norms in international space law (Böhlau Vienna 2012) 119, 122 ff.

[44] Armel Kerrest and Lesley Jane Smith, Article VII, in Hobe/Schmidt-Tedd/Schrogl [eds.], Cologne Commentary on Space Law [2009], Volume 1, page 144, paras 65–67.

[45] Franz Werro and Vernon Valentine Palmer, The Boundaries of Strict Liability in European Tort Law (Carolina Academic Press/Staempfli Verlag 2004) 400 ff.; Gert Brueggemeier, Risk and Strict Liability: The Distinct Examples of Germany, the US and Russia, EUI Working Papers Law No. 2012/29, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2201536

[46] Kerrest and Smith, supra fn 44, page 135, para 30.

Different insurance schemes are available on the market.[47] On the one hand, there is insurance for property damage, including damage caused by the loss of a satellite due to launch failure, collision, or other reasons. Furthermore, the commercial loss as the consequence of an impossibility of operation or other causes can be insured. On the other hand, there is third-party liability for damage caused by the satellite which can be due to launch failure, collision, re-entry, or other causes. In addition, handling insurance can be obtained for partners producing and preparing the satellite for launch. Finally, transportation insurance for, damage incurred during the transportation from the place of production to the launching site has become a regular feature of satellite projects.

As regards property insurance, generally, the declared value of a satellite is decisive. The insurance contract may distinguish between total loss, constructive total loss, and partial loss. Usually, the damage is covered on an "all risk basis".[48] The period of coverage generally extends over 12 months. This kind of property insurance is normally not acquired for small satellites. The premium is relatively high, and reconstruction of the destroyed satellite usually does not make sense. Operators most often opt for "self-insurance", in particular, if the satellite is publicly funded. However, there are also exceptions. The Nee-01Pegaso (Ecuador) was insured for property damage although its value was less than one million USD.[49]

As regards damages caused to third parties during the launching phase, insurance is more common. The damage can be caused by the launch vehicle or by the satellite. Generally, the launching phase insurance is subscribed to by the launch service provider following cross waivers and hold harmless agreements between the parties. One single policy covers various contractors. The duration of such insurance varies.

Concerning the operation phase, insurance could cover damage caused to third parties on Earth and damage caused to third parties by collisions in outer space. Such insurance is sometimes required by national law, for example, in France and Austria.[50] The terms of the insurance contract, such as coverage and premium, depend on technologies, manufacturers, and operators involved. It may be more difficult to obtain a contract for small satellites due to the lack of flight experience of nano-sats. Currently such insurance is not very high in demand, and the market has overcapacity.[51]

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[47] Cécile Gaubert, Insurance in the context of space activities, in: Frans von der Dunk and Fabio Tronchetti (eds), Handbook of Space Law (Cheltenham Edward Elgar 2015) 910, 912–942; see also Irmgard Marboe, Small Satellites: Liability, Risk and Insurance, Presentation made at the Global Space Application Conference, Paris, 2–4 June 2014, available at www.glac2014.org, ISSN 1995-6258.

[48] Gaubert, ibid, 933 ff.

[49] Cécile Gaubert, Do small satellites need insurance, Presentation made at the conference "Small is beautiful – Challenges and Risks of Small Satellites, Vienna, 29 March 2014, available at http://www.spacelaw.at/documents/2014/14_Insurance_Gaubert.pdf

[50] Article 6 of the French Space Operations Act (2008); Article 4, para 4 of the Austrian Outer Space Act (2011).

[51] Gaubert, supra fn 49.

From the perspective of the insurance industry, the risk of damage caused by small satellites on Earth is rather low.[52] In most cases, the re-entry of the satellite leads to a full destruction of the satellite by burning up in the atmosphere. The risk of liability for damage caused by satellites in outer space is also still rather remote, due to lack of clarity on "fault". This may, however, change in the future.

National and International Registration

According to international space law, every space object needs to be registered. There are various legal bases confirming this obligation, such as UN GA Resolution 1721 B of 1961,[53] the Convention on the Registration of Space Objects of 1974 (REG),[54] and UN GA Resolution on the Registration Practice of States.[55] The main reason and incentive for registration is that the State of registry has jurisdiction and control of the respective space object. This serves the State's interest insofar as it can regulate the activity connected to the space object and impose conditions upon the operator. Registration is a duty of the launching State. Since the same concept of the launching State is decisive for the State's international liability, as mentioned above, the State can exercise control and act preventively to avoid that its international liability becomes engaged.

According to Art. I REG and Art. I LIAB, the launching State is the State which launches or procures the launch of a space object or from whose territory or facility a space object is launched. Due to this definition, various States could potentially register. Art. II, para. 2 REG provides that, if there is more than one launching State, the States should jointly agree which of them should register. It follows that only one State should register.

However, in the context of small satellites, it is possible that no State considers itself as the launching State for the purpose of registration. As a consequence, several small satellites have not been registered. The main reason for this undesired result is the uncertainty of the meaning of "to procure the launch of a space object". As many small satellite projects are developed and operated by private entities, it may be questionable whether, in fact, a State has "procured" the launch. The other potential launching State(s), most importantly the State "from whose territory or facility" the object was launched, may not be ready to register the small satellite either, as they usually do not have any interest in exercising jurisdiction and control over the satellite. It can be argued that there is no relevant link between the State and the satellite, when neither the State itself nor any of its citizens are involved in the

[52] Ibid.

[53] Resolution adopted by the General Assembly 1721 B (XVI), International co-operation in the peaceful uses of outer space of 20 December 1961.

[54] Convention on the Registration of Objects Launched into Outer Space of 12 November 1974, 1025 UNTS 15 (hereinafter REG).

[55] Resolution adopted by the General Assembly 62/101, Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects of 17 December 2007.

operation of the small satellite. As a consequence, launch service providers generally renounce the obligation to take care of registration and request the customer, i.e. the private operator of the small satellite, to do so.[56] However, the right and duty to register a satellite under international law is not upon a private operator but upon a "launching State". If the home State of the operator does not consider itself as a launching State for the purpose of registration, the private operator has no legal possibility to ensure that the satellite will in fact be registered. This situation is unsolved under the current status of international space law. It can only be remedied by way of national space legislation and by a broad interpretation of the term "procure" and thus the concept of the "launching State". If such interpretation leads to an approximation of the definition of the "responsible State", this would ensure that the State "responsible" for its national activity in outer space has also jurisdiction and control over the respective space object.

At first sight, such a broad interpretation could trigger a much broader liability of the State for damages caused by private small satellite projects than provided for under the UN space treaties. However, as the State is anyway "responsible" for its national activities in outer space, even if they are undertaken by non-governmental entities,[57] it should not shy away. The main reason is that the risk involved is rather limited, because strict liability only applies for damage caused on Earth. As mentioned above, such risk is minimal in respect of small satellites, because they generally burn up completely upon re-entry into the Earth's atmosphere. On the other hand, damage caused elsewhere, i.e. by a collision in outer space, requires "fault". The most appropriate way of avoiding "fault liability" is to authorize and continuously supervise the small satellite. This is not more than what is already required under Art. VI OST. To the contrary, the "responsibility" for activities in outer space already goes further than that. It includes any violation of an international obligation by the non-governmental entity, regardless of any "fault". The State has responsibility for the violation of the obligations contained in the UN space treaties, but also of other international obligations, such as those under the ITU rules on frequency allocation, as will be discussed in the following. Any State is thus well advised to interpret the concept of the launching State and the responsible State in a similar manner in order to ensure that private small satellite projects do not lead to a violation of international law and trigger the State's international responsibility in a broader sense.

Frequency Registration

Small satellites need radio frequencies for their proper functioning. It is important to bear in mind that the radio frequencies, as well as orbital positions for satellites, are limited natural resources[58] that need to be allocated in a fair and efficient manner.

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[56] Palkovitz and Masson-Zwaan, Orbiting under the Radar, *supra*, fn 7, 566.

[57] According to Art. VI, sentence 1, OST. See the discussion on "Authorization" at text & notes 29 – 39, *supra*.

[58] See Art. 44 (2) ITU Constitution.

The main concern of all users is the avoidance of collisions and interferences. The International Telecommunication Union (ITU) is the international organization entrusted with the allocation of frequencies and orbital positions to different radio communication services on the international level. The legal bases of its work are the ITU Constitution,[59] the ITU Convention[60] and the Radio Regulations.[61] The documents are international treaties that are binding for all of its 193 member States. The provisions regarding frequency allocation and management apply to all radio communications services by satellites irrespective of their size. There are, however, certain particularities which have to be highlighted in the present context.

First of all, it is notable that many small satellites use radio frequencies allocated to the Amateur Satellite Service under the Radio Regulations, even if this is not always in accordance with the definition and purpose of such service:

> A radiocommunication service for purpose of self-training, intercommunication and technical investigation carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.[62]

As has been shown above, small satellites are increasingly used for a number of different purposes and by a number of different users. Not all of them fulfill the criteria of an amateur as defined in the Radio Regulations. The use of amateur frequencies might therefore in many cases not be appropriate. Furthermore, the growing number of small satellites has crowded the amateur satellite service bands and has increased the incidence of radio interference.[63]

On the other hand, it needs to be recognized that compliance with all ITU requirements and procedures could be a complicated, long, and expensive process which is beyond reach for some small satellite operators. Most importantly, the ITU regime requires a procedure of pre-notification, the so-called "Advance Publication of Information" (API), as well as frequency coordination procedures in case of objections.[64]

In front of this background, in 2012, the WRC-12 discussed the issue of small satellites and identified the need to review existing regulatory framework at the

[59] Constitution of the International Telecommunication Union (Geneva, 22 December 1992), as amended by the 2010 Plenipotentiary Conference, see http://www.itu.int/en/history/Pages/ConstitutionAndConvention.aspx

[60] Convention of the International Telecommunication Union (Geneva, 22 December 1992), as amended by the 2010 Plenipotentiary Conference, see http://www.itu.int/en/history/Pages/ConstitutionAndConvention.aspx

[61] The Radio Regulations complement the two basic ITU documents mentioned above. They implement and regulate in more detail the provisions and principles contained in them. They are regularly re-negotiated and updated at the World Radio Conferences (WRC) that take place every 3 years.

[62] ITU RR 2012, No 1.56.

[63] This has even led to the formation of a specialized organization, the Satellite Interference Reduction Group (sIRG). See Jakhu and Pelton, *supra*, fn 8, 57 f.

[64] The respective procedures are regulated in detail in Articles 9 and 11 of the ITU RR 2012.

forthcoming WRC.[65] It considered that, in particular, nano-sats and pico-sats may require regulatory procedures which take into account the short mission time, unique orbital characteristics, and the typical missions of such satellites. In its Resolution 757 on "Regulatory Aspects for Nanosatellites and Picosatellites", it requested the ITU-R to examine the procedures and operation of nano-sats and pico-sats.[66] The Bureau shall report to the WRC-15 the results of these studies. WRC-18 will take up the matter to consider whether modifications of the regulatory procedures of notification and coordination are needed. Until then, the ITU regulations and procedures are applicable to small satellites in the same manner as for larger satellites. The main responsibilities lie with the national administrations that are in charge of implementing the international regime on frequency allocation on the national level.

On the regional level, ESA has launched an information campaign in view of the increasing popularity of small satellites. In a publication entitled "Fly Your Satellite. Frequency Registration Guidelines for SmallSat Missions" it highlights that small satellite missions, including missions involving CubeSats, are perceived as an official national space activity.[67] It points out that also small satellite operators have to comply with a number of international rules. After explaining the relevant rules and regulations, the publication summarizes the requirements in a "Step-by-Step Procedure" for the frequency allocation of small satellite projects. In addition to the relevant ITU rules, it highlights the importance of the International Amateur Radio Union (IARU), an international confederation of national amateur radio organizations that provides a forum for common matters of concern that collectively represents matters to the ITU.[68] It points out that for radio-amateur frequency coordination, the ITU registration procedure and the coordination of the frequency with IARU are necessary.[69]

On the national level, the US has issued a document informing prospective operators of a small satellite project of how frequency allocation and coordination is to be effectuated.[70] It points out that all satellites need a license by the Federal Communications Commission (FCC).[71] However, the FCC recognized the difficulties faced by small satellite operators and has formulated simplified guidelines for the use of radio frequencies allocated to the amateur satellite service. Furthermore, it reduced the respective administrative fees for such projects.

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[65] WRC-15, see www.itu.int/en/ITU-R/conferences/wrc/2015

[66] Resolution 757 (WRC-12), www.itu.int/en/ITU-R/space/AmateurDoc/RES-757.pdf

[67] ESA, Fly Your Satellite. Frequency Registration Guidelines for SmallSat Missions (2014) 6; see generally the respective ESA educational project of the same name: http://www.esa.int/Education/Call_for_Proposals_Fly_Your_Satellite

[68] ESA, Guidelines, supra fn 67, 19.

[69] Ibid. 23.

[70] Federal Communication Commission, Guidance of Obtaining Licenses for Small Satellites, Public Notice, Released 15 March 2013.

[71] See the Communications Act of 1934, 47 USC Chapter 5, as amended, and the Federal Satellite Communications Regulations, 47 Code of Federal Regulations, Part 25.

As can be seen from these recent developments at the international, regional and national levels, there is a need to address the issue of small satellites specifically. The coordination of frequencies remains important in order to avoid harmful interference for the benefit of all. Some simplifications and reduction of costs will certainly be beneficial for the emerging trend of developing small satellites. At the same time, they will facilitate better compliance with the rules on frequency allocation and keeping small satellite activities under control.

Mitigation of Space Debris

A considerable number of small satellites, in particular the nano-sats and smaller satellites, usually lack on-board propellant systems and are thus not maneuverable. Once they are deployed in an orbit, they cannot change their position. This causes serious concerns relating to collisions with other space objects. One example of such a collision is the incident of 23 May 2013 when a CubeSat, Ecuador's first CubeSat, Pegasus, collided with a piece of debris from a Russian rocket.[72]

The increasing use of small satellites can jeopardize the initiatives on the mitigation of space debris taken on the international level with increased intensity, such as the IADC Guidelines on the Mitigation of Space Debris of 2002[73] or the UNCOPUOS Guidelines for the Mitigation of Space Debris of 2007.[74]

The main problem is that once in orbit, small satellites lacking manoeuvering capability cannot be removed. Depending on the orbit, they may remain there for hundreds of years and represent a dangerous threat to functional space craft. This has led to marked criticism of small satellites missions, in particular from the perspective of owners and operators of sophisticated satellite missions, purporting that small satellites are nothing more than space debris in the shorter rather than in the longer run.[75]

On the other hand, small satellites have a lot of potential. Not only are they an important means for developing knowhow in emerging space faring nations, but also for technological development in general, including technologies addressing the problem of space debris. In particular, the issue of debris removal has been

[72] See Jakhu and Pelton, *Small Satellites and Their Regulation*, supra, fn 8, 9.

[73] Space Debris Mitigation Guidelines 2002 of the Inter-Agency Space Debris Mitigation Committee (IADC), see http://www.iadc-online.org/Documents/Docu/IADC_Mitigation_Guidelines_Rev1_Sep07.pdf

[74] Space Debris Mitigation Guidelines of the Committee for the Peaceful Uses of Outer Space, endorsed by the Resolution of the General Assembly 62/217 of 22 December 2007, see http://www.oosa.unvienna.org/pdf/publications/st_space_49E.pdf

[75] See Jakhu and Pelton, *supra*, fn 8, 1. See the most interesting "Ten Top Things to Know About Small Satellites and Space Debris" to face the challenge of space debris, ibid, 71–77.

addressed by a number of researchers with original ideas.[76] Therefore, small satellites can be a threat or an opportunity in the area of space debris mitigation. At the national level, States may have to find a proper balance between the preservation of the space environment and the fostering of new technological developments. Measures to avoid space debris are crucial but should not be implemented in a manner that turns out to be prohibitive for the development and operation of small satellites.

Conclusion

Considering the advantages and disadvantages of small satellites mentioned above, a number of measures may be identified that States could take to ensure that small satellites can develop their positive potential and avoid the negative consequences regarding potential damage and liability. First of all, it must be emphasized that the responsibility of the State for national space activities includes responsibility for small satellites projects. If these projects are undertaken by non-governmental entities, such as universities, research institutions, or companies, authorization and continuous supervision is key. It follows that small satellite projects need to be included in the scope of application of national space legislation.

As regards the potential liability of a 'launching State', the uncertainty as to what 'procurement' means could be remedied by a broad interpretation of 'launching State'. Such a broad interpretation could ensure that the State has 'jurisdiction and control' over small satellites in accordance with Art. VIII OST. Furthermore, the State could establish a right of recourse from the operator in case the State had to pay compensation due to international liability.

As regards the criterion of 'fault' that is not yet defined for the purpose of liability for damage caused by a space object in outer space, it should be kept in mind that it can consist in a violation of a legal norm (e.g. Art. IX OST) or of a standard (e.g. space debris mitigation). It follows that in order to avoid 'fault', small satellites should comply with legal norms and standards.

The question whether small satellites need insurance should be answered in a differentiated way. Property, commercial loss, handling and transportation insurance should be left at the discretion of the operator. However, third party liability (TPL) insurance is strongly advisable for covering liability of the State (launching State/responsible State) and of the private operator (under general private/tort law rules). One possibility would be to ensure, by national legislation, that TPL insurance is a requirement for authorization. However, a waiver of insurance requirement could be considered, if a small satellite activity is in the public interest, e.g. for education, science and/or research.

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[76] *See, e.g.*, Alex Da Silva Curiel, University of Surrey, Presentation at the UN/ESA/Austria Symposium on Small Satellite Program for Sustainable Development, *Space Debris – Issues and Mitigation Measures* (15 September 2011), http://www.unoosa.org/oosa/SAP/act2011/graz/index.html

If the legal and regulatory framework is applied and adapted appropriately, the chances and challenges of small satellites can be balanced in an adequate way. The prospects are promising and positive. Small satellites allow a larger number of people to actively participate in space and enjoy its benefits. They truly have the potential of "making space technology accessible and affordable" as the UN Basic Space Technology Initiative put it.[77]

[77] United Nations/Mexico Symposium on Basic Space Technology, 20–23 October 2014, Ensenada, Baja California, Mexico, see http://www.unoosa.org/oosa/en/SAP/bsti/mexico2014.html

Legal Aspects of Solar Power Satellites

Ram S. Jakhu, Diane Howard, and Andrea J. Harrington

Abstract It is an undisputed fact that the global need for energy will grow exponentially in the future and the search for alternative energy sources will intensify. One alternative source will be space- based solar power (SBSP), to be collected in space and transmitted to Earth by solar power satellite (SPS). As the appropriate technology becomes proven, the economic and operational viability for the launch of SPS system(s) will, to a large extent, depend upon favorable political and legal determinants. One such determinant relates to safety risks and the possible liability of the operator(s) of SPS system(s). This chapter identifies the safety risks of, and analyses liability for, damage caused by SPS. Issues, specifically analyzed under international law and the domestic law of the U.S., include licensing and damage caused (in outer space, in the air and on the Earth) by electronic transmission, and mechanisms to manage liability including *inter alia* insurance coverage, waivers of liability, and dispute settlement mechanisms. The chapter contains recommendations for taking regulatory precautions in order to avoid the risks of possible liability and thereby enhancing favorable circumstances for launch and successful operation of SPS system(s).

This is an expanded and revised version of a preliminary paper by Ram S. Jakhu and Diane Howard presented at the 2010 Colloquium on the Law of Outer Space, Prague, Czech Republic.

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Introduction

Technology drives today's world. We stay connected via handsets of increasing complexity, broadcasts keep us informed of events as they transpire, even allowing us to monitor disasters as they unfold in real time, computers are smaller but faster, our personal vehicles contain gadgetry that can direct us to a destination as we are driving while simultaneously entertaining our passengers with movies, and flights link the remotest corners of the globe. Each and every one of these capabilities relies upon power.

But power comes at a price. The most obvious of these is economic, however our current carbon-based resource carries with it security and environmental implications as well. Nearly 60 % of the world's primary energy supply comes from oil and gas.[1] Members of the Organization of the Petroleum Exporting Countries (OPEC) currently account for approximately 81 % of total global proven oil reserves, while countries comprising the Organization for Economic Cooperation and Development (OECD) hold only about 4 % of the reserves[2] despite consuming approximately 52 % of the world's full amount.[3] Although the U.S. consumes approximately 25 % of the world's energy, the topography of energy use is rapidly changing as developing countries come online in order to raise their standard of living exponentially.[4] As incomes rise in conjunction with the impact of climate change, the energy demand for cooling in summer is set to increase rapidly in the 21st century.[5] Additionally, as temperatures rise, the efficiency of thermal power generation, which currently accounts for about 80 % of global electricity, will decrease.[6] Thus, as we deplete our finite resources,[7] demand increases.

Entwined in the economic costs of a fossil fuel-based resource are the national security costs. Energy security has been defined as the loss of welfare that may occur as a result of a change in the price or availability of energy due to unstable

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[1] J. Hamilton, "Causes and Consequences of the Oil Shock of 2007–08," http://www.brookings.edu/economics/bpea/~/media/Files/Programs/ES/BPEA/2009_spring_bpea_hamilton.pdf; A.C. Eriksen, "World Oil Production Peaked in 2008," posted 17 March 2009, available at: <http://www.theoildrum.com/node/5177>.

[2] OPEC Annual Statistical Bulletin 2013 Table 3.1, available at: <http://www.opec.org/library/Annual%20Statistical%20Bulletin/interactive/current/FileZ/Main.htm>.

[3] *Ibid*, Table 3.16.

[4] Molly Macaulay "Can power from space compete?" *Space Policy* 16 (2000) 283–285 at 284; "Clean energy to grow into 1.6 trillion euros industry: WWF" available at: <http://www.solardaily.com/reports/Clean_energy_to_grow_into_trillion_euro_industry_WWF_999.html>.

[5] Climate Change 2014: Impacts, Adaptation, and Vulnerability, Intergovernmental Panel on Climate Change, available at: <http://ipcc.ch/report/ar5/wg2/>, Chapter 10 at 6.

[6] *Ibid* at 6–7.

[7] "Latest trends in research and development of renewable energy sources" available at: <http://www.renewable-energy-sources.com/2010/02/23/depletion-of-non-renewable-energy-sources-january-2010-status/>; Financieele Dagblad "Oil will be depleted sooner that the IEA expects" *Energy Bulletin* (14 November 2005) available at: <http://www.energybulletin.net/print/10857>.

sources and/or depleting resources.[8] For instance, the U.S.' reliance upon oil production that is beyond its control, in a volatile market where demand is high, exposes that nation to possible political and strategic pressure by those countries controlling production.[9] Financial pressures can undermine a country's ability to effectively lead in the foreign policy arena or can shift ideological priorities in favor of protecting foreign sources of oil and gas.[10]

In addition to these security costs, carbon based energy also includes health and environmental costs or externalities, which include atmospheric emissions, water discharges, soil contamination, land damage from mining, black lung disease, global warming, and acid rain.[11] Not only is the current non-renewable fossil-based system costly, it is also inefficient. The current U.S. electric power grid is more than 100 years old, well past its prime.[12] Patched together between multiple owners, including state governments and private companies, attempts to upgrade often run into dispute.[13] Oil fields, coal mines, and natural gas fields are located far from the population centers most in need of output, adding transportation costs or electrical transmission costs to the equation and often resulting in lost power during transit.[14] At least one renewable, green alternative to fossil-based energy – wind power – is incompatible with, or outpaces, the relic distribution system.[15] In fact, a minimum of 32 U.S. states have mandated that their electric utility companies meet baseline requirements for delivering a proportion of their energy from renewable sources.[16]

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[8] Nicolas Lefevre "Measuring the energy security implications of fossil fuel resource concentration" Energy Policy 38 (2010) 1635–1644 at 1635; *Space-Based Solar Power As an Opportunity for Strategic Security* National Security Space Office Interim Assessment (10 October 2007) at 8.

[9] *Powering America's Defense: Energy and the Risks to National Security*, CNA, Alexandria VA, May 2009, at vii. Available at: <https://www.cna.org/sites/default/files/Powering%20Americas%20Defense.pdf>. CNA is a think tank committed to aiding government leaders in making policy driven decisions.

[10] "The Hidden Cost of Fossil Fuels" Union of Concerned Scientists, available at: <http://www.ucsusa.org/clean_energy/our-energy-choices/coal-and-other-fossil-fuels/the-hidden-cost-of-fossil.html>.

[11] Molly K. Macaulay and Jhih-Shyang Shih "Satellite solar power: Renewed interest in an age of climate change?" *Space Policy* 23 (2007) 108–120 at 110.

[12] David Biello "World's largest machine – the electric grid—is old and outdated" Scientific American News Blog (28 August 2008) available at:<http://www.scientificamerican.com/blog/post/worlds-largest-machine-the-electri-2008-08-28/>; Matthew L. Wald, "Wind Energy Bumps Into Power Grid's Limits" New York Times (26 August 2008) available at: < http://www.nytimes.com/2008/08/27/business/27grid.html >.

[13] *Ibid.*

[14] Joleroy Gauger "Energy Costs Eliminated by Satellite System" 16 Online Journal of Space Communication (Alternative Energy Issue) available at: <http://spacejournal.ohio.edu/issue16/gauger.html>.

[15] Wald, *supra* note 12.

[16] Mark I. Wallach, Legal Issues for Space Based Solar Power, available at: <http://spacejournal.ohio.edu/issue16/wallach.html>.

Enter space based solar power. First presented by P. E. Glaser in 1968,[17] the basic idea is that the sun, source of all energy on Earth,[18] produces energy twenty-four hours a day, seven days a week, everlastingly. Made possible by access to space, the sun's radiant energy would be collected on panels in space, converted to electricity, and then transmitted to Earth.[19] Current technology has refined Glaser's original concept. While he visualized arrays in the Geostationary Earth Orbit (GEO), placement collectors can be located either in the GEO, in Medium Earth Orbit (MEO), or on the surface of the Moon.[20] More recent proposals have even provided the option for placing space-based solar power (SBSP) satellites in Low Earth Orbit (LEO), where the energy would have significantly less distance to travel to reach ground stations.[21] Where Glaser foresaw photovoltaic panels as collectors, now an additional option is available – a solar dynamic system, collecting the solar radiation in a receiver containing a radiant energy absorber, flowing the energy through a cylinder where it is heated and then stored.[22] Photovoltaic film can now be made increasingly thinner; and while to date this has compromised overall efficiency, improved materials are likely in the near future. [23]

Conceptually, the more innovative architectures are envisioned as a network of collector satellites in a common orbit, creating a photovoltaic mass in area of several square kilometers.[24] Wireless transmission could be accomplished in two ways,

[17] P E Glaser "The Future of Power from the Sun," Intersociety Energy Conversion Engineering Conference (I ECEC), IEEE publication 68C-21 – Energy, 1968, pp. 98–103. Dr. Glaser received his first patent in 1971 and the wireless power transmission for the purposes of SPS was first successfully demonstrated at the NASA Space Antenna facility at Goldstone, CA in 1975.

[18] Even fossil fuels originate from the sun. "The ultimate source of energy is the sun. Its energy is found in all things, including fossil fuels. Plants depend on the sun to make food, animals eat the plants, and both ended up becoming the key ingredients for fossil fuels. Without the sun, nothing on this planet would exist." Eric McLamb "Fossils Fuels vs. Renewable Energy Resources: Energy's Future Today" www.ecology.com, available at: <http://ecology.com/features/fossilvsrenewable/fossilvsrenewable.html>.

[19] P E Glaser "Power from the Sun: Its Future" 162 Science No. 3856 (22 November 1968) at 857; Peter E. Glaser "Space Solar Power for Earth" available at: <http://www.nss.org/settlement/manufacturing/SM13.059.SpaceSolarPowerForEarth.pdf>.

[20] *Space-Based Solar Power As an Opportunity for Strategic Security* National Security Space Office Interim Assessment (10 October 2007) at 7.

[21] Aleksey Shtivelman, "Solar Power Satellites: The Right to a Spot in the World's Highest Parking Lot" (2012) 18 Boston University Journal of Science & Technology Law 435; Royce Jones, Alternative Orbits: A New Space Solar Power Reference Design, 16 Online Journal of Space Communication (2010), available at: <http://spacejournal.ohio.edu/issue16/jones.html>.

[22] *Ibid;* F. Shahrokhi, et al. *Space Commercialization: Launch vehicles and programs* (Washington D.C.: American Institute of Aeronautics and Astronautics, 1990) at 126; "Absorbing fluid receiver for solar dynamic power generation and solar dynamic power system", United States Patent 4945731 available at: <http://www.freepatentsonline.com/4945731.html>.

[23] Darel Preble "The Sunsat Act – Transforming our Energy, Economy and Environment" 16 Online Journal of Space Communication, available at: <http://spacejournal.ohio.edu/issue16/preble.html>.

[24] Don Flournoy "SUNSATS: The Next Generation of COMSATS" 16 Online Journal of Space Communication available at: <http://spacejournal.ohio.edu/issue16/flournoy.html>; Ina Jaffe

either by microwave (coherent radio waves) or by laser (coherent visible or infrared light).[25] While microwave efficiency has significantly increased, laser transfer is improving and may become more competitive.[26] The transmitted power would be collected on the ground by large area rectifying antennas (or rectennae), ranging from one to ten kilometers across. The difference between these collection areas and those required for coal or nuclear plants is that the power generated is non-polluting, no toxic waste would need to be disposed of, and the ground beneath the rectennae can be used for agricultural and fish farms.[27] Lastly, strides in robotics have advanced to the point that much, if not all, of the required assembly in space could be accomplished remotely.[28] The basic technology infrastructure to accomplish SBSP is considered to currently exist.[29]

There are several SPS-related concepts that are being proposed and studied, some of them have been well-summarized by Dr. Joseph Pelton in the following Chart 1:

In addition to space solar power, collection of energy in space may have other uses, some of which could include laser ranging to satellites, 'active illumination' of satellites for tracking and/or characterization, laser communication, active debris removal, anti-satellite activities (i.e. blinding Earth-observing sensors), laser weapons in space (i.e. shooting at targets below).[30] They will have their specific issues that need to be addressed. However this chapter exclusively deals with collection of energy in space and beaming it to Earth mainly for civilian and commercial purposes.

As the appropriate technology becomes proven, the economic and operational viability of launching SPS systems will, to a large extent, depend upon favorable political and legal determinants. One such determinant relates to safety risks and the possible liability of the operator(s) of SPS systems. This chapter addresses some legal aspects, especially licensing, safety, and liability risks of SPS; analyzes them against the current legal regime; and explores mechanisms available to manage those risks at an acceptable level.

The second part of the chapter will identify the safety risks associated with SBSP, including possible impacts on biota, environment and human health. While these risks may appear to be minimal when compared to concerns raised in the early

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"Company Plans to Pull Solar Energy From Orbit" (17 December 2009) National Public Radio available at: <http://www.npr.org/templates/story/story.php?storyId=121531373>.

[25] National Security Space Office, *supra* note 20 at 7.

[26] Preble, *supra* note 23 at 2. However, lasers implicate other concerns that are further discussed in Section I on Identification of Safety Risks, *infra*.

[27] Flournoy *supra* note 24 at 2.

[28] Aeronautics and Space Engineering Board, National Research Council, *Laying the Foundation for Space Solar Power: An Assessment of NASA's Space Solar Power Investment Strategy (*2001) at 44; National Security Space Office, *supra* note 20 at 21.

[29] Kathleen E. Lusk-Brooke & George H. Litwin, "Organizing and managing satellite solar power" *Space Policy* 16 (2000) 145–156 at 146; "Let the sun shine in" The Economist (4 December 2008); National Security Space Office, *supra* note 20 at 2.

[30] Mark A. Skinner, in his email to the authors.

Chart 1 Generic review of possible elements in SPS design

Generic review of possible elements in SPS design			
Elements of solar power design			
Degree of modularity of design	Integrated system with concentrators, photovoltaic solar cells (P/Vs), and transmission system to Earth	Free-flying solar concentrators and separate unit with solar cells P/V, and transmission system to Earth	Three independent systems for (i) solar concentration, (ii) photovoltaic, (iii) transmission of power to Earth
Orbits	Super synchronous (i.e. L1 Lagrangien point)	Geosynchronous	Low Earth or Medium Earth Orbit
Concentrator systems	High level of solar concentration (effectively P/Vs "see" equivalent of 100 suns or more)	Medium level of solar concentration (effectively P/Vs "see" equivalent of 10 suns or more)	Low Level of solar concentration (effectively P/Vs "see" equivalent of 3 suns or more)
Degree of sophistication of solar cells (P/Vs)	High efficiency ultraviolet cells or quantum dot systems (i.e. 30–50 % efficiency) and glass shielding for radiation/thermal protection	Medium efficiency P/V cells (20–30 % efficiency) of medium cost	Lower efficiency ultraviolet cells (15–20 % efficiency) and lower cost systems (i.e. amorphous silicon)
SPS to earth transmission system	Laser transmission system	Millimeter wave transmission system	Microwave transmission system
Launch operations	Independent launch operation with proven launcher system and launch insurance. Due diligence against orbital debris	Dual launch operation with limited launch insurance	Use of electronic propulsion or not fully proven launch system technology
Ground systems-design of rectennas (rectifying antennas) for receiving power and terrestrial distribution to power companies			
Rectenna system design	Large rectenna covering more than 20 acres (Sophisticated design to insure lack of reflectivity to the sky or into space) and approved location such as a former quarry or offshore or large location with approved environmental impact statement	Medium to small Rectenna covering 15–20 acres (Conventional design with potential to allow some reflected energy to the sky)	Laser receiving telescope
Transmission Lines to Nearby Cities	Overhead high power distribution lines	Ground based cable transmission conduits	Other

stages of this technology, they must still be taken into account with regard to the legal aspects discussed here.

Given these safety risks, the chapter deals with the complexities of liability for harm and damage, firstly under international law, and secondly under domestic law, with specific attention given to the U.S. regulatory and liability regime. The focus on the U.S. is due to the fact that the SPS technological advancement and the related commercial entrepreneurship are emerging in the U.S. faster than in any other country. Moreover, the U.S. space law is the most developed and, consequently, is instructive or illustrative of the major legal issues that are expected to emerge with the construction and operation of SPS system(s).

The chapter deals with the primary challenges to SBSP, as identified in the 2007 U.S. National Security Space Office assessment, which have been economic and operational.[31] These two factors are essentially interdependent. In order to attract commercial space actors to invest, SBSP must at least be in the realm of economic viability, demonstrating the potential for markets and end users with manageable expenses such that it can be profitable.[32] SBSP exploits a renewable and available energy source; the costs occur in locating the system in order to make use of that natural resource.[33] Above all, launch costs propel skyward the outlays necessary to make SBSP happen.[34] This is a challenge confronting all space activity.[35] Public-private partnerships, allocating risk and responsibility between partners from both sectors, are one means available to defray some of the exorbitant price tag and build the necessary infrastructure.[36]

Finally, the chapter will offer conclusions and recommendations, with the objective of aiding potential SBSP participants, both governmental and commercial, in determining their next steps to make SBSP a reality.

Identification of Safety Risks

One of the core issues to consider in the viability of SBSP is the notion of space safety. Space safety has been defined as:

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[31] National Security Space Office, *supra* note 20 at 3.

[32] Kevin Reed & Harvey J. Willenberg, "Early commercial demonstration of space solar power using ultra-lightweight arrays" *Acta Astronautica* 65 (2009) 1250 – 60 at 1255.

[33] R.B. Erb, "Power from Space – The Tough Questions" The 1995 Peter E. Glaser Lecture 38 *Acta Astronautica* 4–8 (1996), pp. 539–50 at 547.

[34] National Security Space Office, *supra* note 20 at 3, 12–13, 34; Hideo Matsuoka "Global environmental issues and space solar power generation: promoting the SPS 2000 project in Japan" Technology in Society 21 (1999) 1 – 17, 11.

[35] John C. Mankins "A Fresh Look at Space Solar Power: New Architectures, Concepts and Technologies" (Mankins I) 41 *Acta Astronautica*, Nos. 4–10 (1997), 347 – 359, at 349.

[36] D. Kassing, "The role of international organizations in SPS" *Space Policy*, 16 (2000) 129–37, at 133–34.

> the protection of human life and/or spacecraft during all phases of a space mission, regardless of whether this is a 'manned' or 'unmanned' activity. The concept of space safety covers: (a) all aspects from pre-launch, launch, orbital or sub-orbital operations, through re-entry and landing; (b) the protection of ground and flight facilities and surrounding population and buildings in proximity to launch sites; and (c) the protection of space-based services, infrastructure and unmanned satellites.[37]

John Mankins succinctly summarized the challenge of SBSP as finding a balance between "constantly transmitting energy to Earth at a level that is high enough to be useful but low enough so as not to cause any damage."[38] In the early stages of SBSP, the perception was that safety risks would flow from the power level transmitted to Earth, at that time far in excess of more common radio usage, and the atmospheric hazards engendered by the number of heavy lift launches required to place the necessary instrumentation in space.[39] Truthfully, SBSP shares with all other space activity the safety risks inherent in launches, both successful and failed.

Similarly, SPS is vulnerable to, and could be a source of, space debris, particularly in light of the large surface area contemplated by some architectures which are easier to hit and have more moving parts to break. Collision is another safety risk shared by all space activity. However, the chief safety issue discussed in the context of SBSP concerns wireless power transmission (WPT) to Earth and the potential for adverse impacts upon biota and environment, an area subject to much misunderstanding.[40] As SPS expert John Mankins has stated, "the single most important policy consideration for SPS is that of WPT beam health and safety."[41] The salient factors are the form and intensity of the energy to which living things and their surroundings, including the atmosphere, are exposed. The WPT issue can be broken down into environmental effects including radio frequency interference (RFI) and harm to biota, and beam right of way issues creating hazardous conditions. While much of the literature discusses microwave transmission, laser is subject to the same constraints in order to achieve acceptable safety levels. Laser's chief distinction from microwave is in its potential as weaponry.

Initial concerns regarding the power level beamed back to Earth have largely been allayed by the increased use of microwave energy in communications, medical

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[37] Tommaso Sgobba, Joseph N. Pelton and Ram S. Jakhu, "Introduction to space safety regulations and standards" in Joseph N. Pelton and Ram S. Jakhu, (eds.) *Space Safety Regulations and Standards*, (2010) Elsevier, XXXIX.

[38] Quoted by Jeremy Singer in, "Pentagon Considering Study on Space-Based Solar Power" Space News (11 April 2007) available at: <http://www.space.com/businesstechnology/070411_tech_wed.html>.

[39] "Solar Power Satellites and the Ionosphere: The Effect of High Power Microwave Beams on the Ionosphere and the Chemical Effects due to Heavy-Lift Launch Vehicles" CCIR Document 6/46-E (3 March 1980) Adv. Space Res. (1982) Vol. 2, No. 2, 104–09, 104.

[40] R. B. Erb, *et al.*, "International coordination of space solar power related activities" *Space Policy*, 16 (2000) 123–28 at 124; John M. Osepchuk "Microwave policy issues for solar space power" *Space Policy*, 16 (2000), 111–115 at 112.

[41] John C. Mankins, *Space Solar Power: The First International Assessment of Space Solar Power: Opportunities, Issues, and Potential Pathways Forward* (Mankins II) (Paris: International Academy of Astronautics, 2011) at 77.

procedures, radar and industry and the prevalent use of microwave ovens in homes for decades.[42] Even in its most intense section, and even when exposure is prolonged, the beam falls below dangerous levels.[43] Radio frequency energy is non-ionizing; thermal effects are possible but should be minimal as the intensity of the transmitted beam is only about a quarter of that of full sunlight.[44] NASA's studies of the bioeffects of WPT at mid-range frequencies (5.8 GHz) revealed no serious exposure hazard.[45] Interactions between the atmosphere and the power beam are also *de minimus* and are not believed to hold potential for damage.[46]

However some risks remain. Both microwave and lasers, which radiate outside of the visible region (e.g., IR lasers), are invisible to the naked human eye, creating a hazard that is insidious for people working and living near ground stations, flying in aircraft and other airborne vehicles like ultra-lights and balloons, and possibly to avian populations.[47] Visible light lasers are dangerous due to the "startle factor", or temporary blinding or dazzling of airline pilots. Harm to birds factors into the larger environmental context, and mitigation strategies can be included in environmental safety standards.[48] Harmonization of environmental safety standards between countries, as found in other aspects of space activity as well as for electromagnetic energy systems, could be useful in setting an acceptable minimum standard for emissions from WPT.[49]

There is a correlation between frequency and microwave safety. Higher frequencies allow for more desirable antenna size and gain, but at the expense of lower efficiency.[50] Furthermore, the higher the frequency, the more dense and intense the power beam, creating more potential for harm than at lower frequencies. As a result, the dilemma of frequency allocation and orbital slots to be dedicated to SPS goes beyond political and legal considerations. Originally, 2.45GHz was sought as the most optimal frequency for microwave transmission. However, it appears that this is no longer a viable option as it is already in use extensively.[51] NASA and other groups have shown support for 5.8GHz as a feasible alternative and there has been discussion of dedicating this to microwave transmission for SPS as an industrial, scientific, medical (ISM) band.[52] As radio frequency interference (RFI) is an environmental hazard of WPT, it would behoove the International Telecommunication

[42] Erb *et al., supra* note 40 at 124; Osepchuk, *supra* note 40 at 112.

[43] Gerard K. O'Neill *2081: A Hopeful View of the Future* ISBN 0-671-24257-1 (1981) at 182–83.

[44] Erb, *supra* note 33 at 545.

[45] Osepchuk *supra* note 40 at 112.

[46] Erb, *supra* note 33 at 545.

[47] Richard M. Dickinson, "Safety issues in SPS wireless power transmission" *Space Policy*, 16 (2000) 117–22 at 117–18.

[48] One method proposed to address this issue involves avian detectors, screens blocking fly-through and noise makers to direct birds to detour. Beam-shut-off capability is another idea, and one that could be used to avoid problems with low flying aircraft, ultra-lights and hang gliders. *Ibid.*

[49] Osepchuk, *supra* note 40 at 113.

[50] Dickinson, supra note 47, at 117–18.

[51] *Ibid.*

[52] *Ibid.*

Union (ITU) to take this into consideration as a proactive means to avoid or mitigate in-band and out-of-band RFI.

In addition to the potential risks inherent in space to Earth transmission, Earth to space beams have been proposed to power orbital transfer vehicles between LEO and GEO and these, too, could pose threats similar to those described here.[53] Likewise, radio transmissions from ground stations to the photovoltaic SPS for communications and control have the potential to create unlawful harmful interference with frequencies in use by other applications.[54]

Ground exposure to microwave and laser beams can be circumvented through the use of fencing. Passengers and crew of aircraft could more likely than not be spared any harmful exposure by use of a Faraday Cage,[55] or metal shell, which would intercept WPT where desired. Low flying aircraft and recreational flight vehicles such as gliders or balloons could remain safe by observing no-fly zones, or control spaces, as currently used for the military. More difficult to avoid would be the vulnerability of spacecraft operations to temporary disruptions of electronics functions caused by "front-door" entry of beams through radio links and "back door" entry by electromagnetic field leakage through cracks in cases or cables. Beams could blind sensors or overheat thermal structures in spacecraft and create problems for aircraft in the form of visible objects in the night sky or unwanted noise. One potential solution lies in the fact that beam crossing of airspace necessarily implicates existing international and domestic aviation policy and regulation.

Last to be listed here is the potential for military and/or aggressive use of a SPS. Because of its size and function, the SPS could be a target for other States that are not participating in a given SPS enterprise.[56] Likewise, non-participating States could be, or at least perceive themselves to be, vulnerable to misuse of WPT against ground targets or other in-space objects,[57] particularly the use of laser by participating States with interests hostile to their own. Proximity rules or "keep out zones" and rights to inspect could ameliorate these concerns.

Liability Aspects

The operation of SPS system(s) will be governed primarily by both international space law and respective national space laws, in addition to all other laws and regulations dealing with the production and distribution of electricity and the activities

[53] *Ibid* at 119.

[54] Paul B. Larsen, "Current legal issues pertaining to space solar power systems" *Space Policy*, 16 (2000) 139–144 at 142.

[55] Encyclopedia, Faraday Cage, available at: <http://www.statemaster.com/encyclopedia/Faraday-Cage>.

[56] Paul G. Dembling & Delbert D. Smith, "Solar Power Satellites and Security Considerations: The Case for Multilateral Agreements" 11 *Journal of Space Law* 73 (1983), at 74.

[57] John C. Mankins, *The Case for Space Solar Power* (Mankins III) (Houston: Virginia Edition Publishing, 2014) at 352.

of power enterprises. As noted above, several SPS-related designs are expected to emerge, and each of these models will have its own specific risks and liabilities. Some of them are briefly summarized as following:

- Flaws in the technical design and its ability to produce power at projected levels and cost efficiency. This might give rise to liability (including product liability) claims by those who funded the project;
- Flaws in rectenna design or problems with its location; e, g. reflected energy could have an adverse effect on aircraft, nearby homes or industry, or even satellites that need a low noise environment to operate. Rectenna could have an adverse ecological effect on fish or ocean life, or local flora or fauna if on land, etc.;
- Transmission lines to cities would have to get regulatory approval and depending on the level of transmission power could have impact on housing or industry that are along the transmission pathway;
- Transmission via laser, millimeter wave or microwave and translation from electrical power to radio frequency and back has a number of issues that could involve interference to other satellite systems, medical protective systems, etc., this could result in operation from Low Earth Orbit (that is quite congested) and would be very difficult indeed;
- Malfunction of concentrators so that they focused destructive power and light on other satellites or even high altitude aircraft would be a concern and would call for a "failsafe design" in this regard;
- If the SPS unit is designed for upgrade or for retrofit of P/V cells or to take sections apart, this would have implications in terms of investor claims, end of life disposal, etc.; and
- If there were a pointing accuracy problem in the power transmission unit from the SPS back to Earth, especially if the pointing system malfunctioned and started beaming power or radio frequency emissions at military, communications, remote sensing, navigation and time, weather satellites, etc. so that they could be disabled, then this could trigger a multi-billion dollar liability.

However, in this section we will address only those liability issues, chiefly under international space and telecommunication law, which relate to damage if caused (in outer space, in the air, or on the Earth) by an SPS as a space object parked in the GEO and by its electric transmissions. The second part of this section is devoted to the relevant U.S. laws and regulations, the rationale for which is explained above.

International Law

Liability of SPS as a Space Object

As noted above, SPS will carry the same risks as any other space activity involving launching of payloads, the possibility of collisions in outer space, and the likelihood of debris falling back to Earth from a failed or dead satellite system(s). However, in

a number of ways an SPS will be different from any other space object launched and operated to date. Therefore, its possible peculiarities need to be understood first.

If an SPS were to be operated from the GEO, possibly it would either be assembled in the GEO or constructed in LEO and then transferred to its desired orbital position in the GEO.[58] Significant progress has been made in the development of robotics technology capable of assembling an SPS in space.[59] The building of an SPS system of approximately 50 km^2 in size in LEO might involve an unprecedented number of launchings as each satellite could be of anywhere from approximately 34,000 to 51,000 metric tons in mass, requiring 280 launches over a period of eight years on the basis of one launch per month from three different launch sites.[60] Even if there are significant advances in solar cell and launch technologies, launch and construction activities both in LEO and GEO will be enormous, thus having a high probability of on orbit mishaps causing damage in outer space, in the air and/or on the Earth.

A State or its nationals who suffer any damage caused by a space activity of a foreign State may hold that foreign State liable and make a claim of State responsibility under general international law[61] or under the national law of the State that is believed to have suffered the damage. Generally, however, such claims would have to overcome severe uncertainties such as choice of law, conflict of laws, grounds for claims, recoverability and quantum of damages, court procedure, nature and admissibility of evidence, language of the court, jurisdiction of the court, etc. It might also incur extensive costs, and could drag on for a fairly long period of time before resolution. On the other hand, within the realm of international space law, which is more specific and certain, there are two international treaties that directly apply to cases of liability for damage occurring during the conduct of space activities, including the launching and operation of SPS system(s); namely the 1967 Outer Space Treaty and the 1972 Liability Convention.[62] A State Party to these treaties, or its nationals, has the option to make a claim for compensation under either of these agreements if

[58] For a discussion of various options for construction of a SPS system, see International Union of Radio Science, *White Paper on Solar Power Satellite (SPS) Systems*, September 2006 (Version01Sept06), available at: <http://ursi.ca/SPS-2006sept.pdf>.

[59] Susumu Sasaki, *Japan Aerospace Exploration Agency*, "Space Transportation for SPS" (presented in Kobe, Japan as part of SPS 2014 on April 15, 2014).

[60] Donald Rapp, "Solar Power Beamed from Space," *Astropolitics*, (2007), 5:1, 63–86 at 65–67.

[61] For details, see the *Articles on Responsibility of States for Internationally Wrongful Acts* adopted by the International Law Commission at its fifty-third session (2001), printed in the Report of the International Law Commission on the work of its Fifty-third session, *Official Records of the General Assembly, Fifty-sixth session, Supplement No. 10* (A/56/10), chp.IV.E.1, November 2001. Article 1 of these Articles specifies that: "Every internationally wrongful act of a State entails the international responsibility of that State."

[62] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies* ("the Outer Space Treaty"); opened for signature on 27 January 1967, 610 UNTS 205, (as of 1 January 2014, there are 103 States Parties to this Treaty); *The Convention on International Liability for Damage Caused by Space Objects* ("the Liability Convention") opened for signature on 29 March 1972, 961 UNTS 187 (as of 1 January 2014, there are 91 States Parties to the Convention).

damage suffered is caused by any other State Party to these two agreements. It is important to keep in mind that compensation for any damage caused by a space object or its component parts, launch vehicle or its component parts, or any piece of debris created by them, will be recoverable under either or both of these treaties.[63]

Where the parties to a dispute have ratified the Liability Convention, the Outer Space Treaty "applies only to the extent that its provisions are compatible" with those of the Liability Convention.[64] Therefore, the Liability Convention would apply in lieu of Article VII of the Outer Space Treaty, which normally determines 'liability' of a launching State, but would not preclude a recovery under Article VI of the Outer Space Treaty, which determines State 'responsibility' (i.e. 'responsibility' is a broader principle that includes 'liability') for activities of other entities supervised by that State. Both of these articles are discussed in further detail below. For the purposes of relations between States that are parties to the Outer Space Treaty but not to the Liability Convention, of which there are twenty-two such States, the Outer Space Treaty would govern "their mutual rights and obligations" and thus the Liability Convention would not apply.[65] In the case where at least one State is not a party to either treaty, then general international law would apply, and a fault-based liability regime would be in effect premised upon three elements: a legal obligation imputable to a State, a breach of that obligation, and a discernable link between the act and the harm suffered.[66]

The Outer Space Treaty, under Article VII, holds a launching State[67] liable if the damage is caused "to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space." In addition, under Article VI of the Outer Space Treaty, each State Party to

[63] The term space object in both the Outer Space Treaty and the Liability Convention includes the component parts of a space object. The liability for damage caused by a piece of space debris was confirmed by the settlement of dispute between Canada and the U.S.S.R. when the Soviet COSMOS-954 dead satellite fell to Earth. See: *Canadian Department of External Affairs Communiqué* "Disintegration of Cosmos 954 Over Canadian Territory In 1978." No. 27, Issued on: 02.04.1981.

[64] *Vienna Convention on the Law of Treaties*, 23 May 1969, 1155 UNTS 331 [hereinafter VCLT], art 30(4)(a). Though the VCLT entered into force after both the Outer Space Treaty and the Liability Convention and is therefore not technically applicable to either, the provisions of Article 30(a) are "no more than an application of the general principle that a later expression of intention is to be presumed to prevail over an earlier one." *International Law Commission*, Draft Articles on the Law of Treaties with Commentaries, 1966 available at: <http://legal.un.org/ilc/texts/instruments/english/commentaries/1_1_1966.pdf> at 217.

[65] VCLT, *ibid*, art 30(4)(b). This rule is also an expression of a customary practice and, in fact, reflects the same rule applied in international law for the purpose of amending multilateral treaties. Draft Articles on the Law of Treaties with Commentaries, *ibid.*

[66] *Chorzów Factory (Germany v. Poland)*, (1928) PCIJ (ser. A) No 17 at 47.

[67] Article VII of the Outer Space Treaty does not utilize the term "launching state" but refers to the state which "launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched." This formulation was incorporated into Article I(c) of the Liability Treaty as the definition of "Launching State".

the Treaty is internationally responsible for national activities in outer space whether such activities are carried on by governmental agencies or by non-governmental entities, whose space activities require authorization and continuing supervision by the appropriate State. A State is also responsible for such activities if carried out by an international organization in which that State participates. It is only in the English version of the Treaty that a distinction is made between responsibility and liability.[68] The texts of the Treaty in the Chinese, French, Russian, and Spanish languages, which are equally authentic, make no distinction between responsibility and liability. Therefore, a liability claim for compensation can also be made under Article VI of the Outer Space Treaty. The applicable standard in this situation would be a due diligence standard.[69] Once that standard is met, "State responsibility occurs the moment the breach is committed, and not when the State is seen to have failed in its duty to prevent, suppress or repress such a breach."[70]

The Outer Space Treaty neither places limitation on the amount of compensation where there is liability, nor defines the term 'damage'. Therefore, the ordinary meaning of the term (*i.e*. loss of or harm to one's property or injury to or death of a natural person) will be applicable. The amount of compensation to be claimed could be such that would be sufficient to re-establishment, where possible, of the situation that existed before the damage occurred. This could include not only direct damages but also indirect, mental, moral, and consequential damages. The amount of compensation is to be determined in accordance with international law and the principles of justice and equity.[71] However, if the case were brought before a national court, the court would generally apply its national law to make that determination.

The provisions of Article VII of the Outer Space Treaty have been further elaborated and strengthened by the Liability Convention. The Convention is a victim-oriented treaty as its Preamble specifies its main objective is to establish

> effective international rules and procedures concerning liability for damage caused by space objects and to ensure, in particular, the prompt payment under the terms of this Convention of a full and equitable measure of compensation to victims of such damage.

Therefore, the Convention, in unambiguous terms, holds the launching State "absolutely liable to pay compensation for damage caused by its space object on the

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[68] 'Responsibility' is broader than 'liability'. Ben Cheng asserts that: "Responsibility means essentially answerability, answerability for one's acts and omissions, for their being in conformity with whichever system of norms, whether moral, legal, religious, political or any other, which may be applicable, as well as answerability for their consequences, whether beneficial or injurious. In law, it applies in particular to a person's answerability for compliance with his or her legal duties, and for any breaches thereof …… The term liability is often used specifically to denote the obligation to bear the consequences of a breach of a legal duty, in particular the obligation to make reparation for any damage caused, especially in the form of monetary payment ….": Ben Cheng, "Article VI of the 1967 Space Treaty Revisited: 'International Responsibility', 'National Activities', and 'The Appropriate State'", 1998, 26 *Journal of Space Law* 7, at 9.

[69] *Ibid* at 13–14.

[70] *Ibid* at 15.

[71] *Articles on Responsibility of States for Internationally Wrongful Acts, supra* note 61, arts. 35 and 36.

surface of the Earth or to aircraft [in] flight."[72] This means the State that makes a claim on its own behalf or on behalf of its national, need not establish anything (not even fault) beyond the fact that damage has been caused by a space object (or its component part or debris created by it) belonging to the State against whom a claim has been made. This feature of the Convention made possible the straight forward and expedient settlement of Canada's claim against the U.S.S.R. for compensation for damage caused by dead Soviet space object (i.e. space debris) Cosmos-954 when it intruded into Canadian air space, depositing on Canadian territory hazardous radioactive debris from the satellite.[73]

However when it comes to damage caused in outer space "to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State," Article III of the Liability Convention creates fault-based liability. In other words, the claimant State must establish not only that the damage has been caused by a space object (or its component parts or debris created by it) belonging to another State, but also that the damage was due to the latter State's fault or the fault of persons for whom that State was responsible. It should be noted that due to limited space monitoring (space surveillance) capability, especially on the part of a claimant State that is not a well-developed space-power, it will be difficult if not impossible to clearly and convincingly establish fault on the part of the State whose space object (especially an untracked small piece of space debris) is believed to have caused the damage. This is why, after the 10th February 2009 collision between the dead Cosmos-2251 space object and the active Iridium-33 satellite, vigorous efforts are being made, especially by the U.S., to strengthen space situational awareness (SSA) capability.[74] Consequently, it is becoming important to have in place mutually agreed upon 'rules of the road' (i.e. space traffic management – STM – rules) in order to prevent space collisions.[75] It is hoped that by the time

[72] The Liability Convention *supra* note 62, art II.

[73] "Disintegration of Cosmos 954", *supra* note 63.

[74] According to the testimony of the Secure World Foundation, the "owner or operator of a particular satellite usually has excellent knowledge about the position of that satellite in space, but little to no information about the locations of other objects around them. This situation was the *root cause* behind the collision of two satellites in February – the owner of the Iridium satellite, which could have potentially maneuvered it out of the way, did not know about the impending close approach." See: "Keeping the Space Environment Safe for Civil and Commercial Users" Testimony of Secure World Foundation. U.S. House Committee on Science and Technology, Subcommittee on Space and Aeronautics. Hearing on 28 April 2009. For a detailed legal analysis of the Iridium-Cosmos collision, see Ram S. Jakhu, "Iridium-Cosmos Collision and its Implications for Space Operations" in the Schrogl, Kai-Uwe et al. (eds.) Yearbook on Space Policy: 2008/2009, Springer Wien New York, 2010 at 254–275. One notable organization in the effort to strengthen SSA capability is the Space Data Association, founded following the Iridium-Cosmos collision by Inmarsat, Intelsat, and SES to share data and technical support for the purpose of ensuring safety and integrity of space operations, including the creation of an automated SSA system; available at: <http://www.space-data.org/sda/about/sda-overview/>.

[75] For detailed discussions of various aspects of Space Traffic Management, see W. Gaubatz, R. Smiljanic, P. Sterns, L. Tennen, *International Rule Planning for Governing Space Transportation*, Proceedings of the 43rd Colloquium on the Law of Outer Space 220 (2001); Schrogl, Kai-Uwe.

construction of an SPS system begins in about twenty to thirty years, there might be sufficient SSA capabilities and uniform STM rules in place and adopted by, or fully coordinated through, an international organization such as the International Civil Aviation Organization (ICAO).

According to Article I (a) of the Liability Convention, the term "damage" "means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations."[76] Some authors believe that only physical damage caused by an SPS space object (or its component parts or debris) and any other damage caused by "effects of microwave radiation having physical manifestations"[77] would be recoverable. However, since compensation for "other impairment of health" is recoverable, it is reasonable to assume that mental or psychological damage, as well as any consequences of a non-functioning satellite without physical manifestation would also be covered by the term 'damage'.

International space law only imposes liability for damage on States and not upon any private entity. Though there are several proposals for private companies to undertake the construction and operation of an SPS system, the sheer cost (hundreds of billions of dollars) and the long timelines for completion might make an SPS venture beyond the reach of private companies alone. If a private company were to build an SPS system, its State of nationality (State of incorporation[78]) would be required to make provision under its domestic law for licensing to facilitate that State's performance of its international obligation of 'authorization and continuing supervision' as required under Article VI of the Outer Space Treaty. Secondly, the authorizing State would be not only responsible but could also be held liable if any damage is caused by an SPS system owned by the authorized company. Similarly, as noted above, States are responsible and could be held liable if any damage is caused by an SPS system belonging to an international organization in which they participate.

Liability for Electric Transmissions

An SPS system will use radio frequencies for its operation (telemetry, tracking and command) as well as for transmission of electric power to receiving rectennae on Earth.[79] Therefore, there are primarily two ways that damage might be caused; i.e. interference to other radio services and adverse effects on human health and property.

"Space Traffic Management. The New Comprehensive Approach for Regulating the Use of Outer Space: an International Perspective." October 2007. ESPI Perspectives 3. 2 Sept. 2009, available at : <http://www.espi.or.at/images/stories/dokumente/flash_reports/stmflashrep3f2.pdf>.

[76] The Liability Convention, *supra* note 62, art I(a).

[77] Nicholas M. Matte (ed.), *Space Activities and Emerging International Law*, 1984, CRASL, McGill University, Montreal, 497.

[78] *Barcelona Traction (Belgium v Spain)*, [1970] ICJ Rep 3.

[79] For details, see International Union of Radio Science, *supra* note 58.

Interference to Radio Services

In order to avoid harmful interference, all telecommunication services using radio waves are regulated and coordinated internationally through the International Telecommunication Union (ITU) – the oldest specialized agency of the United Nations. A complex web of highly technical rules, procedures and standards for this purpose are detailed in ITU's Constitution, Convention and Radio Regulations.[80] The ITU achieves this by allocating different frequency bands to specific radio services and by adopting and applying technical standards for their utilization.

Starting with a recommendation in 1979 for further scientific investigations,[81] the ITU has been seeking the most suitable band of frequencies for SPS systems. So far, it has not decided to define SPS as a separate radio service and to allocate specific frequencies to it. Several authors and studies propose that the frequencies allocated for ISM applications should be used for SBSP purposes. The ISM has been defined in the ITU Radio Regulations Article 1.15 as "Operation of equipment or appliances designed to generate and use *locally* radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications." (emphasis added).[82] Several points are worthy of specific note here: firstly, the ISM applications are not a telecommunication service and the use of their allocated bands must not cause harmful interference to radio services. Secondly, the ISM frequencies are allowed to be used only for 'local' use; thus their use for SPS, as being international in scope, would not be covered. Thirdly, from a technical perspective it has been asserted that the ISM frequencies would not be

[80] For details, see Constitution and Convention of the International Telecommunication Union, 1994 (as amended in 2014) and ITU Radio Regulations, 2012 Edition; Ram Jakhu, "Regulatory Process for Communications Satellite Frequency Allocations," in Pelton J., Madry S., Camacho Lara S. (eds.), *Handbook of Satellite Applications: Springer Reference*, Springer-Verlag Berlin Heidelberg, 2013 at 272–292.

[81] ITU, World Radiocommunication Administrative Conference, Geneva, 1979, Recommendation 3, entitled "Relating to the Transmission of Electric Power by Radio Frequencies from a Spacecraft" decided to "undertake appropriate studies on all aspects of the effects of such radio transmissions of power from space on radio communication services and to make appropriate recommendations taking into account the ecological and biological implications." This Recommendation is reprinted in Dembling & Smith, *supra* note 56, at 82.

[82] Under footnote 5.138 of the ITU Radio Regulations, in addition to others, bands "6 765–6 795 kHz (center frequency 6 780 kHz), 433.05-434.79 MHz (center frequency 433.92 MHz) in Region 1 except in the countries mentioned in No. 5.280, 61–61.5 GHz (center frequency 61.25 GHz), 122–123 GHz (center frequency 122.5 GHz), and 244–246 GHz (center frequency 245 GHz) are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radio communication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant ITU-R Recommendations."

appropriate and sufficient for SBSP purposes.[83] The use of currently allocated ISM radio frequencies for SPS would be illegal and any consequential damage caused to radio services could become a legal basis for invoking State responsibility and/or making a claim for appropriate compensation. Therefore, in order to avoid such risk (i.e. harmful interference to an SPS service as well as to radio communication services of other countries), the ITU must define WPT as a service for SPS and allocate specific and sufficient bands of radio frequencies on a global basis so that SPS could be available to all areas of the world.

Irrespective of the fact that the SPS activity would not be a telecommunication service under ITU Radio Regulations, there is a clear precedent for the ITU's jurisdiction over this activity as the ITU has, for several decades, been regulating a non-telecommunications application like ISM and global navigation satellite services. "It may be possible – perhaps necessary – for a specific RF frequency to be selected for SPS wireless power transmission (for example, 2.45000 GHz); the selected frequency may well need to be made exclusive."[84]

Adverse Effects on Human Health and Property

There are some concerns expressed about the adverse impact upon the humans who work or live close to ground based rectennae that receive microwaves carrying power transmissions from an SPS. There is currently no data fully proving such risk, mainly due to current indecision about the type of radio frequency to be used and the intensity of the power to be transmitted. Still, the International Union of Radio Science (URSI) has expressed its concern that "Above the centre of the rectenna, the SPS power flux density will be considerably higher than the currently permissible safety levels for human beings."[85]

The URSI warned that human access around the rectennae "would need to be carefully controlled to ensure environmental safety and health standards are maintained."[86] The URSI noted the International Commission on Non-Ionising Radiation Protection, and Japan, both apply more stringent limits.[87] However, there are no legally binding international safety standards to ensure safety of human health from exposure to microwaves carrying power transmissions from an SPS. Any damage in the form of adverse effects on human health (i.e. 'impairment of health')

[83] Kozo Hashimoto and Naoki Shinohara, "Requirements and Challenges of International Spectral Management for Future Space Solar Power", a paper presented at the International Symposium on Solar Energy from Space, Toronto, September 8–10, 2009 (a copy on file with the authors of this paper). Also see, Takeshi Hatsuda, Kenji Ueno and Kakoto Inoue, "Solar Power Satellite Interference Assessment", (2002), IEEE, *Microwave Magazine*, Vol. 3, No.4, 65–70.

[84] Mankins III, *supra* note 57 at 338.

[85] International Union of Radio Science, *supra* note 58.

[86] *Ibid.*

[87] *Ibid.*

caused by SPS electric transmissions would become a basis for imposing responsibility and/or liability on the SPS operating States and, consequently, for a claim for compensation under international space law.

Domestic Law of the U.S

As countries bear international responsibility for their national activities in space, including both public entities and private companies, SBSP activities will need to be appropriately regulated by a national government.[88] In the U.S. there is an extensive regulatory regime comprised of licensing and review, which is discussed here in order to understand the legal challenges faced in establishing an SPS system, including the question of liability under domestic law, and its relationship to liability under international law.

Space Activity Licensing in the U.S

Under U.S. national space law as codified in Chapter 509 of Title 51, the Federal Aviation Administration (FAA) retains responsibility for licensing nongovernmental U.S. space activities, including launching and reentry.[89] A license is required of anyone seeking to conduct a launch or reentry or operate a launch/reentry site in the U.S.; a U.S. citizen (including corporations) seeking to launch or reenter a vehicle or operate a launch/reentry vehicle outside the U.S.; or a U.S. citizen launching or reentering a vehicle or operating a launch site in a foreign territory if an agreement with the government of the foreign territory states that the U.S. will exercise jurisdiction.[90] It is important to note that in the case of a consortium launching outside the territory of the U.S. and outside the territory of a foreign country, a license is required unless there is an agreement with a foreign country which states that said country maintains jurisdiction over the launch, reentry, or facility.[91]

The FAA Associate Administrator for Space Transportation will conduct an Environmental Review in order to assess the environmental impacts of a proposed activity.[92] This is a complex process involving the FAA and Environmental Protection Agency, as well as a public hearing and a 45-day public review period. The FAA has provided a set of *Guidelines for Compliance with the National Environmental Policy Act and Related Environmental Review Statutes*, which are

[88] Mankins II, *supra* note 41 at 71.

[89] 51 USC §§ 50901 et seq. The corresponding regulations issued pursuant to Chapter 509 can be found in 14 CFR at chapter III, parts 415, 420, 431 and 435.

[90] 51 USC § 50904 (a).

[91] 51 USC § 50904 (a)(3).

[92] 42 USC § 4321.

available to help entities properly navigate the process.[93] Given the high number of launches required for a full space-based solar power system, environmental impact is a significant issue to consider.

The FAA will conduct a policy review, following an initial consultation, which will require extensive information from the applicant, including information about the launch vehicle and systems as well as ownership information and data regarding the flight profile.[94] This review will ascertain whether there may be adverse impacts to the U.S. in terms of international obligations, national security issues or foreign policy interests.[95] As part of a subsequent review, an applicant will be required to show that the proposed operation will satisfy the relevant risk standards.[96] An FAA-conducted payload review will establish whether the applicant has appropriately obtained any necessary licenses, authorizations, or permits, some of which will be discussed in the following section, and ensure that the launch of such a payload would not be detrimental to health and safety or U.S. policy.[97] The FAA, however, may waive its licensing requirements as it sees fit.[98]

Though the FAA may not conduct a full payload review in circumstances where a Federal Communications Commission (FCC) license has been obtained, the payload review does have the effect of extending "the scope of the Office of Commercial Space Transportation's authorization and control beyond just the activities of launching and re-entry to include the nature, operation and activities of all space objects launched or re-entered under United States license"[99] in terms of safety, security and foreign policy interests, and international obligations. Such extension of authority would be relevant to an SPS system regarding preapproval of its unique on-orbit operations. A payload owner or operator can request a review in advance in order to receive a determination of any issue raised that could impede the issuance of a license.[100]

Satellites and related technologies have generally fallen under the set of regulations known as the International Traffic in Arms Regulations (ITARs), which are administered by the U.S. Department of State,[101] though the National Defense

[93] *Associate Administrator for Commercial Space Transportation*, Guidelines for Compliance with the National Environmental Policy Act and Related Environmental Review Statutes for the Licensing of Commercial Launches and Launch Sites available at: <https://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/EPA5DKS.pdf>.

[94] 14 CFR § 431.25.

[95] 14 CFR § 431.23.

[96] 14 CFR § 431.35.

[97] 14 CFR § 415.51.

[98] 51 USC § 50905(b)(3); 14 CFR § 404.5(b).

[99] *Review of Existing National Space Legislation Illustrating How States are Implementing, as Appropriate, Their Responsibilities to Authorize and Provide Continuing Supervision of Non-governmental Entities in Outer Space: Note by the Secretariat*, COPUOS, 40th Sess, § 1(2), UN Doc A/AC. 105/C.2/L.224 (2001), § II(I)(68).

[100] 14 CFR § 415.56.

[101] U.S. Department of Commerce & Federal Aviation Administration, Introduction to U.S. Export Controls for the Commercial Space Industry (2008), available at <http://www.space.commerce.gov/library/reports/2008-10-intro2exportcontrols.pdf>.

Authorization Act of 2013 has authorized the U.S. president to move satellite technologies from the ITAR list to the Commerce Control List (CCL).[102] Items that are on the CCL are subject to the less restrictive Export Administration Regulations (EARs), which are administered by the Department of Commerce and which require a license to export. President Obama has undertaken an initiative to revise the export control regime, clarifying those items that are included on the list and those that can be moved to the CCL.[103] Revisions have been made to Category IV of the U.S. Munitions List (subject to ITARs), which includes launch vehicles.[104]

Exporting, in the context of ITARs, is defined broadly and includes not only physically sending or taking an article beyond the borders of the U.S., but also transferring control or ownership (including on-orbit transfer), and notably disclosing technical data to foreign persons (in the U.S. or elsewhere, including oral or visual disclosure).[105] The Directorate of Defense Trade Controls can issue authorizations in the forms of licenses, agreements, or exemptions for exports.[106] Any launch of U.S. satellite technology from a non-U.S. territory or involving non-U.S. entities or personnel will require compliance with ITAR requirements; this includes participation in multinational launch consortia. With respect to an SPS system, the respective ITARs and EARs must be followed, and the FAA will verify appropriate licensing before a launch license is provided. Regulations will apply not only to the launch vehicles being used by the SBSP entity(ies), but also to the technology onboard SPS systems themselves, and any rectennae or processing stations for energy that are present on the Earth.

One example of a launch consortium including participants from multiple States that launches beyond the territory of any State is Sea Launch, which includes U.S., Ukrainian, Russian, and Norwegian entities, and which obtained a license from the FAA in March 1999.[107] Despite financial issues, several failed launches and a bankruptcy filing in 2009,[108] Sea Launch has continued to launch satellites as recently as May 2014.[109] Following the bankruptcy, the company has operated as a Swiss company,[110] maintaining its assets and launch license in the U.S.[111] Thus, even in light of U.S. export controls, Sea Launch provides a proof-of-concept in the

[102] *National Defense Authorization Act for Fiscal Year 2013*, U.S. Pub. L. 112–239.

[103] 79 FR 22740 (2013).

[104] 79 FR 34 (2013).

[105] 22 CFR § 120.17.

[106] 22 CFR § 120.

[107] Joosung J. Lee, "Legal Analysis of Sea Launch License: National Security and Environmental Concerns" *Space Policy* 24 (2008) 104 at 104.

[108] "The Chapter 11 Reorganization of Sea Launch, LLC", Alston and Bird LLP, available at: <http://www.alston.com/files/docs/3-23-11-Items-Insert.pdf>.

[109] "Eutelsat 3B Mission Overview", Sea Launch, available at: <http://www.sea-launch.com/missions>.

[110] "About Sea Launch", Sea Launch available at: <http://www.sea-launch.com/about/11398>.

[111] John Sloan, "Introduction to FAA Officer of Commercial Space Transportation (AST) and International Outreach" (18 Oct. 2012) available at: <https://www.gwu.edu/~spi/assets/docs/John%20Sloan%20charts.pdf> at 7.

licensing and regulation by the U.S. of international launch consortia, which would be applicable in the case of space-based solar power. It is worth noting, however, in this specific example, that foreign-made space vehicles cannot launch from the U.S. Sea Launch.[112]

Use of Radio Frequencies and Orbital Positions by SPS Under the U.S. Law

In the U.S., the Federal Communications Commission (FCC) is responsible for assigning radio frequencies for all non-governmental users of spectrum,[113] pursuant to the Communications Satellite Act of 1962 and the Communications Act of 1934.[114] "The satellite space station licensing process is composed of three distinct processes: allocating available spectrum for the proposed satellite service, developing service rules and granting licenses to qualified applicants."[115] The FCC endeavors to minimize interference while maximizing the number of systems that can be utilized.[116] It is worth noting that there are also federal regulations in place governing the granting of licenses for fixed microwave services.[117]

There are two distinct processes for assigning radio frequencies, one for GEO-like satellite systems with unidirectional antennae, and one for Non-GEO satellite systems, with omni-directional antennae.[118] GEO-like assignments are made on a first-come, first-served basis and are non-transferrable to any other entity.[119] On the other hand, Non-GEO assignments have a distinct processing method that differentiates between "lead applications" and "competing applications."[120] This type of license is transferrable or assignable to another entity with FCC authorization.[121]

The licensing of Earth stations is also a function performed by the FCC.[122] When applying for an Earth transmitting station license, information that must be provided

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[112] "About the Office, Frequently Asked Questions", Federal Aviation Administration Office of Commercial Space Transportation, available at: <https://www.faa.gov/about/office_org/headquarters_offices/ast/about/faq/>.

[113] The FCC Online Table of Frequency Allocations, 47 CFR § 2.106 (updated 13 April 2013), available at: <http://transition.fcc.gov/oet/spectrum/table/fcctable.pdf>.

[114] Communications Satellite Act art. 201(c) (11) (1962); Communications Act titles I-III (1934).

[115] Regulating Satellite Networks: Principles and Process, FCC, available at: <http://transition.fcc.gov/connectglobe/sec8.html>.

[116] *Ibid*.

[117] 47 CFR §§ 101.4-101.97; Wallach, *supra* note 16.

[118] 47 CFR §§ 25.157-25.158.

[119] 47 CFR § 25.158(c).

[120] 47 CFR § 25.157.

[121] Unlike the provision noted in *supra* note 119 regarding GEO-like systems, there is no provision in 47 CFR § 25.157 prohibiting transfer, therefore enabling the text of 47 CFR § 25.119; see also, Satellite Space Station Licensing Reform, FCC, available at: http://transition.fcc.gov/ib/sd/ssr/ssslr.html> for further details on transfer of control application requirements.

[122] 47 CFR §§ 25.130-25.139.

to the FCC includes frequency bands, satellites to be used, power and density levels, and the diameter of the antenna,[123] with modified filing requirements for receive-only Earth stations.[124] Permission is required for a U.S. ground station to operate with a non-U.S. licensed satellite; competitive opportunities for comparable U.S. satellites and compliance with requirements to operate in the U.S. must be demonstrated.[125] An SPS system involving any international cooperation would therefore have to satisfy all of these requirements, creating a lengthy bureaucratic procedure before it could become functional. The inevitably international nature of such an undertaking also has consequences for questions of liability under domestic law, as will be discussed in the next section. Once again, U.S. laws should be taken as the applicable model for national regulation of SBSP activities.

Liability Under the U.S. Law

Because States are internationally liable for damage caused by their space objects, whether the responsible entity is public or private, they will tend to put domestically applicable liability regimes in place in order to limit their liability vis-á-vis entities involved in an SBSP operation, and in order to be able to recover possible international claims made against them. SBSP operations will therefore need to be conducted with consideration of the relevant liability regimes.[126] Liability for space activities is addressed at the national level in the U.S. through the Commercial Space Launch Act (CSLA).[127] A three-tier liability regime requires that a licensee maintain insurance or be able to self-insure for the Maximum Probable Loss (MPL) up to $500 million. Congress can allocate funds to indemnify the licensee for the amount between the MPL and $3 billion (as adjusted for inflation after January 1, 1989), and the licensee will be liable for any amounts in excess of the inflation-adjusted $3 billion.[128] Additionally, cross-waivers of liability must be maintained between the licensee and all commercial entities that are involved in the activity, including contractors and subcontractors, as well as between those parties and the U.S. government for amounts in excess of the mandated insurance coverage.[129]

Though the FAA maintains jurisdiction over launch and reentry activities, it does not have jurisdiction over on-orbit activities. This "means that the risk-sharing

[123] 47 CFR §§ 25.130.

[124] 47 CFR §§ 25.131.

[125] 47 CFR §§ 25.137.

[126] Mankins II, *supra* note 41 at 71.

[127] 51 USC § 50901 et seq.

[128] 51 USC §§ 50914–50915. Statement of Alicia Puente Cackley, Director, Financial Markets and Community Investment, "*COMMERCIAL SPACE LAUNCHES FAA's Risk Assessment Process Is Not Yet Updated*," Testimony Before the Subcommittee on Space, Committee on Science, Space, and Technology, House of Representatives, United States Government Accountability Office, 4th February 2014, at 2, available at: <http://www.gao.gov/assets/670/660635.pdf>.

[129] 51 USC §§ 50914–50915.

regime would not extend to cover an accident that occurred in orbit."[130] Wireless energy transmission is not part of FAA responsibility and there is no requirement to maintain insurance for such transmission.[131] Given concerns regarding the transmission of solar energy to Earth stations, this gap is potentially problematic. The issue of whether FAA authority should be extended to cover on-orbit operations through an amendment to the CSLA is under discussion by the Space Subcommittee of the U.S. House of Representatives Science, Space and Technology Committee.[132]

"[O]nce in orbit, the legal consequences of maintaining a SPS system, including potential damage from its wireless energy transmission, are not included and left to general tort law in the U.S."[133] Though the U.S. government would still be responsible for providing compensation to other States under the Liability Convention (or Outer Space Treaty, as the case may be), the spaceflight operator would be liable for damages in tort without receiving indemnification from the U.S. government.[134] If SBSP were determined to be an ultra-hazardous activity, a strict liability regime would apply in U.S. tort law, meaning that no negligence or fault would need to be proven in order for a recovery to occur.[135] Otherwise, a standard negligence regime would apply.[136]

The brief discussion in this section indicates the complexity of and the necessity for resolution of the key legal issues for smooth construction and operation of an SPS system. In addition, it would be imperative to address these matters well in advance in order to attract the requisite financial investment, which would possibly be on the order of billions of dollars.

Managing Risks

Given the potential risks discussed in Part I, and the extensive liability regimes discussed in Part II, in order to make SBSP operations more attractive and economically viable, it would be prudent to consider ways of managing the risks associated. This can be done in several ways, including risk allocation, public-private

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[130] Matthew J. Kleiman, Jennifer K. Lamie & Maria-Vittoria Carminati, *The Laws of Spaceflight* (Chicago: American Bar Association, 2012) at 86.

[131] Deliana Ernst, "Beam It Down, Scotty: The Regulatory Framework for Space-Based Solar Power" (2013) 22:3 Review of European, Comparative & International Environmental Law 354 at 360–361.

[132] Smith, Marcia S., House Hearing Reveals FAA-COMSTAC Rift on Learning Period for Commercial Human Spaceflight (Feb. 4, 2014) Space Policy Online available at: <http://www.spacepolicyonline.com/news/house-hearing-reveals-faa-comstac-rift-on-learning-period-for-commercial-human-spaceflight>.

[133] Ernst, *supra* note 131 at 365.

[134] Kleiman *et al., supra* note 130 at 86.

[135] Ernst, *supra* note 131 at 360–361.

[136] *Ibid*.

partnerships, clear regimes of dispute resolution and improved regulation of risk management through domestic legislation. Each of these will be discussed here in turn.

Risk Allocation

Traditionally, as in commercial undertakings in a wide variety of scenarios, exposure to liability in an SPS system could be handled by the allocation of a particular risk to the party or parties best suited to manage it at the least cost. This would apply in ventures whether they are private or public, or some combination thereof.[137] Often, risk is allocated by the procurement of insurance coverage.

Insurance can be obtained by the satellite owner (the exception), launch suppliers (the rule), or the satellite operator.[138] Producers, launching States, or related organizations may be co-insured. The launch pad and damage to the payload are usually not covered by insurance but managed by cross-waivers of liability.[139]

The timeline of coverage usually begins during the preparation for launch, which is considered a time of high risk.[140] This is usually the responsibility of the launch service provider, as is the highly risky lift-off. In-orbit operations of a satellite usually fall to the satellite operator, with the risk decreasing after the first year. Coverage for re-entry is also available. On-orbit insurance typically either covers the first year or the life of the satellite.[141]

Space insurance encompasses a number of different covers and markets.[142] Loss of or damage to the satellite itself is placed in a highly specialized international insurance market, and includes the launch and in-orbit phases. Coverage can be had

[137] Allocation of risk is a necessary factor in setting up public-private partnerships. The Canadian Council for Public-Private Partnerships, available at: <http://www.pppcouncil.ca/aboutPPP_definition.asp>.

[138] The launch service provider as an additional named insured often adds the operator. Sometimes the operator purchases in-orbit third party coverage which comes into operation when the launch coverage expires. Operators and insurers would like to see manufacturers assume more financial responsibility for the performance of hardware. Peter B. de Selding "Buyers, Insurers Want Satellite Makers to Take on More Financial Risk" Space News (18 April 2005).

[139] These can apply even with a finding of gross negligence.

[140] Issues of concern include: (i) credit risk, (ii) technology risk, (iii) market risk, (iv) asset risk, (v) political risk and (vi) legal risk.

[141] Kleiman *et al., supra* note 130 at 113–114.

[142] "Covers" is a term of art in insurance and widely used to refer to a contract for insurance or a type of coverage, available at: <http://www.aami.com.au/customer-service/insurance-glossary.aspx#cc>.

for total loss, constructive total loss, or partial loss of the space asset, including loss of operational capacity and, sometimes, loss of revenues, on an all-risks basis.[143]

Historically, space insurers have shied away from coverage of liabilities between participants in a project for failure or malfunction of a space service and performance shortfalls, instead requiring cross waivers of liability and "hold harmless" agreements within the limits allowed by domestic law and the floor set by the international space treaties.[144] These agreements are incorporated in the launch procurement contracts protecting sub-contractors all along the satellite and launcher contractual chains. While the liabilities within those two chains depend principally upon the national law applicable to the relevant contract, insurers assume them to be dealt with contractually. The indemnification agreements help manage the cost of insurance. Cross waivers are essentially exclusion of liability clauses, and are so standard in space projects that the United States built them into the first tier of its financial responsibility regime as outlined in the Commercial Space Launch Act.[145]

NASA published a notice of proposed rulemaking on cross waivers in October 2006, supplementing the prior rule in effect since 1991. The changes address cross waivers among partner States and their contractually or otherwise related entities of the International Space Station, as well as expanding the scope of its missions servicing the station from ELVs (expendable launch vehicles) to RLVs (reusable launch vehicles). President Clinton delegated to the Administrator of NASA the authority to enter into cross waivers with foreign governments and their agents.[146] In 2008,

[143] The total premium for 2007 was estimated at $ 500-550 M US, while the first two quarters of 2008 garnered approximately $411 M US in premiums. "Aon, Inmarsat in Space Partnership" "Insurance Journal" available at: <http://www.insurancejournal.com/news/international/2008/09/19/93857.htm>. In the face of short-term policies, exorbitant rates, and disputed terms, some satellite operators chose to rely on self-insurance in the early 2000s. Michael A. Taverna, "Back in Business: As private equity influence wanes, satellite operators turn again to space insurance market" *Aviation Week & Space Technology* (23 April 2007) 26–27. However, in 2007, companies appeared to reconsider more traditional risk management. New coverage, including third-party and product liability for private space ventures, are in the works; however, the cost of maximum probable loss (MPL) coverage is a sensitive issue which can handicap the small launch startups planning entry into the suborbital flight market. "Space Activities and Relevant Insurance Implications" available at: <http://www.pagnanellirs.com/index.html?pg=10&id=2&itszn=2&idpress=22>.

[144] Sophie Moysan, Aviation and Space Department, Marsh SA *The Insurance Point of View* presented at Project 2001 Plus Workshop "Towards a harmonized approach for National Space Legislation in Europe" Berlin 29–30 January 2004.

[145] Federal Aviation Administration/Office of Commercial Space Transportation "Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation" (1 August 2006) at 2.

[146] The text of the promulgated changes reads:

(c)(1) Cross waiver of liability: Each Party agrees to a cross waiver of liability pursuant to which each Party waives all claims against any of the entities or persons listed in paragraphs (c)(1)(i) through (c)(1)(iv) of this section based on damage arising out of Protected Space Operations. This cross waiver shall apply only if the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of

NASA was granted authority to enter into cross-waivers of liability and language updated in 2012 provides for appropriate cross-waivers for International Space Station (ISS) and non-ISS related activities requiring a launch; the rule does not differentiate between RLVs and ELVs.[147]

International Consortium/Public-Private Partnership

The 2007 feasibility study of SPS performed by the U.S. National Security Space Office identified the costs associated with access to space and development of the necessary supporting infrastructure as the chief obstacles to bringing SBSP to fruition,[148] particularly with regard to space transportation.[149] The development of an RLV would increase the viability of an SBSP project. Given the scale of launches required for SPS, investment in an RLV or other more efficient launch system would be sensible, [150] and indeed would prove beneficial to the development of the space industry as a whole. Cooperative efforts are the most efficient means to overcome these challenges, between the commercial and government sectors and also internationally.

A number of countries are onboard, exhibiting more than casual interest in SBSP. For instance, Japan has ranked SBSP with a high level of importance and the U.S. conducted the feasibility study mentioned above.[151] Canada, Europe, India, China, and Russia have seen participation in SBSP at some level in the

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its involvement in Protected Space Operations. The cross waiver shall apply to any claims for damage, whatever the legal basis for such claims, against:

(i) Another Party;
(ii) A Partner State other than the United States of America;
(iii) A related entity of any entity identified in paragraph (c)(1)(i) or (c)(1)(ii) of this section; or
(iv) The employees of any of the entities identified in paragraphs (c)(1)(i) through (c)(1)(iii) of this section.

14 CFR Part 1266, available at: <http://www.thefederalregister.com/d.p/2008-02-26-E8-2868>; "NASA Notice of proposed rulemaking: Cross-Waiver of Liability" available at: <http://www.spaceref.com/news/viewsr.html?pid=22414>.

[147] 14 CFR 1266; 48 CFR 1852.228-76; 48 CFR 1852.228-78. See also *NASA Procurement Notice*, 27 September 2012 available at: <http://www.hq.nasa.gov/office/procurement/regs/pn04-73.html>.

[148] National Security Space Office, *supra* note 20 at 3.

[149] Jeff Foust, Making the case, again, for space-based solar power, The Space Review (28 November 2011) available at: <http://www.thespacereview.com/article/1978/1>.

[150] Peter Garretson, Solar Power in Space? (Spring 2012) Strategic Studies Quarterly 97 at 111.

[151] Lusk-Brooke & Litwin, *supra* note 29 at 147.

past few years.[152] Not only would international teaming help spread the risks and defray costs, it would also promote global coordination and utilization. Already, international energy groups exist that could lay the groundwork for increasing public awareness, which could in turn help direct political will.[153]

Moreover, partnerships between government, industry and academia could allocate risk and allow for profit in the development of the requisite economic and distribution infrastructure. Methods of financing public services have undergone significant transformation since World War II. "[T]he international trend was to nationalize energy and other infrastructure assets and institute controls over private monopolies in order to limit abuses of market power."[154] Over time, the costs of public ownership and/or subsidization, including the erosion of operational efficiency, became apparent, resulting in a restructuring trend.[155]

Whereas privatization is on a downward spiral,[156] public-private partnerships are now hailed as "the new paradigm for economic development in the twenty-first century…increasingly being used as a policy tool to transform the role of national and local governments in public service delivery, infrastructure development, poverty alleviation, capital market improvement, and governance around the world."[157] This trend is global,[158] particularly in the European and Asian markets.[159] In an interview given in 1999 when he was Deputy Director of the Congressional Budget Office, Barry Anderson, now head of the Organization for Economic Cooperation and Development (OECD), expressed his belief that public-private partnerships

[152] National Security Space Office, *supra* note 20 at 41; Mankins I, *supra* note 35 at 349; "Japanese to pursue space-based solar power plant" (4 September 2009) available at: <http://www.cleanbreak.ca/2009/09/02/japanese-to-pursue-space-based-solar-power-plant/>; Tyler Hamilton, "Space-based solar power back in play" (15 October 2007) The Star available at: <http://www.thestar.com/columnists/article/266738>.

[153] Erb, *et al., supra* note 40 at 126.

[154] Robert Taylor, "Independent Regulation and Infrastructure Reform", available at: <http://www.ip3.org/ip3_site/independent-regulation-and-infrastructure-reform.html>.

[155] *Ibid*.

[156] Jerome Donovan, "Don't Want to Privatize? Then Corporatize (But Do it Right)" available at: <http://www.ip3.org/ip3_site/don-t-want-to-privatize-then-corporatize-but-do-it-right.html>. Although privatization and public-private partnerships have often been used interchangeably in the US, this paper will treat the two as separate, discrete entities found at different points along the public – private continuum, with privatization referring to the furthest point on the private side, and the PPP falling somewhere along the spectrum, depending on the one-off characteristics of each particular project.

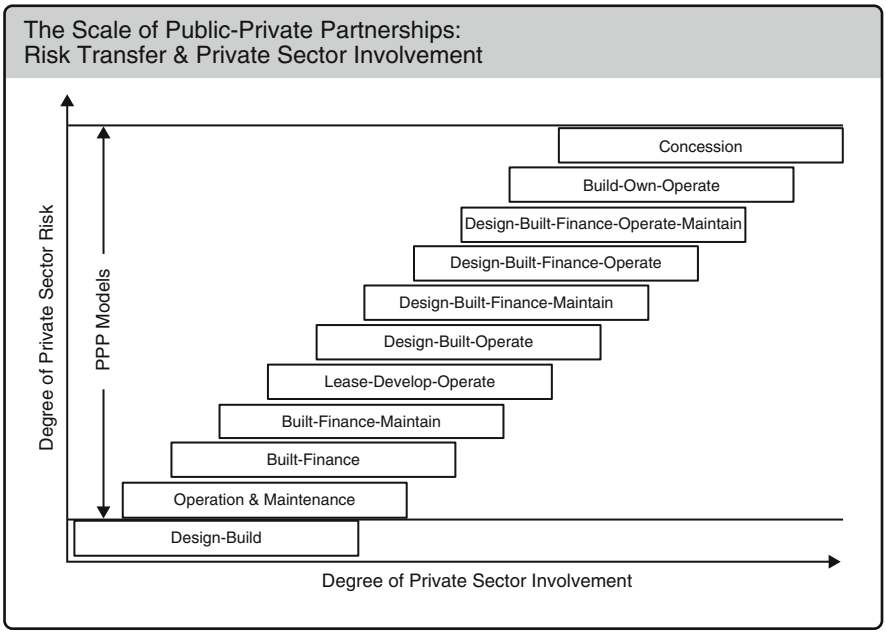
[157] Cici Brown, Empowerment Plus Institute, "President's Welcome" available at: <http://empin.org/address.html>.

[158] Jumoke Jagun, Isabel Marques de Esa, "The Role and Importance of Independent Advisors in PPP Transactions" available at: <http://www.ip3.org/ip3_site/the-role-and-importance-of-independent-advisors-in-ppp-transactions.html>.

[159] Jacques Cook, "US PPP Market on the Upswing: Some Thoughts from Abroad" available at: <http://www.ip3.org/ip3_site/us-ppp-market-on-the-upswing-some-thoughts-from-abroad.html>.

were a possible mechanism to achieve budget reform in the face of constraints on top-down budgeting mechanisms in the U.S.[160]

Absent a universal legal definition of P3s, they are "generally recognized [to exist] wherever there is a contractual relationship between the public sector and a private sector company designed to deliver a project or service that traditionally is carried out by the public sector."[161] Public-private partnerships aspire to draw upon the strengths of both sectors. In Canada, the term has a very specific meaning: "[f]irst, it relates to the provision of public services or public infrastructure. Second, it necessitates the transfer of risk between partners. Arrangements that do not include these two concepts are not technically 'public-private partnerships'…."[162] Allocation of risk is a necessary factor.



The Canadian Council for Public-Private Partnerships[163]

P3s are creative arrangements. Usually, a governmental entity enters into contract with a private consortium that sets up a single purpose entity known as a special purpose vehicle. The private consortium is typically formed by a joint venture

[160] Interview with Barry Anderson, Deputy Director of the Congressional Budget Office (Fall 1999) 5 Georgetown Public Policy Review 23 at 5.

[161] Cook, *supra* note 159.

[162] Definitions, The Canadian Council for Public-Private Partnerships, available at: <http://www.pppcouncil.ca/aboutPPP_definition.asp>.

[163] International PPP Schools Survey Report, Canadian Council for Public-Private Partnerships, available at: <http://www.pppcouncil.ca/pdf/schools_survey.pdf> at 6.

between a range of contractors, banks, investors, and suppliers willing to commit equity and/or resources to the project.[164]

Some underlying principles are indispensable to their success. Value for money is crucial. It refers "to the best possible outcome after taking account of all benefits, costs and risks over the whole life of the procurement."[165] Risk is perceived from the public sector's perspective as "any event which jeopardizes the quality or quantity of service that they have contracted for" and from the private sector's perspective as any event which "causes the cash flow profile of the project to depart from the base case and jeopardize the debt servicing ability of the project or its ability to generate a dividend stream for shareholders."[166]

Optimally, risks are allocated to the party in the best position to control them. Rules guiding optimal distribution of risk require that the party to whom the risk is allocated has:

- been made fully aware of the risks they are taking,
- the greatest capacity [expertise and authority] to manage the risk effectively and efficiently (and thus charge the lowest risk premium),
- the capability and resources to cope with the risk eventuating,
- the necessary risk appetite to want to take the risk and
- been given the chance to charge an appropriate premium for taking it.[167]

Internationally, examples of P3s abound. They include, *inter alia*, airports, airlines, tunnels, highways, hospitals, social programs, defense facilities, rapid transit systems including the Las Vegas monorail, bridges, health service delivery systems, governance infrastructure, schools and universities, air traffic services, power providers, Central Park in New York City, the U.S. Federal Reserve, water taxi companies, InfraGard (the FBI and the private sector), construction projects, ports, domestic telecommunications infrastructure, and the information superhighway.[168] Commercial space mirrors this trend toward hybrid entities; examples can be found

[164] A. Ng & Martin Loosemore, "Risk Allocation in the private provision of public infrastructure" (2007) 25 Int'l J of Project Management at 66, 67.

[165] Xiao-Hua Jin and Hemanta Loloi, "Risk Allocation in Public-Private Partnership Projects – An Innovative Model with an Intelligent Approach", presented at The Construction and Building Research Conference of the Royal Institution of Chartered Surveyors, Georgia Tech, Atlanta U.S.A., 6–7 September 2007 at 3.

[166] *Ibid.* at 3–4.

[167] Ng & Loosemore, *supra* note 164 at 67.

[168] Matthew H. Hoy, "The Information Superhighway: The Road to Rural Economic Development?" (1996) 6-Fall *Kansas Journal of Law & Public Policy* 217; Nicholas P. Miller and Kenneth A. Brunetti, "Using Public-Private Partnerships to Develop Intelligent Transportation Systems: Potential Legal Barriers" presented at Intelligent Transportation Systems and the Law, October 23 – 24, 2000, Chicago, Illinois; Ronald Paul Hill, "Service Provision Through Public-Private Partnership: An Ethnography of Service Delivery to Homeless Teenagers" (2002) 4 J. of Service Research 4, 278; Clavio Valenca Filho and Joao Bosco Lee, "Brazil's New Public-Private Partnership Law: One Step Forward, Two Steps Back" (2006) 22(5) *Journal of International Arbitration*, 419; Jagun and Marques de Esa, supra note 158.

in a host of space applications encompassing remote sensing, international telecommunications, global navigation, spaceports, and indeed proposed SPS systems.

A consortium structured on the early INTELSAT/COMSAT model for SBSP could provide the necessary support from both the public and private side, buy-in from multiple countries which would most likely be necessary to overcome the steep economic costs, adequate allocation of risks, facilitate legislation to provide a legal framework and create sufficient operational infrastructure.[169] One essential component of such a legal infrastructure would be the implementation of cross-waivers of liability. Such cross-waivers are, in fact, required between all entities for any space activities involving a launch carried out in conjunction with NASA.[170] While they are not required for activities not involving NASA, they are incorporated in many other contracts for space activities, and should be used by any consortium creating an SPS. Essentially, these cross-waivers ensure that no party to the contract (or any entity related to it) will sue any other party to the contract (or entity related to it) for damages caused by the other, except under a very limited set of circumstances.[171]

INTELSAT began as an intergovernmental consortium of country (or State-designated private company) shareholders who paid according to use and received profits proportionate to their investment.[172] COMSAT was a private for-profit company, legislatively created to be the U.S. signatory to, investor in, and provider of INTELSAT services in the U.S.[173] A consortium with monies paid in accordance with use lends itself well to SBSP in order to attract more users to the system. Such internationalization also has the added benefits of establishing circumstances that are conducive to the creation of standardized international regulations and mitigating the danger that an SPS system could be weaponized.

[169] National Security Space Office Interim Assessment, *supra* note 20 at 34; Kassing, *supra* note 36 at 133.

[170] 14 CFR § 1266.104.

[171] Steve Mirmina, *"Cross-Waivers of Liability in Agreements to Explore Outer Space: What They Are and How They Work"* (2012) 9 SciTech Lawyer 1.

[172] "Intelsat" available at: <https://www.princeton.edu/~achaney/tmve/wiki100k/docs/Intelsat.html>.

[173] Leland L. Johnson "Issues in International Telecommunications: Governmental regulation of COMSAT" (RAND January 1987) at iii.

Dispute Resolution

The Liability Convention provides for non-adversarial settlement of disputes that have not been resolved through diplomatic channels.[174] However, only States can bring a claim under the Convention. Alternatively, disputes have been resolved through national courts, arbitration, or mediation. Because of the probability of private sector involvement in SBSP and its transnational nature, these last methods of dispute resolution become very attractive options to resolve disputes that may arise in SBSP ventures.

The UN Model Law on International Commercial Arbitration, drafted by the United Nations Commission on International Trade Law (UNCITRAL), defines the principal requirements, or elements, of dispute resolution by arbitration.[175] They are: (1) an agreement by the parties, (2) to submit all or certain disputes to arbitration, (3) which have arisen or may arise out of a defined legal relationship between them, (4) whether these disputes are contractual or not.[176] Usually, the agreement refers to claims "which arise out of or in connection with this contract."[177] This language is sufficient to include all issues associated with the contract's conclusion, validity, interpretation, performance, damages, and termination.[178] Tort claims may be covered if they bear some nexus to the performance of the parties' contractual obligations.[179]

Arbitration agreements are usually in the form of a clause in the contract that sets forth the parties' rights and responsibilities. They are recognized globally and favored in some jurisdictions.[180] While the International Chamber of Commerce in

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[174] The Liability Convention, *supra* note 62, arts XIV – XX; Article XIV reads:

> If no settlement of a claim is arrived at through diplomatic negotiations as provided for in article IX, within one year from the date on which the claimant State notifies the launching State that it has submitted the documentation of its claim, the parties concerned shall establish a Claims Commission at the request of either party.

[175] Klaus Peter Berger "The Nature of the International Arbitral Process" in Understanding Transnational Commercial Arbitration (edited by the Center for Transnational Law 2000) UTCARB 1.II.

[176] *Ibid.*

[177] *Ibid*, 1.II.2.a.

[178] *Ibid.*

[179] *Ibid.*

[180] Section 2 of the U.S. Federal Arbitration Act states:

> A written provision in any … contract evidencing a transaction involving commerce to settle by arbitration a controversy thereafter arising out of such contract or transaction … shall be valid, irrevocable, and enforceable, save upon such grounds as exist at law or in equity for the revocation of any contract. 9 U.S.C. § 2.

Section 2 "declare[s] a national policy favoring arbitration" of claims that parties contract to settle in that manner. *Southland Corp. v. Keating*, 465 U.S. 1, 10, 104 S.Ct. 852, 79 L.Ed.2d 1 (1984); *Preston v. Ferrer*, 552 U.S. 346, 349, 128 S.Ct. 978, 983, 169 L.Ed.2d 917 (2008). For an in depth discussion, see Patricia Sterns and Leslie Tennen, *Resolution of Disputes in the Corpus Juris Spatialis: Domestic Law Considerations*, Proceedings of the 36th Colloquium on the Law of

Paris (ICC) recommends that parties referencing ICC arbitration in their contracts use model language,[181] not all parties share the same priorities for their dispute resolution. In drafting an arbitration clause, the same principles apply that are applicable to good drafting in general. Simplicity is a good starting point. If the parties have a specific tribunal in mind, then it is necessary to ensure that the provision's language meets that tribunal's requirements and is compliant with its rules.[182] The arbitration clause gives the parties latitude to choose the arbitrator selection process and set arbitrator qualifications, determine whether and what discovery is available, what rules apply (evidentiary and procedural), scheduling, level of confidentiality, the role the arbitrators will play, decision format and whether binding, the appeal process if any, choice of law, provisional remedies, and methods of enforcement.[183] Often, a contract choosing the UNIDROIT Principles as the contract's governing law also includes an arbitration clause. There is a complex interplay between arbitration providers and arbitration clauses; at times, the chosen provider will not enforce other negotiated terms of the arbitration agreement because of conflicts with provider rules.[184] As a result, even simple clauses can have complicated results.

An alternative and specialized model, the Optional Rules for Arbitration of Disputes Relating to Outer Space Activities put forth by the Permanent Court of Arbitration (PCA), provides sample language for an arbitration clause in cases where the parties wish to implement the Optional Rules.[185] If the parties agree to refer a dispute to the PCA under these Optional Rules, then a "waiver of any right to immunity from jurisdiction, in respect of the dispute in question, to which such party might otherwise be entitled" will be constituted; it is not necessary for jurisdiction to characterize the dispute as specifically relating to outer space for the rules to apply.[186] The Optional Rules are based on and modify the 2010 UNCITRAL Arbitration Rules to address the particular needs of this subject area,[187] and govern the relevant issues with regard to arbitration including notice, representation, number and selection of arbitrators, and procedures to be followed.

Outer Space 172 (1994); Jean-Gabriel Castel "The enforcement of agreements to arbitrate and arbitral awards in Canada," *Canada-United States Law Journal*, 17 (January 1991) 491.

[181] The ICC model arbitration clause is:

> All disputes arising out of or in connection with the present contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules.
>
> Available at: <http://madaan.com/arbitrationicc.html>.

[182] Gary H. Barnes "Drafting an Arbitration Clause – A Checklist" HG.org: Worldwide Legal Directories available at: <http://www.hg.org/adradd1.html>.

[183] *Ibid.*

[184] W. Mark C. Weidemaier "The Arbitration Clause in Context: How Contract Terms Do (and Do Not) Define the Process" (2006 – 2007) 40 *Creighton Law Rev*iew 655 at 660.

[185] Optional Rules for Arbitration of Disputes Relating to Outer Space Activities, Permanent Court of Arbitration (6 Dec. 2011) available at: <http://pca-cpa.org/shownews.asp?ac=view&pag_id=1261&nws_id=323>, Annex.

[186] *Ibid*, art 1.

[187] *Ibid*, Introduction.

Another possibility is mediation which, like both arbitration and adjudication, also employs neutral third parties.[188] However, the mediator does not issue a binding decision. The procedures are less structured and more flexible than those followed by either courts or arbitral tribunals.[189] Mediation can be entirely consensual or it can be court ordered.[190]

Legislation as Regulatory Risk Management

Legislation provides yet another alternative for risk management. The Price-Anderson Act in the U.S. "provides a system of indemnification for legal liability" arising from nuclear accidents.[191] In 2005, the Act was extended for another twenty years. India and the U.S. have recently entered in to the Civilian Nuclear Agreement to foster civilian partnership between the two countries and to encourage this cooperation. As a result, India is drafting its Civil Liability for Nuclear Damage Bill that would indemnify U.S. corporations for any nuclear accidents caused on Indian territory, instead channeling liability to the operator of the nuclear plant.[192] These are good examples of use of legislation to manage risk and can be used as models for SBSP.

Conclusions and Recommendations

In summation, the success of SBSP will depend heavily upon safe design and operation of the SPS system, which in turn requires identification of safety standards prior to design and construction. To be effective, those standards must be uniform and implemented within the existing international and national regulatory regimes. In this way, a larger number of countries could be attracted to, and served by, the project, creating a larger market and a chance at eventual return on investment.

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[188] Sarah R. Cole, et al. "Mediation: Law, Policy and Practice" § 1:1 (2d ed.).

[189] For a good, if amorphous, definition of mediation, see, Mediation Definition available at: <http://terryharris.com/Mediation%20Definition.htm>.

[190] Deborah Lynn Zutter "Incorporating ADR in Canadian Civil Litigation" (2001) 13 Bond L Rev. Issue 2, article 11, available at: <http://epublications.bond.edu.au/cgi/viewcontent.cgi?article=1215&context=blr>; Edward P. Davis, Jr. "Mediation in the US Legal System" The Institute for the Study and Development of Legal Systems available at: <http://lawcommissionofindia.nic.in/adr_conf/DAVIS5.pdf>.

[191] The Price Anderson Act, Background Information, available at: <http://www.ans.org/pi/ps/docs/ps54-bi.pdf>; "Civil Liability for Nuclear Damage" (January 2010) available at: <http://www.world-nuclear.org/info/inf67.html>.

[192] Syed Ali Mujtaba Syed "Wakeup to Civil Liability for Nuclear Damage Bill" Ground Report (12 March 2010) available at: <http://www.groundreport.com/Opinion/Wakeup-to-Civil-Liability-for-Nuclear-Damage-Bill/2919665>.

More significantly, these standards would decrease the risks inherent to SBSP creating less chance of liability and, again, bringing economic viability into possibility.

Environmental standards are needed in addition to safety standards. URSI must play a role in monitoring the risks present at or near ground stations, or anywhere that biota are exposed to the WPT.

The most effective vehicle to make SBSP a reality would be a P3 consortium, preferably in a form reminiscent of early INTELSAT/COMSAT, comprised of participants from government, industry, and academia, collaborating and co-managing the activity.[193] This model could distribute cost across users, minimize and allocate risks, foster international cooperation and enhance utilization. In addition, the involvement of numerous countries could facilitate harmonization of safety and environmental standards, at least among the participants.

Strides in technology continue to make SPS more feasible, as collaborative efforts such as the SPS 2014 Conference in Kobe, Japan, give international participants a chance to share their progress and exchange ideas and recommendations moving forward.[194] The time to address these issues is now. The ultimate pay off will be felt by generations to come.

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[193] David Whalen *The Rise and Fall of COMSAT: Technology, Business, and Government in Satellite Communications* (Palgrave Macmillan 2014) at 3.

[194] Frank Morring Jr., "Low Cost Launches May Boost Chances for Space Solar Power" (April 21, 2014) available at: ≤ http://www.aviationweek.com/Article.aspx?id=/article-xml/AW_04_21_2014_p24-678947.xml&p=1>.

Prospects for the Arbitration of Disputes in Public – Private Space Projects

Tare Brisibe

Abstract International law exists for several purposes including the provision of principles and modalities governing peaceful settlement of disputes. Whilst utilization of outer space continues to have a transformational impact on humankind, the emergence of a global space industry can be attributed to increased involvement by private enterprise in outer space ventures, traditionally conducted by States through Public-Private Partnerships (PPP's), amongst other business ventures. PPP's raise a variety of interesting and important questions of a legal nature including the settlement of disputes if and when they do arise. Noting that arbitration is increasingly used for settling disputes, under privately financed infrastructure projects, alongside the fact that international arbitration has evolved as the preferred method for resolving disputes arising from cross-border investments, particularly those involving States, this chapter addresses prospects for arbitration of disputes relating to outer space activities, arising from PPP's. This chapter examines particular characteristics of existing arrangements for dispute settlement in PPP's, identifying gaps if any, and justifies a proposal for pragmatic solutions, relying on the Optional Rules for Arbitration of Disputes Relating to Outer Space, adopted in 2011 by the Permanent Court of Arbitration.

This chapter re-visits arguments first advanced in 2010 as a discussion paper, titled: *Alternative Resolution of International Investment Disputes in Public-Private Space Projects*, invited by and submitted to the Chair (H.E. Judge Fausto Pocar) of the PCA Advisory Group of Experts, mandated to develop Optional Rules for Arbitration of Disputes Relating to Outer Space Activities (PCA Advisory Group) and is written and published in the sole opinion of the author.

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Introduction

In proposing Optional Rules for Arbitration of Disputes Relating to Outer Space,[1] under the auspices of the Permanent Court of Arbitration (PCA), relying on the United Nations Commission on International Trade Law[2] (UNCITRAL) Arbitration Rules[3] alongside the PCA's 2001 *Optional Rules for Arbitration of Disputes Relating to Natural Resources and the Environment*, two aspects were addressed whilst giving consideration to those disputes which may arise from what are commonly referred to as Public – Private Partnerships (PPP's) involving foreign investment or participants. Namely, the identification of gaps, if any, in current PPP's for dispute resolution, and examination of their particular characteristics. Part II contextualizes the chapter, followed by analysis against a backdrop of internationally recognized scenarios[4] in the paper's Part III, where options for dispute resolution are compared from two projects in Nigeria (Nigcomsat-I satellite[5]) and the European Union – E.U. (Galileo[6]). Given the dominance of United States of America's (U.S.) private sector participation within traditional public space infrastructure projects, partnerships[7] involving the U.S. National Aeronautical and Space Administration (NASA) are examined, as well as treaty provisions adopted under the auspices of the International Institute for the Unification of Private Law[8] (UNIDROIT). Part IV concludes the chapter.

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[1] On December 6, 2011, the Administrative Council of the PCA adopted *Optional Rules for the Arbitration of Disputes Relating to Outer Space Activities*. (Outer Space Optional Rules).

[2] UNCITRAL was established by UNGA Resolution 2205 (XXI) of 17 December 1966 to promote the progressive harmonization and unification of international trade law.

[3] Adopted on 28 April 1976, *Yearbook of the United Nations Commission on International Trade Law,* vol. VII, 1976, part one, chap. II, sect. A (United Nations publication, Sales No. E.77.V.1). The 1976 text was revised in August 2010, UNGA Resolution 65/22 of 10 January 2011, *text reprinted in* http://www.uncitral.org/uncitral/en/uncitral_texts/arbitration/2010Arbitration_rules.html

[4] UN Publication, A/CN.9/SER.B/4, *UNCITRAL Legislative Guide on Privately Financed Infrastructure Projects* (2001) ISBN 92-1-133632-5 (UNCITRAL Guide).

[5] See: Brisibe T., *Law and Regulation of Activities Related to Outer Space in Nigeria*, Zeitschrift für Luft- und Weltraumrecht, Vol. 4 (2006) at pages 562 and 565.

[6] See: *Regulation (EU) No. 1285/2013 of the European Parliament and of the Council of 11 December 2013 on the implementation and exploitation of European satellite navigation systems and repealing Council Regulation (EC) No 876/2002 and Regulation (EC) No 683/2008 of the European Parliament and of the Council*.

[7] "Space Act Agreements" concluded pursuant to the U.S. *National Aeronautics and Space Act of 1958* (Space Act), as amended (42 U.S.C. § 2451 et seq.).

[8] UNIDROIT, an independent intergovernmental organization established to study needs and methods for modernizing, harmonizing and co-coordinating private and in particular commercial law as between States and groups of States, is applying the 2001 *Convention on International Interests in Mobile Equipment* (Cape Town Convention*)* to space assets by the 2012 *Protocol on Matters specific to Space Assets* (Space Protocol). For an overview, see Stanford M. J., *The Way to the Successful Completion of the Negotiations,* in Proceedings of the International Institute of Space Law (2014) Volume 56, ISBN 978-94-6236-440-0, at pages 691–714. This author participated at

Context and Definitions

The trend[9] commencing in the early 1980s, toward private sector participation and competition in infrastructure sectors, such as telecommunications, electricity, transport, public housing, prisons and defense, has been driven by general as well as country-specific factors. This time line coincides with the beginnings of industry participation in traditional government owned and operated space projects in respect of which reference can be made to, amongst others, the European Arianespace[10] launcher and U.S. Landsat[11] earth observation programs. Clearly, with respect to the space sector, this trend[12] is on the rise. Among general factors one can cite as justification for private sector participation in infrastructure sectors, two principal considerations influence the increase in space related PPP's. Firstly, because space technology is often dual-use, it is unlikely that governments would encourage unbridled growth of the commercial market with opportunities for complete or total control by industry participants. Secondly, space activities with extremely high capital and infrastructure development costs remain prone to indebtedness and stringent budget constraints thereby limiting the public sector's ability to meet increasing infrastructure needs.

A standard definition does not exist for these circumstances where governments turn to the private sector for financing, design, construction, and operation of infrastructure projects, although PPP's are generally understood[13] as referring to contractual agreements formed between a government agency and a private sector entity

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related multilateral fora, including the: UNCOPUOS Space *ad hoc* consultative mechanism (Paris, September 2001); 1st Session of the Committee of Governmental Experts for the preparation of a draft *Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Space Assets* (Rome, December 2003), and the 2nd Government/Industry Forum on the preliminary draft *Protocol on Matters Specific to Space Assets* (London, April 2006).

[9] See: UNCITRAL Guide, Supra, note 4 at page 1.

[10] At present, Arianespace's 24 shareholders include companies from the Ariane industrial team and national space agencies. See: http://www.arianespace.com/about-us-corporate-information/shareholders.asp last accessed on 9 May 2015 and based on information last updated on January 5, 2011.

[11] The Landsat program was subject to attempts at its privatization pursuant to the repealed *Land Remote Sensing Commercialization Act*, 15 U.S.C. §§4201–4292 (1984) by a PPP involving the U.S. National Oceanic and Atmospheric Administration and the Earth Observation Satellite Company (EOSAT) later re-named Space Imaging. See: Gabrynowicz, J. I., *Expanding Global Remote Sensing Services*, in *Proceedings of the Workshop on Space Law in the Twenty-First Century*, UNISPACE III Technical Forum, July 1999, UN Publications, (2000) ISBN 92-1-100833-6 at page 99.

[12] For a description of space related PPP's in China, India and the Philippines, See: UNESCAP, *Public-Private Partnership and Community Participation an Applications of Space Technology For Socio-Economic Development Compilation of Policies And Practices In Selected ESCAP Member Countries,* (2007). For a 2013 summary report of Public-private collaboration on space activities See: *Space Security Index* (2013) ISBN 978-1-927802-05-2 at pages 64–66.

[13] See Deloitte Research, *Closing the Infrastructure Gap: The Role of Public-Private Partnerships* (2006) at page 5.

that allows for greater private sector participation in the delivery of public infrastructure projects. In this regard, there are three broad categories[14] in which the private sector could participate in infrastructure projects involving either: (a) Public ownership and public operation; (b) Public ownership and private operation; and (c) Private ownership and operation. Within this broad spectrum, any form of PPP model may be adopted by the parties from a possible variety[15] including project financing[16] (by international or foreign investment) which may also involve the taking of security interests[17] in assets. Noting that security interests in personal property provide a secured creditor with two kinds of rights, a *property right* allowing the secured creditor, in principle, to repossess property or have a third party repossess and sell it, and a *priority right* to receive payment with the proceeds from sale of the property in event of default by the debtor. In this respect, three space sector specific definitions under the 2012 Space Protocol deserve mention.

Firstly, "*debtor's rights*"[18] which mean "*all rights to payment or other performance due or to become due to a debtor by any person with respect to a space asset.*"[19] Secondly, "*rights assignment*"[20] means "*a contract by which the debtor confers on the creditor an interest (including an ownership interest) in or over the whole or part of existing or future debtor's rights to secure the performance of, or in reduction or discharge of, any existing or future obligation of the debtor to the*

[14] UNCITRAL Guide, Supra, note 4 at pages 13–14.

[15] The choice of a PPP model may include: Design-Build; Design-Build-Maintain; Design-Build-Operate; Design-Build-Operate-Maintain; Build-Own-Operate-Transfer; Build-Own-Operate; Design-Build-Finance-Operate/Maintain. PPPs can also be used for existing services and facilities in addition to new ones. Some of these models include Service Contract; Management Contract; Lease; Concession; and Divestiture. For detailed definitions, see: Deloitte Research, Supra note 13 at page 5.

[16] Non-public financing of infrastructure could involve debt finance (loans obtained on commercial markets) or equity investment, from which various financing sources include: equity capital; commercial loans; "subordinated" debt; institutional investors; capital market funding; financing by Islamic financial institutions (due to restrictions on charging interest); financing by international financial institutions; and combined public and private finance. UNCITRAL Guide, Supra, note 4 at pages 15–18.

[17] For an overview of Security Interests see: Omar P., *International Insolvency, Security Interests and Creditor Protection*, in Davies I., (ed.) *Security Interests in Mobile Equipment*, Ashgate, (2002) at pages 293–334.

[18] Article I (2) (b of the Space Protocol, http://www.unidroit.org/instruments/security-interests/space-protocol last accessed on 9th May 2015.

[19] *Id.* Article I (2) (k), defines a "space asset" as "*any man-made uniquely identifiable asset in space or designed to be launched into space, and comprising (i) a spacecraft, such as a satellite, space station, space module, space capsule, space vehicle or reusable launch vehicle, whether or not including a space asset falling within (ii) or (iii) below; (ii) a payload (whether telecommunications, navigation, observation, scientific or otherwise) in respect of which a separate registration may be effected in accordance with the regulations; or (iii) a part of a spacecraft or payload such as a transponder, in respect of which a separate registration may be effected in accordance with the regulations, together with all installed, incorporated or attached accessories, parts and equipment and all data, manuals and records relating thereto.*"

[20] *Id.* Article I (2) (h).

creditor which under the agreement creating or providing for the international interest is secured by or associated with the space asset to which the agreement relates." And thirdly, "*rights reassignment*"[21] construed as "*(i) a contract by which the creditor transfers to the assignee, or an assignee transfers to a subsequent assignee, the whole or part of its rights and interest under a rights assignment; or (ii) a transfer of debtor's rights under Article XII(4)(a) of this Protocol."*

These definitions all serve to underscore the fact that security arrangements are pivotal in financing infrastructure projects, and considering that a significant number of space assets are being financed by private-sector investors rather than central governments, it is of note that efforts to develop UNIDROIT's 2012 Space Protocol were described[22] as seeking to *inter alia* open up new economic opportunities, in particular with a view to enhancing access to the international capital markets of those countries most in need of such financing to develop their economic infrastructure to meet essential needs, namely the emerging and developing economies. In other words, the Cape Town Convention along with its Space Protocol is expected to enable asset-based financing and leasing of space assets with prospective international lenders being assured of their *rights* and *priorities* in the event of a debtor's insolvency. This said, given the potentially public nature of space projects, mention should also be made of the practice of applying mandatory domestic laws to transactions of this nature. In any case, with the increase in space related PPP's, alongside the adoption of uniform rules facilitating the financing of space assets, it is most appropriate for one to consider mechanisms for the resolution of disputes which may arise from such investor relationships.

Scenarios, Characteristics and Specific Circumstances

It is contended that issues which most frequently give rise to disputes during the life of a project agreement are those related to possible breaches of the agreement during the construction phase, the operation of the infrastructure facility or in connection with the expiry or termination of the project agreement.[23] One should also add

[21] *Id*. Article I (2) (i).

[22] Stanford M. J., *The preliminary draft Protocol to the Cape Town Convention on Matters specific to Space Assets: A unique opportunity to expand the benefits of space-based services and to broaden the market for commercial space activities in general*, in Proceedings of the UN/Iran Workshop on Space Law, *Role of International Space Law in the Development and Strengthening of International and Regional Cooperation of States in the Peaceful Exploration and Uses of Outer Space*, Tehran, 8–11 November 2009. See further: Stanford M. J., and de Fontmichel A., *Overview of the current situation regarding the preliminary draft Space Property Protocol and its examination by COPUOS*, Unif. L. Rev, 2001-1, at pages 60–77; UN Doc. A/AC.105/C.2/L.225 *Draft Convention of the International Institute for the Unification of Private Law on international interests in mobile equipment and the preliminary draft protocol thereto on matters specific to space property – Report of the Secretariat and the secretariat of the International Institute for the Unification of Private Law;* and UNIDROIT 2010 *C.G.E./Space Pr./4/Report.*

[23] UNCITRAL Guide, Supra, note 4 at page 175.

that the fairly simplistic definition of PPP's put forward hereinbefore, risks an underestimation of the inherently complex nature of PPP's, because privately financed infrastructure projects typically require the establishment of a network of interrelated contracts and other legal relationships involving various parties.[24] Such projects must take account of the diversity of relations, which may call for different dispute settlement methods depending on the type of dispute and the parties involved.

This said, the main disputes may be divided into three broad categories, i.e.: (a) Disputes arising under agreements between the concessionaire and the contracting authority and other governmental agencies[25]; (b) Disputes arising under contracts and agreements entered into by the project promoters or the concessionaire with related parties for the implementation of the project[26]; or (c) Disputes between the concessionaire and other parties.[27] Given the scope of this paper and with regard, in particular, to infrastructure projects involving foreign investors, it is noteworthy that a framework for the settlement of disputes between the contracting public authority and foreign companies participating in a project consortium may be provided through adherence to the *Convention on the Settlement of Investment Disputes between States and Nationals of Other States*.[28] Likewise, bilateral investment agreements may provide a framework for the settlement of disputes between the State and foreign companies. In these treaties, the host State would extend, to investors that qualify as nationals of the other signatory State, a number of assurances and guarantees, whilst expressing its consent to arbitration, for instance, by referral to ICSID or to an arbitral tribunal applying the UNCITRAL Arbitration Rules. For illustration, the dispute settlement provisions at section 26 of the *Nigerian Investment Promotion Commission Act*,[29] read *inter alia* as follows:

> *(1) Where a dispute arises between an investor and any Government of the Federation in respect of an enterprise, all efforts shall be made through mutual discussion to reach an amicable settlement. (2) Any dispute between an investor and any Government of the*

[24] *Id*. at page 173.

[25] *Ibid.* Public projects, including those of a space-related nature, could be governed by either administrative law or contract law as supplemented by special provisions developed for government contracts for the provision of public services.

[26] *Id*. at page 174. Such contracts would usually include at least: (i) contracts between parties holding equity in the project company; (ii) loan and related agreements; (iii) contracts between the project company and contractors, which themselves may be consortia of contractors, equipment suppliers and providers of services; (iv) contracts between the project company and the parties who operate and maintain the project facility; and (v) contracts between the concessionaire and private companies for the supply of goods and services needed for the operation and maintenance of the facility.

[27] *Ibid.* Users or customers of the facility, which in the context of space-related PPP's could include customers of downstream space services such as airlines, airports, marine vessels etc., or even individual users of satellite communications terminals or GPS receivers. Parties to these disputes may not necessarily be bound by any prior legal relationship of a contractual or similar nature.

[28] UN Treaty Series, Vol. 575, No. 8359 (1981). Establishing the International Center for the Settlement of Investment Disputes (ICSID).

[29] *Laws of the Federation of Nigeria*, Chapter N117, (Decree No 16 of 1995).

Federation in respect of an enterprise to which this Act applies which is not amicably settled through mutual discussions, may be submitted at the option of the aggrieved party to arbitration as follows… (b) in the case of a foreign investor, within the framework of any bilateral or multilateral agreement on investment protection to which the Federal Government and the country of which the investor is a national are parties; or (c) in accordance with any other national or international machinery for the settlement of investment disputes agreed on by the parties. (3) Where in respect of any dispute, there is disagreement between the investor and the Federal Government as to the method of dispute settlement to be adopted, the International Centre for Settlement of Investment Disputes Rules shall apply.

It is further contended[30] that the long duration[31] of privately financed infrastructure projects makes it important to devise mechanisms to *prevent*, as much as possible, disputes from arising so as to preserve the business relationship between the parties. Recorded practices[32] with a view to achieving the objectives mentioned above, often provide for composite dispute-settlement clauses designed to prevent, to the extent possible, disputes from arising, to foster reaching agreed solutions and to put in place efficient dispute settlement methods when disputes nevertheless arise. Such clauses typically provide for a sequential series of steps starting with an early warning of issues that may develop into a dispute unless the parties take action to prevent them. In most cases, adversarial dispute settlement mechanisms are only used when the disputes cannot be settled through the use of conciliatory methods. This desire to prevent, as much as possible, disputes from arising so as to preserve the business relationship between the parties is one which also prevails in the space sector.

As one commentator noted in 2001 *"discussing dispute settlement mechanisms at the ESA*[33] *could be something of a challenge, because the twenty-five year history of the Agency has been free of any actual cases of dispute settlement. This may be attributable to the dissuasive effect of dispute settlement clauses calling for final and binding disposition of a dispute through arbitration; in other words, because invoking arbitration clauses implies a significant investment of time and money, the parties to an agreement or a contract will be encouraged, and make their best efforts, to settle their disagreement at an earlier opportunity."*[34] Bearing the above statement in mind, and generally with respect to PPP's, it would appear that the commonly used methods for preventing and settling disputes arising from public infrastructure projects include a range of options, *viz*: early warning; partnering;

[30] UNCITRAL Guide, Supra, note 4 at page 175.

[31] For instance, the procurement process for manufacture, launch and in-orbit delivery of a commercial satellite could take anywhere between 2 and 5 years at the minimum.

[32] UNCITRAL Guide, Supra, note 4 at page 175.

[33] Acronym for European Space Agency.

[34] Farand A., *The European Space Agency's Experience with Mechanisms for the Settlement of Disputes*, in Permanent Court of Arbitration/Peace Palace Papers, *Arbitration in Air, Space and Telecommunications Law*, Kluwer Law International (2002) ISBN 90-441-1773-3, at page 145. For similar conclusions see: Bohlmann U. K., *Disputing with ESA*, in Proceedings of the International Institute of Space Law (2014) Volume 56, ISBN 978-94-6236-440-0, at pages 213–226.

facilitated negotiation; conciliation and mediation; non-binding expert appraisal; mini-trial; senior executive appraisal; review of technical disputes by independent experts; dispute review boards; non-binding arbitration; and judicial proceedings.[35] Because the focus of this chapter concerns dispute resolution mechanisms in the context of space related PPP's, specific scenarios must be examined, and it is to these scenarios that this chapter now turns.

Nigcomsat-I[36]

Participation of international partners and foreign lenders in the Nigcomsat-I satellite communications project involved the establishment of a network of interrelated contracts and legal relationships with a variety of parties. Subject to choice of law (non-Nigerian) provisions with the possibility of recourse to international commercial arbitration following a dispute avoidance process, a prime contract concluded between the National Space Research and Development Agency (NASRDA) of Nigeria and China Great Wall Industries Corporation governed the manufacture, launch and in-orbit delivery of a hybrid geostationary communications satellite. Supplementary contractual relationships were also established for delivery of the associated ground segment, a network operations center, telemetry, tracking and command facilities, with various Chinese entities subject to choice of law (non-Nigerian) provisions and a waiver of sovereign immunity, limited to specific assets of the signatory on behalf of the Nigerian government with the possibility for recourse to international commercial arbitration. Whilst Nigcomsat-I failed in orbit during the month of November 2008 due to faulty solar arrays, the use of good offices and conciliatory methods, without invoking any form of adversarial dispute settlement mechanism, ensured a replacement, Nigcomsat-I R, was delivered by the manufacturer in 2011.

Galileo

Originally conceived as a PPP, with the termination of negotiations for the conclusion of a concession contract with the private sector, this primarily public project does not now appear to anticipate private partnerships. This said, it is certainly

[35] UNCITRAL Guide, Supra, note 4 at pages 176–187.

[36] This author advised negotiations to secure Export Buyers Credit from China Export Import Bank for part financing procurement of Nigcomsat-I, and to obtain insurance covering launch and in-orbit delivery. On behalf of the Nigerian space agency (NASRDA) the author maintained legal oversight of Nigcomsat Limited being the private company incorporated to manage satellite network operations and deliver services to public and private sector users from the Nigcomsat-I satellite. NASRDA is a para-statal of the Nigerian Federal Ministry of Science and Technology.

worth mentioning given its very visible profile. Moreover, in the context of this chapter, considering ESA's role[37] in the program, it is certainly worthwhile to note ESA's practice with respect to the settlement of disputes. One commentator on the topic concluded[38] that, ESA's practice with regard to settlement of disputes is firstly, based on the ESA Convention,[39] which clearly favors the constitution of an arbitral tribunal for final disposition of a dispute between ESA and any other entity under public international law, or *between ESA and a contractor*. The second is one which tends to develop in large scale cooperation[40] projects with international partners, where the possibility of referring a dispute to arbitration or another dispute settlement mechanism is subject to conclusion of a new specific agreement once the multilayered consultation process has been exhausted.

NASA Space Act Agreements

It is stated that under its Space Act authority, NASA has entered into a significant number of agreements with diverse groups of people and organizations, both in the *private* and public sector, in order to meet wide-ranging NASA mission and program requirements and objectives.[41] The Agreement Partner can be a U.S. or foreign person or entity, an educational institution, a Federal, state, or local governmental unit, a foreign government, or an international organization.[42] Mechanisms by which disputes are resolved with respect to such Space Act agreements, which clearly constitute PPP's, can be gleaned from a sample of the respective clauses in the said agreements. For instance, Article 19 (Dispute Resolution) of the Space Act

[37] Supra note 6.

[38] Farand, Supra, note 34 at page 156 and *Cf:* Bohlmann U. K., Supra, note 34.

[39] Specifically with respect to the ESA practice on the conclusion of written contracts, see: Annex 1 (Privileges and Immunities), Article XXV of the Conv*ention for the Establishment of a European Space Agency*, 14 I.L.M. p. 864 (1975). The said Article XXV reads: "1. *When concluding written contracts, other than those concluded in accordance with the Staff Regulations, the Agency shall provide for arbitration. The arbitration clause or the special arbitration agreement concluded to this end shall specify the law applicable and the country where the arbitrators sit. The arbitration procedure shall be that of that country. 2. The enforcement of the arbitration award shall be governed by the rules in force in the State on whose territory the award is to be executed."* For related implementing regulations, see: Regulations of The European Space Agency – General Clauses and Conditions for ESA Contracts, ESA/REG/002, rev. 1 Paris, 7 February 2013.

[40] *Cf:* Dispute resolution provisions of various bilateral Memoranda of Understanding governing co-operation on the civil international space station, available on-line at: http://www.esa.int/SPECIALS/ECSL/SEMYF7D3M5E_2.html. Last accessed on 10 May 2015.

[41] A 2014 report listing active NASA Space Act Agreements shows the agency has concluded nearly 1800 such instruments with domestic and international entities. See: National Aeronautics and Space Administration, Office of Inspector General, Report No. IG-14-020, *NASA's Use of Space Act Agreements,* June 5, 2014.

[42] See: NASA Policy Directive 1050.1I, *NAII 1050-1A NASA Advisory Implementing Instruction, Space Act Agreements Guide.*

Agreement between NASA and Kistler Aerospace Corporation and Rocketplane Limited, Inc., COTS[43] Demonstration reads:

> *All disputes concerning questions of fact or law arising under this Agreement shall be referred by the claimant in writing to the RpK Administrative Contact and the NASA Administrative Contact, who shall seek to resolve such disputes by Agreement. If they are unable to resolve the dispute, then the dispute will be referred to the JSC Commercial Crew Cargo Project Manager and the CEO of RpK for joint resolution. If the parties are still unable to resolve the dispute, the Associate Administrator for Exploration Systems Mission Directorate, or the Deputy of the Directorate, will seek to resolve the dispute, but if necessary issue a written decision that shall be a final Agency decision for all purposes including for purposes of seeking judicial review. Pending resolution of any disputes pursuant to this Article, the Parties agree that performance of all obligations shall be pursued diligently in accordance with the direction of the JSC Commercial Crew Cargo Project Manager. The Parties agree that this Disputes Resolution procedure shall be the exclusive procedure followed by the Parties in resolving any dispute arising under, or based on, an express or implied provision of this Agreement, including an alleged breach.*[44]

The NASA Space Act Agreements (SAA) guide[45] addressing the subject of dispute resolution[46] arising from agreements with foreign entities (that would encompass private sector participants) also recommends as follows:

> *All SAAs should include a dispute resolution clause. The SAA should outline the specific procedures to be followed. SAAs should first include language stating that both parties agree to consult promptly with each other on all issues involving interpretation, implementation, or performance of the SAA. Generally, issues are handled at the working level before being elevated to a higher level if the parties cannot achieve resolution. Any matter that cannot be settled at this initial level is referred to the next higher level official for both parties. Depending on the complexity and sensitivity of the agreement, the dispute may be referred for resolution to the next higher level of officials of both parties. That official may be the official who signed the agreement. If these officials are unable to resolve a dispute under an agreement governed by U.S. law, the NASA official at the working level, or one level higher (depending on the complexity and visibility of the SAA activity) should provide to the SAA partner, in writing, a final Agency decision. This final Agency decision becomes part of the administrative record of the dispute. Note: With rare exception, the NASA Administrator should not be involved in dispute resolution activities. Use of the Administrator as the designated official for making a final Agency decision requires consultation with the Offices of the Administrator and the General Counsel. Referring a dispute to "the NASA Administrator or his designee" is acceptable. In very limited instances NASA may agree to a provision that permits possible settlement of disputes through an agreed*

[43] The Commercial Orbital Transportation Services Demonstration program (COTS) is intended to motivate private development of commercial spacecraft capable of servicing the International Space Station with the retirement of the Space Shuttle. Rocketplane Kistler (RpK) was dropped from the COTS program in 2007 for failing to meet financial milestones.

[44] *Cf*: Space Act Agreements between NASA and various private sector entities in respect of Commercial Crew Development with: Blue Origin; Paragon Space Development Corporation; Sierra Nevada Corporation Space Systems; The Boeing Company; United Launch Alliance, and COTS with: Space Exploration Technologies Corp. (SpaceX) and Orbital Corporation.

[45] NASA Advisory Implementing Instruction, NAII 1050-1A, dated August 15, 2008.

[46] Id. § 4.5.17.

form of resolution, such as non-binding arbitration or mediation. However, the provision must provide that, at the time of the dispute, both parties, must agree to submission of the specific matter in dispute. Agreement to any such clause is highly unusual and requires specific approval by the General Counsel.

Cape Town Convention and Space Protocol

With respect to resolution of disputes, Chapter XII – Jurisdiction, Article 42[47] (Choice of Forum) of the 2001 Cape Town Convention, reads:

1. Subject to Articles 43[48] and 44, the courts of a Contracting State chosen by the parties to a transaction have jurisdiction in respect of any claim brought under this Convention, whether or not the chosen forum has a connection with the parties or the transaction. Such jurisdiction shall be exclusive unless otherwise agreed between the parties.

2. Any such agreement shall be in writing or otherwise concluded in accordance with the formal requirements of the law of the chosen forum.

The 2012 Space Protocol, cross referenced to Article 42 and 43 of the Convention, in its Chapter IV – Jurisdiction, Article XXXIII (Waiver of sovereign immunity), provides:

1. – Subject to paragraph 2, a waiver of sovereign immunity from jurisdiction of the courts specified in Article 42 or Article 43 of the Convention or relating to enforcement of rights and interests relating to a space asset under the Convention shall be binding and, if the other conditions to such jurisdiction or enforcement have been satisfied, shall be effective to confer jurisdiction and permit enforcement, as the case may be.

2. – A waiver under the preceding paragraph must be in writing and contain a description, in accordance with Article VII, of this protocol.

One can summarize from the Convention and Protocol's provisions above that, assuming adequate steps are taken to forestall a State(s) from relying on its sovereign status to deny jurisdiction or enforcements, the above provisions uphold the right of parties to a transaction to choose the forum, conferring jurisdiction on the *courts* (emphasis mine) of any Contracting State, provided this choice is exercised in writing or otherwise in accordance with formal requirements of the *lex fori.*[49] Albeit, without precluding the possibility of the parties recourse to any other form of dispute resolution process such as arbitration.

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[47] For a commentary on Article 42, see: UNIDROIT 2003 C.G.E. Space Pr./1/W.P.4, *Extract from the Official Commentary on the Convention on International Interests in Mobile Equipment and Protocol thereto on Matters specific To Aircraft Equipment by Professor Sir Roy Goode*, Rome, June 2003 at pages 118–120.

[48] Article 43 (Jurisdiction under Article 13) pertains to interim relief pending final determination of a creditor's claim.

[49] Laws of the jurisdiction in which a legal action is brought.

Concluding Remarks

Scenarios for dispute settlement arising from PPP's in the space sector reveal a tendency for dispute avoidance alongside reluctance to employ adversarial dispute settlement mechanisms. Nonetheless, the notion[50] that arbitration is used increasingly for settling disputes, which will certainly arise, under privately financed infrastructure projects, complements the contention[51] that international arbitration has evolved as the preferred method for resolving disputes arising from cross-border investments, particularly those involving States. Such arbitration could be *ad hoc*, typically under the UNCITRAL Rules which served as the basis for the 2011 Outer Space Optional Rules, or institutional, under the auspices of one of various institutions, that could very well include the PCA[52] and others such as, the London Court of International Arbitration, the Paris based International Chamber of Commerce, and the American Arbitration Association.

As far as the PPP space project focus of this chapter is concerned, it is noteworthy that in the matter of *Republic of Serbia* v *Imagesat International NV,*[53] a United Kingdom (UK) High Court dismissed an application by Serbia to challenge an earlier arbitral award for lack of substantive jurisdiction under Section 67 of the 1996 U.K. *Arbitration Act*, on the ground that Serbia had conferred substantive jurisdiction on the arbitrator by virtue of Terms of Reference. The arbitration arose from a contract between Israeli satellite operator, ImageSat and the State Union of Serbia and Montenegro (the State Union). Shortly after the arbitration was commenced, the State Union split and Serbia responded to the request for arbitration. The arbitrator decided, as a preliminary issue, that Serbia was the continuation of the State Union, rather than a successor State, and was a proper party to the contract and the arbitration. Serbia argued that the arbitrator did not have jurisdiction to determine this issue. The UK court dismissed the Section 67 challenge, on the ground that Serbia had conferred substantive jurisdiction on the arbitrator, by virtue of the Terms of Reference, to deal with the question whether it was a continuator or successor State. Beatson J (i.e., the presiding Judge) also held that, in the context of this case, that issue was justiciable and *arbitrable*. (emphasis mine). However, it is important to highlight the fact that the Judge expressed doubt (*obiter*) about whether such issues would have been justiciable in court proceedings. In particular, he noted at paragraphs 119, 120, 126 and 135 respectively:

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[50] UNCITRAL Guide, Supra, note 4 at page 183.

[51] Onwuamaegbu U., *International Dispute Settlement Mechanisms – Choosing Between Institutionally Supported and Ad Hoc; and Between Institutions*, in Yanaca-Small K., (ed) *Arbitration Under International Investment Agreements – A Guide to the Key Issues*, (2010) Oxford University Press at page 64.

[52] *Ibid*. Citing R. Doak Bishop *et al*, *Foreign Investment Disputes: Cases, Materials and Commentary*, 12, Kluwer Law International, (2005).

[53] [2009] EWHC 2853 (Comm), [2010] 1 Lloyd's Rep 324.

- The Court in the *Ecuador*[54] case rejected the argument that a matter that was justiciable in an arbitration should be treated as non-justiciable by the Court when it arises in the context of a section 67 application. It stated…If issues regarding jurisdiction are justiciable before the arbitrators, we do not find it easy to see why they should be regarded as non-justiciable before the English court.
- In doing so the Court of Appeal appears to have accepted that "justiciability" in a Court differs from "justiciability" or "arbitrability" before an arbitral tribunal. *Given the importance of arbitral tribunals as dispute resolution mechanisms in relation to the commercial transactions of sovereign States and the unavailability of sovereign immunity or act of state defences to a state which has agreed to submit a dispute to arbitration, this is not surprising.* (emphasis mine).
- Serbia's position on non-justiciability also involves both the arbitrator and the court having to accept its assertion that it was not a party to the underlying contract and the arbitration agreement. There is also force in the response…..that it would be wrong to "allow a State to escape liability under a commercial contract merely by pronouncing that it was not an original party to the contract, and then sheltering behind a cloak of non-justiciability in order to prevent an arbitration or adjudication based on the true legal position". The approach taken by the Court of Appeal in *Ecuador v Occidental* suggests that ImageSat's submissions are to be preferred.
- *Despite the factual indications in this case that Serbia is the continuator of the State Union, had the context in this case not been an arbitration concerning a commercial contract, I do not consider the material before me enables me to conclude that the question would have been justiciable* (emphasis mine).

Imagesat was successful,[55] but the judge's *obiter* remarks as to whether the question of Serbia's status was justiciable in a non-arbitration context bring into sharp focus the complexities which may arise when private parties enter into commercial contracts or partnerships with States as would traditionally be envisaged in PPP's.

Clearly, any consideration of dispute settlement mechanisms for the space sector must contend with characteristics peculiar to the space sector. It is pertinent in this regard to stress that an appraisal of the current mechanisms and procedures for settlement of disputes arising from outer space activities reveals the following 9 (nine) particular characteristics. *First*, private enterprises do not have direct access to mechanisms for resolution of disputes in the current, and mainly public,

[54] *Republic of Ecuador v Occidental Exploration and Production Co* [2006] QB 423. In this case "the Court of Appeal considered jurisdictional issues that arose under an agreement to arbitrate under UNCITRAL Rules that both parties agreed was validly made by them." See the decision of the U.K. High Court in *Republic of Serbia v Imagesat International NV*, Supra note 53 at paragraphs 115, 116 and 117.

[55] It is reported that "the above decision led to a 28 million euro ($38.4 million) arbitration settlement from the government of Serbia and an agreement by Israel Aerospace Industries Ltd of Israel, to buy $81 million worth of ImageSat bonds held by Pegasus Capital Advisors LP, a New York-based private equity investment firm." See: Barbara Opall-Rome, *Israel's ImageSat Sheds Some Legal Baggage*, Space News, Friday, 28 January, 2011.

international legal framework governing outer space activities. *Second*, decisions arising from mechanisms for the resolution of disputes in the current public international legal framework governing outer space activities are generally non-binding. *Third,* the right of States to exercise sovereign immunity could influence the initiation and conduct of proceedings by a tribunal constituted to arbitrate over disputes pertaining to outer space activities, including the enforcement of any awards. *Fourth*, the confidential and strategic nature of outer space activities could give rise to challenges associated with adducing evidence before a tribunal constituted to arbitrate over disputes arising from outer space activities. *Fifth*, given the relevance of mandatory laws designed to protect the public interest, particularly in disputes between private entities and the State, an arbitration tribunal addressing a dispute over outer space activities could be faced with possible limitations on the arbitrators' and contractual parties' freedom to choose applicable laws. *Sixth*, there is an established trade (space sector) practice of liability cross-waivers. *Seventh*, the potential for debate on the scope of what constitutes outer space activities poses significant challenges for ascertaining the jurisdiction of a tribunal established to address a dispute pertaining to outer space activities. *Eighth*, the technical nature of outer space activities justifies the need for appropriate legal and scientific expertise in support of related arbitration proceedings. *Ninth*, because pre-dominant actors (i.e., States) involved in outer space related activities have consistently demonstrated a reluctance to engage in adversarial forms of dispute resolution, rules of procedure designed to govern the activities of an arbitration panel must be attractive so as to encourage their adoption and use by States.[56]

Arbitration has become the preferred method of dispute resolution in many fields of international endeavor. In arbitration, there is party autonomy in choosing the applicable substantive law. As such, international law on its own, or used in conjunction with a national system of law, may be specified as the "substantive law" of a contract, particularly where that contract is with a State or a State agency. The PCA's 2011 Optional Rules for Arbitration of Disputes Relating to Outer Space, which are voluntary and applicable only with the consent of Parties, are open to States, inter-governmental organizations and non-governmental entities. With provisions on confidentiality, amongst others, the PCA's Optional Rules can be modified by Parties, and offer the choice of appointing Arbitrators, in order to secure final and binding decisions leading to internationally recognized and enforceable awards.

[56]The 9 (nine) characteristics were advanced by this author in January 2011, concerning the first draft of Outer Space Optional Rules, in response to an invitation for comments, from the Chair (H.E. Judge Fausto Pocar) of the PCA Advisory Group of Experts. Also published in: Brisibe T., *The 5th Nandasiri Jasentuliyana Keynote Lecture on – A Normative System for Outer Space Activities in the Next Half Century*, in: Proc. IISL Coll. (2014) Volume 56, ISBN 978-94-6236-440-0 at pages 25–26; Brisibe T., *The Role of Arbitration in Settlement of Disputes Relating to Outer Space Activities*, Financier Worldwide, December 2012, pp. 48–50.

Legal Issues in China's Future Participation in the Space Protocol to the Cape Town Convention

Yun Zhao

Abstract After more than 10 years of work, the UNIDROIT finally adopted the Space Protocol to the Cape Town Convention in 2012. This protocol is meaningful in dealing with the issue of international interests in financing space assets. It is expected to create a predictable legal regime for the space financing industry. China, an important space power in the world, has great stake in the success of the space financing industry. China has been actively involved in the negotiation process for the Space Protocol and has already acceded to the Air Protocol to the Cape Town Convention. It would thus be necessary to examine possible impact of this third protocol on space financing industry in China. This article will further investigate the possibility of China's accession to the protocol.

Introduction

In the era of space commercialization, more and more satellites are used for telecommunications, remote sensing and navigation; private entities are increasingly involved in such commercial activities. In view of the high risks entailed in and high capital requirement for space activities, space financing has been frequently used to facilitate private entities to enter the space field. While an international legal regime was instituted in 1988 to deal with general financing issues,[1] such rules do not work well for space financing, which normally involves assets with high value located in a sovereign-free space. The necessity of setting up appropriate rules for space financing is widely acknowledged.[2]

[1] See UNIDROIT Convention on International Factoring, May 28, 1988, 27 I.L.M. 943 (1988), entered into force May 1, 1995.

[2] See for example, H.L. Buxbaum, *Unification of the Law Governing Secured Transactions: Progress and Prospects for Reform*, 8 Uniform Law Review 323–324 (2003); N. Hazan, *The UNIDROIT Preliminary Draft Protocol on Matters Specific to Space Assets*, 28 Annals of Air & Space Law 223 (2003).

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The work of the International Institute for the Unification of Private Law (UNIDROIT) to conclude a convention on international interests in mobile equipment provided an excellent opportunity for the international society to examine possible rules for space financing.[3] The preparatory work started in 1988 with the Canadian member proposal for a working group on the matter,[4] but at that time, the concept of "mobile equipment" was not yet defined and space assets were not included. Through years of study, aircraft equipment, railway rolling stock and space assets were identified as the "mobile equipment" to be regulated by the convention. An important decision was made in 1997 as to the style of this uniform regime: with a convention covering all three types of mobile equipment to be concluded first, supplemented by three protocols dealing with each type of mobile equipment respectively.[5]

The UNIDROIT held a diplomatic conference at Cape Town in 2001 to pass the Convention on International Interest in Mobile Equipment (Cape Town Convention), intending to provide uniform rules to promote international financing for high-value mobile equipment.[6] This convention took effect in 2006.[7] However, the application of this convention shall be combined with the protocol for the specific type of mobile equipment.[8] The Protocol on Matters specific to Aircraft Equipment (Aircraft Protocol) was concluded at the same time and took effect in 2006. The Luxembourg Protocol on Matters specific to Railway Rolling Stock (Railway Protocol) was enacted in 2007. China ratified the Convention and the Aircraft Protocol on 3 February 2009.

It took a much longer period of time for the international society to conclude the Protocol on Matters specific to Space Assets (Space Protocol).[9] The work started in 1997 with the setup of a Space Working Group and the Protocol was able to be adopted 15 years later when the diplomatic conference was held in Berlin in 2012

[3] Stacey A. Davis, *Unifying the Final Frontier: Space Industry Financing Reform*, 106 Commercial Law Journal 459–462 (2001).

[4] Paul B. Larsen & Juergen A. Heilbock, *UNIDROIT Project on Security Interests: How the Project Affects Space Objects*, 64 Journal of Air Law and Commerce 722 (1999); Roy Goode, *Transcending the Boundaries of Earth and Space: The Preliminary Draft UNIDROIT Convention on International Interests in Mobile Equipment*, 3 Uniform Law Review 52 (1998); Ronald C.C. Cuming, *"Hot Issues" in the Development of the (Draft) Convention on International Interests in Mobile Equipment and the (Draft) Aircraft Equipment Protocol*, 34 International Lawyer 1093 (2000).

[5] Mark J. Sundahl, *The "Cape Town Approach": A New Method of Making International Law*, 44 Columbia Journal of Transnational Law 342 (2006).

[6] Martin J. Stanford & Alexandre de Fontmichel, *Overview of the Current Situation Regarding the Preliminary draft Space Property Protocol and Its Examination by COPUOS*, 6 Uniform Law Review 60 (2001).

[7] See Status-Convention on International Interests in Mobile Equipment (Cape Town, 2001), available at http://www.unidroit.org/status-2001capetown

[8] Sean D. Murphy, *Contemporary Practice of the United States Relating to International Law: Private International Law: Cape Town Convention on Financing of High-Value, Mobile Equipment*, 98 American Journal of International Law 852–853 (2004).

[9] See further discussion, Mark J. Sundahl, *The Cape Town Convention: Its Application to Space Assets and Relation to the Law of Outer Space* 26 (Leiden: Martinus Nijhoff, 2013).

to adopt the Space Protocol. The enactment of this protocol is most meaningful to the future development of space financing. With China rapidly developing its space technology and increasingly advancing its ambition of space commercialization, the enactment of space financing rules shall no doubt exert heavy influence on future involvement of private entities in space activities in China.

While this protocol was only newly enacted in March 2012, China will need to start to seriously consider legal issues involved in possible participation in the space protocol. This paper rightly takes up this task. With China already a member to the aircraft protocol, this paper will carry out the study on possible legal issues related to China's participation in the space protocol by making extensive reference to the practice of China's participation in the aircraft protocol. It is believed the previous experience shall be most beneficial to the study of the space protocol since the subject matters of both protocols belong to high-value mobile equipment.

Part 2 offers an overview of the Space Protocol and examines important provisions of the protocol. Part 3 looks into the impact of the protocol on relevant space industries in China: satellite industry, banking industry and insurance industry. Part 4 puts forward suggestions and measures to be taken by the Chinese government for its future participation in the Space Protocol. This paper concludes that the Space Protocol will bring benefits to China's space industry and that China should take a proactive attitude towards the participation in the Space Protocol in the future.

An Overview of the Space Protocol

Acknowledging the benefits of establishing a uniform and predictable regimen governing international interests in space assets and in related rights, the Space Protocol aims to establish an international registration system for titles or security interests in space assets.[10] A Supervisory Authority shall be established to take over the task of setting up the International Registry, and appointing and dismissing the Registrar.[11] The immediate definitional difficulty lies in the understanding of "space asset". The actual applicable scope of the protocol is determined by this concept.[12] The Committee of Governmental Experts spent many years to reach a consensus on this concept.

The formal document defines "space asset" to be "any man-made uniquely identifiable asset in space or designed to be launched into space, and comprising (i) a

[10] The Cape Town Convention, Article 16(1), available at http://www.unidroit.org/instruments/security-interests/cape-town-convention; The Space Protocol, Article XXXII (1), available at http://www.unidroit.org/instruments/security-interests/space-protocol

[11] The Cape Town Convention, Article 17(2)(a)–(b). A Space Preparatory Commission to act as the Supervisory Authority was established in 2013. See Space Preparatory Commission, http://www.unidroit.org/instruments/security-interests/space-protocol

[12] Yun Zhao, *Revisiting Selected Issues in the Draft Protocol to the Cape Town Convention on Matters Specific to Space Assets*, 76 Journal of Air Law and Commerce, No. 4, 813–816 (2011).

spacecraft, such as a satellite, space station, space module, space capsule, space vehicle or reusable launch vehicle, whether or not including a space asset falling within (ii) or (iii) below; (ii) a payload (whether telecommunications, navigation, observation, scientific or otherwise) in respect of which a separate registration may be effected in accordance with regulations; or (iii) a part of a spacecraft or payload such as a transponder, in respect of which a separate registration may be effected in accordance with the regulations, together with all installed, incorporated or attached accessories, parts and equipment and all data, manuals and records relating thereto."[13]

The Cape Town Convention creates an important term, that of "international interests", which is closely connected with the high-value mobile equipment and can be registered under the regime. The Cape Town Convention puts down three types of international interests: (1) to be granted by the chargor under a security agreement, or (2) vested in a person who is the conditional seller under a title reservation agreement, or (3) vested in a person who is the lessor under a leasing agreement.[14] These international interests extend to proceeds of the object[15] and can be transferred. The priority right is endowed upon those registered interests, over the interests subsequently registered and those unregistered interests.[16]

The convention and the protocol also provide rules on default remedies. The right owner can "take possession or control of any object charged to it, or sell or grant a lease of any such object, or collect or receive any income or profits arising from the management or use of any such object" through self-help measures or application to the court for public relief.[17]

However, such remedies shall be restricted under certain circumstance, in particular in the situation of public service. The understanding of "public service" brought in heated discussions during the drafting process.[18] The protocol avoids the definition for public service and leaves it to the member states. If a certain space asset is used to provide public service, the public service provider or the relevant member state may register a public service notice.[19] In case of default, the debtor can have not more than 6 months to cure its default.[20] During this period, the debtor, creditor and the public service provider can cooperate in good faith to find an appropriate solution.[21] The creditor can take appropriate remedial actions only after the elapse of the 6-month period.

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[13] The Space Protocol, Article I.2(k).

[14] The Cape Town Convention, Article 2(2).

[15] The Cape Town Convention, Article 2(5).

[16] The Cape Town Convention, Article 29(1).

[17] The Cape Town Convention, Article 8(1)–(2).

[18] See for example, UNIDROIT, Report of the Intersessional Consultations with Representatives of the International Commercial Space and Financial Communities, Paras. 24–27, UNIDROIT Doc. C.G.E./Space Pr./5/W.P.4 (October 18, 2010).

[19] The Space Protocol, Article 27(1).

[20] The Space Protocol, Article 27(4).

[21] The Space Protocol, Article 27(7)(a).

The disputing parties may reach a written agreement concerning the choice of forum for relief; failing such an agreement, the court where the object or the debtor is situated shall have jurisdiction.[22] As far as space assets are concerned, the location of the object, when not on Earth, shall be deemed "located in the Contracting State which registers the space asset, or on the registry of which the space asset is carried."[23]

Closely related to the issue of jurisdiction, the protocol provides the mechanism of waiver of sovereign immunity. While the international society still have divergent views over the practice of absolute and limited immunity, this protocol avoids setting the default position of either practice by leaving to the member states to decide whether to waive the sovereign immunity in writing.[24]

Impact of the Space Protocol on the Relevant Industries in China

Since the successful launch of its first liquid meteorological rocket, T-7, in September 1960,[25] China has made spectacular achievements in space technologies and space activities. China launched the first satellite, Dongfanghong-1(DFH-1) in 1970, and launched and retrieved the first manned spacecraft, the Shenzhou V, in 2003.[26] Along with these technological advancements, China has also carried out commercial space activities. China entered the international commercial space launch market in 1990 when Long March No. 3 rocket launched AsiaSat 1 into orbit.[27] Since then, China has been a major participant in the commercial space market, providing not only launch services, but also space products (more specifically, satellites). China is at the moment among the very few countries which can provide both the production and launch services of satellites to a third country. The on-orbit transfer of satellites has been tested on several occasions. For example, China launched the China-built communication satellite PakSat 1R and transferred on-orbit to Pakistan on 12 August 2011.[28]

Satellites can be applied for various purposes and in various fields, including forestry, surveying and mapping, environmental protection, disaster management, telecommunications and broadcasting, global navigation and meteorology. To a certain

[22] The Cape Town Convention, Article 43(1)–(2).

[23] The Space Protocol, Article 1(3).

[24] The Space Protocol, Article 33.

[25] Brian Harvey, The Chinese Space Program: From Conception to Future Capabilities, 10 (Praxis, 1998).

[26] The State Council Information Office, China's Space Activities, December 2011.

[27] C.V. Anderson (Ed.), National Aeronautics and Space Administration (NASA): Background, Issues, Bibliography, 62 (New York: Nova, 2002).

[28] Stephen Clark, Chinese Rocket Launches New Satellite for Pakistan, 12 August 2011, http://www.space.com/12622-china-rocket-launch-pakistan-satellite.html

extent, satellites are the basis for space activities. The large amount of investments needed for the satellite production and launching services is usually resolved through space financing. China's expertise in satellite manufacturing and launching will no doubt benefit from the predictable space financing regime of the Space Protocol.

Normally the consumers in the satellite transactions will need to arrange space financing by using the satellite as security. The financial institutions may provide a better condition for space financing for consumers from the member state of the Space Protocol since the protocol effectively protects the interests of the creditors. When the transactions take the form of processing contracts, China shall remain the owner of the satellite and undertake risks before the final on-orbit transfer of the operating satellite. Under such a situation, China will need to arrange space financing for the production and launch of satellites; China may similarly benefit from the protocol with the satellite as security.

Under the above two models, the consumers and China can get better deals from the financial institutions and thus lower the necessary operational costs. As such, it will be easier for consumers from developing countries to secure the necessary budget for purchasing satellites; China will also be able to profit from larger numbers of on-orbit transfers of satellites. The same benefit can also come from China's leasing of satellite services for consumers from other member states.

Banking and insurance are two other industries which may be affected by the operation of the Space Protocol. Under a space financing arrangement, the banking industry is normally positioned as "creditor or secured party". The Cape Town Convention and the Space Protocol successfully set up the system for procuring the interests of the creditors. This pro-creditor regime is based on three objectives: (1) a transparent priority principle as mentioned above concerning the priority of the registered international interests over those unregistered or subsequently-registered interests; (2) a prompt enforcement principle for default remedies; and (3) a bankruptcy enforcement principle that the enforcement of the first two principles shall not be affected by the bankruptcy of the debtor.[29]

As creditor, the bank shall have international interests over space assets as defined in the Space Protocol. The concept of space asset is broad enough to cover both the objects having been launched into outer space and those still in the process of manufacturing and transportation. The international interests to be registered in the International Registry include not only existing interests, but also prospective interests.[30] In case of default, the creditor can take appropriate measures to protect its interests. The public service exception to default remedies is defined in a neutral and technical measure, avoiding confusion and gray area in the enforcement. By not delving in the understanding of the concept of " public service", the protocol allows relevant parties to serve a notice on the matter and the 6-month period shall apply. From the brief discussions above, we can see that registration is the central theme of this protocol. Two types of registration (international interests and public services)

[29] Iwan Davies, *The New Lex Mercatoria: International Interests in Mobile Equipment*, 52 The International and Comparative Law Quarterly, No. 1, 168–171 (2003).

[30] The Cape Town Convention, Article 19(4).

are equally important; the time of the registration shall be the technical point in deciding the right of priority and enforcement. As such, the whole system is designed in an easy-to-operate manner and can effectively function to protect the interests of the creditors.

Space insurance is indispensable for high-risk space activities; some states have provided compulsory insurance in their domestic laws.[31] The involvement of space insurance is important for the arrangement of space financing. With the failed launches in the mid-1990s, China faced great difficulty in securing insurers and re-insurers in the international market. United Entity, consisting of major insurance companies in China, was set up to undertake insurance businesses for space launchings conducted by China. The foreign insurers were hesitant to offer insurance services for the space businesses from China at that time, having concerns over the launching safety and success rate. This concern has immediate connection with the legal regime for the insurance industry.

The Space Protocol introduced the concept of "salvage" to protect the interests of the insurers. The insurer shall enjoy "a legal or contractual right or interest in, relating to or derived from a space asset …upon the payment of a loss relating to the space asset."[32] To prevent possible loopholes to the prejudice of the insurers, the protocol adopts an overarching provision guaranteeing the realization of any rights arising from the applicable domestic law.[33] This arrangement will no doubt enhance the insurers' confidence in their involvement in space financing and enhance the healthy development of this industry.

From the discussions above, it is clear the Space Protocol was designed to protect the interests of the creditors to facilitate space financing; however, we must note that the debtors could also benefit from such an arrangement. This has been made obvious in the Cape Town Convention in that it applies "when, at the time of conclusion of the agreement creating or providing for the international interest, the debtor is situated in a Contracting State; the fact that the creditor is situated in a non-Contracting State does not affect the applicability of this Convention."[34] Once the state from which the debtor comes is a member to the protocol, the creditor, in view of the existing guaranteeing mechanism set up by the protocol, will have more confidence in the debtor and thus be more willing to provide space financing on better conditions and terms. This debtor will be in a comparatively advantageous position to secure the budget needed for the space activity than the debtors from those states not yet a member to the protocol.

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[31] See for example, Article 25(1) of the Law of the Russian Federation "About Space Activity" (Decree No. 5663-1 of the Russian House of Soviets) which provides that "The organizations and citizens, which exploit space technology or to whose order the creation and use of space technology in scientific and national-economy purpose is carried out, shall take compulsory insurance coverage in the amount set by the legislation of Russian Federation."

[32] The Space Protocol, Article 4(3).

[33] Id.

[34] The Cape Town Convention, Article 3.

Moreover, the debtors may benefit from the international interests registered by the creditors. As such, the priority right from the registration by the creditors against any unregistered interests or interests subsequently registered can also be enjoyed by the debtors during the period of their control and use of the space assets.

Suggestions on the Chinese Government's Future Participation

The Coordination Between the Space Protocol and the Chinese Legal Regime

The Cape Town Convention and the Space Protocol create an international registration mechanism to create a transparent regime for international interests in space assets. This international registration mechanism is separate from any existing domestic registration system. This mechanism is believed to be a cost-efficient, fair and easy-to-operate system. The practice of the Aircraft Protocol testifies to the feasibility of this registration mechanism.

While the State Administration for Science, Technology and Industry for National Defense (SASTIND), formerly known as the Commission of Science, Technology and Industry for National Defense (COSTIND), is in charge of national registration of space objects and the Ministry of Foreign Affairs is in charge of international registration of space objects with the United Nations Secretary-General under the Registration Convention,[35] the registration of international interests in space assets is a separate system. It is noted that in China, no domestic registration system for mobile equipment is in place.

While the Property Law defines the registration system for real estates, no similar rules are provided for the registration of all the movables, which is understandable in view of the large number of movables and the infeasibility of registration for each and every movable. Several types of movable are identified for registration, including water-crafts, aero-crafts and motor vehicles.[36] No clear provisions in this law have provided the registration of space assets. We may also refer to the Guaranty Law for assistance. This law identifies some additional types of properties whose registration is required for guaranty: land-use right, real estates or factories and other buildings of township (town) or village enterprises, forest trees, aircraft, ships and vehicles, the equipment and other movables of enterprises.[37] Again, the space assets are not clearly listed as those required for registration.

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[35] Convention on Registration of Objects Launched into Outer Space, November 12, 1974, 1023 U.N.T.S. 15.

[36] Article 24 of the Property Law provides that "The establishment, modification, transfer and lapse of the right to property in respect of water-crafts, aero-crafts and motor vehicles without first being registered, shall not affect any *bona fide* third party."

[37] Article 42 of the Guaranty Law.

At the same time, the provision of *bona fide* possession of the movables in the same law[38] causes difficulty in the determination of the situation when to protect a *bona fide* third party for the space asset. One condition for *bona fide* possession is that the transferred property has been registered in accordance with the laws or delivered to the transferee for those not required for registration.[39] On the one hand, space assets are not those listed under the Property Law requiring registration; on the other hand, the transfer of space assets normally takes the form of constructive possession, which does not fall within the normal scope of "delivery" in the Property Law.

It would thus be advisable to set up a national registration mechanism similar to that of the Space Protocol, if not in all the fields, at least in the field of and for the purpose of space financing. It is good to see that the Credit Reference Center of the People's Bank of China has already established a similar registration mechanism for general financing activities in July 2009.[40] We will need to examine whether this general registration mechanism works for space financing and whether we need to have another national entity in charge of the national registration of interests in space assets; we will also need to see the coordination between the national registration mechanism and the international mechanism with regard to the registration of interests in space assets.

Except for a short paragraph on salvage, the Space Protocol does not contain detailed rules regarding insurance. The operation of space insurance largely relies on domestic laws. China has an Insurance Law, which provides detailed rules on salvage. For example, where the subject matter suffers partial loss, the insured may terminate the contract within 30 days from the time when the insurer pays indemnity; and, unless otherwise provided in the contract, the insurer may also notify the insured of the termination as long as the notification is served 15 days in advance. Upon termination, the insurer shall refund the insurance premium for the part of the subject matter that has not suffered any loss to the insured, after deducting the premium for the period from the commencement of the insurance liability to the contract termination.[41] The insured shall acquire all rights in the subject matter after paying the full insured amount which equals the insurable value.[42] It is reasonable to apply all those rules to the situation of salvage of space assets.

However, we must note that the Insurance Law also provides that laws and administrative regulations regarding compulsory insurance shall prevail over the

[38] Article 106(1) of the Property Law provides that "Where the real or movable property is transferred to a transferee by a person without the power to do so, the rightful owner shall have the right to recover such property. Unless otherwise provided by law, the transferee shall obtain the ownership in respect of such real or movable property in any of the following circumstances: (i) the transferee accepts the transfer in good faith; (ii) such property is transferred with a reasonable price; (iii) the transferred property has been registered in accordance with the laws requiring such registration, and those not required to be registered has been delivered to the transferee."

[39] Id.

[40] Financing Registration, http://www.pbccrc.org.cn/chanpinfuwu_306.html

[41] Article 58 of the Insurance Law.

[42] Article 59 of the Insurance Law.

rules in the Insurance law.[43] We have mentioned earlier the compulsory nature of space insurance in most states. The nature of space insurance is quite different from other types of insurance, especially with regard to the sensitiveness of space assets. Space assets normally involve high and sensitive space technologies, relevant states may have restrictive rules in giving up all rights in the space assets to the insurers or any other third party. Consequently when it comes to the domestic rules on salvage, we may need to keep a close look at the export control regime in China, in particular, the Administrative Regulations on Export Controls of Military Items,[44] and the Administrative Regulations on Export Control of Missiles and Missile-related Items and Technologies.[45]

Declarations to Be Made for the Purpose of Accession[46]

The discussions in this paper show that the Space Protocol brings benefits to both the creditors and debtors. As a major space-faring nation in the world, China has a great stake in space financing. As such, China shall generally benefit from acceding to this new regime. No reservation is allowed under the protocol, but China may make some declarations at the time of accession.[47] It is also noted that declarations made under the Cape Town Convention shall apply to this protocol unless stated otherwise.[48] Consequently, China needs to carefully study appropriate declarations well beforehand; this includes the areas under the Space Protocol which are allowed for declarations and the declarations having been made to the Cape Town Convention.

When acceding to the Cape Town Convention, China made declarations to the following articles: Article 39(1)(a); Article 39(1)(b); Article 39(4); Article 40; Article 43; Article 50(1); Article 53; Article 54(1); Article 54(2). By examining these declarations, the author is of the view that most of them can similarly apply to

[43] Article 186(2) of the Insurance Law.

[44] Promulgated by the State Council and the Central Military Commission Order No. 234, October 22, 1997, effective January 1, 1998, revised October 15, 2002.

[45] Promulgated by the State Council Order No. 361, August 22, 2002, effective August 22, 2002.

[46] The wordings regarding the declarations discussed in this section are cited fully from the official declarations lodged by the People's Republic of China (PRC) under the Cape Town Convention and the Aircraft Protocol at the Time of the Deposit of its Instrument of Ratification in Respect Thereof, http://www.unidroit.org/english/conventions/mobile-equipment/depositaryfunction/declarations/bycountry/china.htm. The discussions in this section also benefit from the research report of Research Project No. 2 of the China Institute of Space Law in 2011: "Analysis on the Advantages and Disadvantages of China's Accession to the Space Protocol", conducted by the China Great Wall Industry Group Corporation, Ltd., 31 March 2012.

[47] Article 43(1) of the Space Protocol provides that "No reservations may be made to this Protocol but declarations authorized by Articles XXXIX, XLI, XLII and XLIV may be made in accordance with these provisions."

[48] Article 42 of the Space Protocol provides that "Declarations made under the Convention…shall be deemed to have also been made under this Protocol unless stated otherwise."

the Space Protocol. Some declarations were made with the Aircraft Protocol in mind, thus what China needs to do is to further extend these several declarations to the Space Protocol. This can include the following articles:

(1) Article 39(1)(a): "All non-consensual rights or interests which have priority over secured creditors under the law of the PRC shall have priority without registration over registered international interests, including but not limited to: claim for bankruptcy expenses and community debts, employee's wages, taxes arising prior to the mortgage, pledge or lien of the space asset, claim for remuneration for rescuing the space asset, claim for necessary expenses incurred for the custody and maintenance of the space asset, etc." This declaration is in full compliance with relevant rules in the current Insolvency Law in China regarding the priority right for secured creditors in the insolvency proceedings.[49] The Insolvency Law moves further by providing the order of payment in case of insolvency: (1) insolvency costs and debts of common interest; (2) wages, medical fees, injured and disability compensations, compensations for a bereaved family owed by the debtor to the employees, basic pension and medical insurance premium defaulted by the debtor to the employee's private account; (3) social insurance premium and tax payable by the debtor; (4) general bankrupt claims.[50]
(2) Article 40: "Rights of a person obtaining a court order permitting attachment of a space asset in partial or full satisfaction of a legal judgment shall be registrable non-consensual rights or interest."
(3) Article 53: the declaration here does not appear to be relevant to the space asset as far as the location of headquarter of relevant airline.

Other declarations made previously regarding the Convention can continue to apply and China does not need to repeat at the time of acceding to the Space Protocol:

(1) Article 39(1)(b): "Nothing in this Convention shall affect the right of a State or State entity, intergovernmental organization or other provider of public services to arrest or detain an object under the laws of the PRC for payment of amounts owed to such entity, organization or provider directly relating to those services in respect of that object or another object."
(2) Article 39(4): "A right or interest of a category covered by the declaration made under Article 39(1)(a) shall have priority over an international interest registered prior to the date of ratification of the Protocol."
(3) Article 43: "Article 43 is applicable to the PRC, and paragraph 1 and 2(a) hereinto are applicable under the condition that the court of a contracting State chosen by the parties shall be a court located in a place that has actual connections with the dispute of the agreement."

[49] Article 109 of the Insolvency Law provides that "Secured creditors are entitled to obtain payment in priority over debtor's specific asset."

[50] Article 113 of the Insolvency Law.

(4) Article 50(1): "The Convention shall not apply to a transaction which is an internal transaction in relation to the PRC."
(5) Article 54(1): "While the charged object is situated within the territory of the PRC, the chargee shall not grant a lease of the object within the territory of the PRC."
(6) Article 54(2): "Any remedy available to the creditor under any provision of the Convention which is not there expressed to require application to the court may be exercised only with leave of the court of the PRC." The Convention provides the possibility of self-help measures; however, the self-help action in another state touches on the sovereignty issue; in the past, China has always taken a cautious attitude towards this position; furthermore, the sensitive nature of the subject matter of the Space Protocol[51] justifies a more cautious attitude towards the actions to be taken for a self-help remedy. It is thus advisable to keep this declaration in this regime. But it should be made known that the court procedure is only a formality requirement and will not involve any substantive review of the dispute. As such, the public-help measure shall not cause extra barriers or difficulty for creditors to obtain remedies in China. Thus, the declaration shall not defeat one of the original purposes of the Cape Town Convention – to reduce the cost of financing.[52]

As far as the Space Protocol is concerned, we will need to carefully examine the provisions which allow for declarations.

(1) Article 8: China declares the application of a similar article in the Aircraft Protocol, which requires such a declaration, regarding choice of law. However, Article 8 of the Space Protocol is drafted such a way that "this Article applies unless a Contracting State has made a declaration."[53] As such, China does not need to specifically declare the application of this article.
(2) Article 20: The system of relief pending final determination is accepted in almost all the jurisdictions. The Chinese laws also provide interim measures for court proceedings. At this point, a similar declaration to the Aircraft Protocol can be made that "China will apply the provisions of Article 20(1), (2), (3) and (4) of the Protocol. The court of the PRC, upon receipt of the application, shall, in respect of the remedies specified in Articles 13(1)(a), (b) and (c) of the Convention, make order within 10 calendar days which shall be enforced immediately and in respect of the remedies specified in Article 13(1)(d) and (e) of the Convention, make order within 30 calendar days which shall be enforced immediately."

[51] Martin J. Stanford, *The New Regimen: Its History and Future After South Africa*, 12 European Review of Private Law 12–13 (2004).

[52] Lome Clark & Jeffrey Wool, *Entry into Force of Transactional Private Law Treaties Affecting Aviation: Case Study—Proposed UNIDROIT/ICAO Convention as Applied to Aircraft Equipment*, 66 Journal of Air Law and Commerce 1406 (2001).

[53] Article 8(1) of the Space Protocol.

(3) Article 21: Insolvency Law is another area worthy of serious consideration. The Space Protocol contains two provisions on insolvency. Article 21 provides two options for the insolvency remedies. Neither these two options conflict with the Insolvency Law, thus it is up to China to decide on one option which is easier to operate and more beneficial to China. The same position can be taken as the Aircraft Protocol to ensure consistency between the two regimes that "China will apply the entirety of Alternative A to all types of insolvency proceeding defined by the Protocol, and that the waiting period shall be 60 calendar days."
(4) Article 22: This article, concerning assistance to foreign insolvency administrators, requires an explicit declaration on the application; to be consistent with the declaration under the Aircraft Protocol, China shall also declare the application of this article.
(5) Article 27(4): in view of the importance of public service to a state and the complexity in the curing of default, China may declare a maximum period of 6 months from the date of registration by the creditor of a notice in the International Registry for the exercise of remedies by the creditor against a defaulting debtor.
(6) Similar to the declaration made under the Aircraft Protocol, "unless otherwise notified by the Government of the PRC, the Convention and the Space Protocol shall not apply to the Hong Kong Special Administrative Region and Macao Special Administrative Region."

Conclusion

The Space Protocol successful establishes an international registration regime for international interests in space assets. This regime adds transparency to the field of space financing, which benefits both the creditors and debtors. China has actively participated in the whole negotiating and drafting process and takes a positive attitude towards conclusion of this protocol. The author holds an optimistic view that China will accede to the Space Protocol in the near future. Thus, it is urgent to study possible declarations to be made upon China's accession. By making reference to China's practice in acceding to the Cape Town Convention and the Aircraft Protocol, this paper analyses the potential impact of the Space Protocol on China's space and financial industries, and offers suggestions on possible declarations upon accession. With various stakeholders involved in the long negotiation process,[54] the final conclusion of the Space Protocol in March 2012 showed the consensus that the protocol shall well fit in the space financing industry and that all the states, both spacefaring and non-spacefaring nations would be able to benefit from this regime. As a major participating entity in the negotiation, China should take a proactive attitude and prompt actions to accede to the Space Protocol and bring benefits of this protocol to the space and financial industries in China.

[54] Dara A. Panahy & Raman Mittal, *The Prospective UNIDROIT Convention on International Interests in Mobile Equipment as Applied to Space Property*, 4 Uniform Law Review 303 (1999).

Chinese Space Legislation: Current Situation and Possible Way Forward

Fabio Tronchetti

Abstract In the last decade China has achieved a remarkable level of success in the space sector and has rapidly become one of the most dynamic and innovative space players. Indeed, not only is China at the forefront of space exploration and utilization but it is also capable of providing a number of space services on a commercial basis, including launching and satellite navigation and positioning.

While rapidly expanding the range and ambition of its space endeavors China appears to lack the same level of dynamism and flexibility in the legal organization and implementation of its national space activities. Opposite to a growing worldwide trend, which has seen emerging space actors enacting dedicated national space legislation, China does not have a comprehensive, fully fledged national space law. Instead, Chinese space activities are run through a number of internal management rules and departmental regulations issued by space authorities. This situation, which might be explained by taking into account historical factors and the nature of Chinese space activities and players, has the potential to negatively affect Chinese economic and organizational interests in the space field.

The purpose of the present chapter is to analyze the current legal framework regulating Chinese space activities, to review its positive features and shortcomings, and to discuss a possible way forward.

Introduction

In the last decade China has undoubtedly emerged as the most prominent rising star in the space sector. In such a limited timeframe China has been capable to achieve remarkable results in the fields of manned and unmanned space exploration and to

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gain international admiration and respect. Milestones of this process have been the sending into space of the first Chinese astronaut in 2003, the launch of the first Chinese space station, Tiangong-1, on 29 September 2011,[1] the commencement of the operation of the Beidou-2 navigation satellite system[2] in the Asia -Pacific Region in December 2012,[3] and the landing of the Yutu rover on the lunar surface on 14 December 2013.[4]

Due to the significance of these achievements the eyes of the world are now aimed at China. China is, thus, at a crossroad of its history and its choices not only are going to determine its role as a space actor but also its impact as an economic and technological power.

Over the next decade China is expected to move beyond its limited current status of leader of the 'developing world' in the space sector and to pursue the more ambitious goal of becoming a 'global' space actor.[5] Being a 'global' space actor signifies, on one side, to be able to influence global space activities from a political and technological point of view and, on the other side, to be capable of attracting foreign third parties to invest in the Chinese market, to use Chinese space services and to cooperate with China.

The achievement of these objectives, however, could be seriously hampered by the lack of a comprehensive national legislation regulating Chinese space activities.[6] Indeed, unlike many space-faring States which have enacted national space laws[7] or

[1] Tiangong-1 is the first operational component of the Tiangong program, which aims to place a larger, modular station into orbit by 2023. Tiangong-1 was visited by a series of Shenzhou spacecraft missions, including two manned missions in June 2012 and June 2013. The Tiangong program foresees the launch of the Tiangong-2 space laboratory in 2015, with an experimental core space station module around 2018. The ultimate aim is to build a 60-ton multi-module space station by 2020. For more information on the Tiangong program see at http://www.nasaspaceflight.com/2011/09/china-major-human-space-flight-milestone-tiangong-1s-launch/ (last accessed January 16, 2014).

[2] For more information on the Beidou system see at http://en.beidou.gov.cn/ (last accessed January 16, 2014).

[3] For an extensive analysis of these achievements see B. Harvey, *China in space: the great leap forward*, Springer (2013).

[4] Yutu is an unmanned lunar rover that forms part of the Chinese Chang'e 3 mission to the Moon. Its main purposes are to study the material composition of the lunar soil and to demonstrate and develop technologies for future missions. The Chang'e lunar program foresees a sample return mission by 2017 and possibly a human mission by 2025–2030. For more information see/cf. Z. Sun, Y. Jia, H. Zhang, Technological advancements and promotion role of Chang'e-3 lunar probe mission, 56(11) Science China Technological Sciences 2702 (2013).

[5] A discussion of space activities from a developing country's perspective is provided by Y. Schmidt, International space law and developing countries, in C. Brünner, A. Soucek (eds.), *Outer space in society, politics and law*, Springer (2011), 690–726.

[6] See/cf. H. Zhao, The status quo and future of Chinese space legislation, 58(1) ZLW 94 (2009); Y. Zhao, Regulation of space activities In the People's Republic of China, in R. Jakhu (ed.), *National regulation of space activities*, Springer (2010), 247–265; J. Li, Progressing Towards New National Space Law: Current Legal Status and Recent Developments in Chinese Space Law and its Relevance to Pacific Rim Space Law and Activities, 35 J. Space L. 439 (2009).

[7] See/Cf. Austria: Austrian Federal Law on the authorization of space activities and establishment of a national space registry (2011); France: Bill No. 2008-518 relating to spatial operations (2008);

have started the process leading to their adoption,[8] China runs its space operations through a multitude of internal management rules and departmental regulations issued by space authorities.

This situation could have been acceptable while the size of Chinese space activities was limited and China was making efforts to develop indigenous space technology. However, as China expands its range of action, opens up to commercial ventures, and undertakes ambitious space projects, the preservation of the current legal *status quo* is not recommendable. The adoption of an adequate corpus of national space legislation could enable China to better comply with its international obligations, seize commercial opportunities and improve its international perception.

There seems to be an increasing awareness among Chinese leaders on the need for improving the legal framework. Nevertheless, the process towards the formulation of a more elaborated space legislation still faces numerous obstacles, mostly related to the complicated law-making process in China.

The present paper will describe the status and limits of the present legal framework governing Chinese space activities, the desirability for strengthening and expanding it, and the feasibility of such an option.

Overview of the Legislative and Administrative Organization of Chinese Space Activities

The Legislative Evolution

The Chinese space program has so far concentrated on technological developments while substantially leaving behind research and adoption of national space law.[9] This choice can be explained, *inter alia*, by pointing out the strategic need for China to close the technological gap with space-faring States (notably the United States and Russia) and the perception among Chinese leaders that a too-stringent law could slow down achievements in the space sector.

In the 1980s, however, as the size of Chinese space activities began to grow,[10] China realized the importance of space law in the development of its space program

Japan: Basic Space Law - Law No.43 (2008); Netherlands: Rules concerning space activities and the establishment of registry of space objects – Space activities act (2006); Belgium: Law on the activities of launching, flight operations or guidance of space objects (2005).

[8] For example, Indonesia, see at http://en.hukumonline.com/pages/lt51f27a6c7c90d/indonesia-s-new-space-law (last accessed January 16, 2014).

[9] For an analysis of the Chinese space program from its infant stage to the first manned spaceflight in 2003 see B. Harvey, *From conception to manned spaceflight*, Springer (2004).

[10] For example, in the early 1980's significant improvements were made to the Chinese Long March Rocket series which constitutes the main series of space launch vehicles of the People's Republic of China. These improvements enabled China to initiate a commercial launch program in 1985. On the evolution of the Chinese space program see H. Zhao, National Space Law in China, Martinus Nijhoff Publishers (2015).

and took initiatives to advance in this area. China became a full member of the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS) in 1980, ratified the Outer Space Treaty in 1983 and three additional space treaties, namely the Rescue Agreement, the Liability Convention and the Registration Convention, in 1988.[11] These moves opened the way to the development of Chinese space legislation.

Initial efforts in this direction were undertaken in 1994 but a decision to move forward was only made in 1998 as a consequence of the reform of the administrative system of Chinese space industries. As described, no comprehensive and specific national space law exists in China at the moment. However, some regulations dealing with the registration and licensing of space objects have been adopted, namely the Provisions and Procedures for the Registration of Space Objects on February 8, 2001, and the Interim Measures on the Administration of Permits for Civil Space Launch Projects on November 21, 2002. Additionally, on January 1, 2010 a new Departmental Regulation, the Interim Instrument of Space Debris Mitigation and Management, entered into force.

Organizational Structure of Chinese Space Activities

The development of the Chinese space industry started in the 1950s in conjunction with advancements in missile and rocket technologies.[12] Activities were directed by the Fifth Institute of the Ministry of Defense established in Beijing in 1956. In 1965 this Institute set up the Ministry of 7th Machinery Industry to organize and manage the research, design, test, production and infrastructure of a missile and launch vehicle. These initiatives led to the launch of the first Chinese manufactured satellite (DFH-1) aboard a Chinese built space vector, the Long March launch vehicle, in 1970.

[11] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereafter Outer Space Treaty), London/Moscow/Washington, done 27 January 1967, entered into force 10 October 1967; 610 UNTS 205; TIAS 6347; 18 UST 2410; UKTS 1968 No. 10; Cmnd. 3198; ATS 1967 No. 24; 6 ILM 386 (1967); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (hereafter Rescue Agreement), London/Moscow/Washington, done 22 April 1968, entered into force 3 December 1968; 672 UNTS 119; TIAS 6599; 19 UST 7570; UKTS 1969 No. 56; Cmnd. 3786; ATS 1986 No. 8; 7 ILM 151 (1968); Convention on International Liability for Damage Caused by Space Objects (hereafter Liability Convention), London/Moscow/Washington, done 29 March 1972, entered into force 1 September 1972; 961 UNTS 187; TIAS 7762; 24 UST 2389; UKTS 1974 No. 16; Cmnd. 5068; ATS 1975 No. 5; 10 ILM 965 (1971); Convention on Registration of Objects Launched into Outer Space (hereafter Registration Convention), New York, done 14 January 1975, entered into force 15 September 1976; 1023 UNTS 15; TIAS 8480; 28 UST 695; UKTS 1978 No. 70; Cmnd. 6256; ATS 1986 No. 5; 14 ILM 43 (1975).

[12] For an overview of the organization framework of Chinese Space Activities see H. Zhao, Status quo – footnote 6 at 99–100.

In 1982 the Ministry of the 7th Machinery Industry was renamed Ministry of Aerospace Industry. In 1993, pursuant to the decision on the structural reform program of the State Council of the Eighth National People's Congress, the China Aviation Industry Corporation, the China Aerospace Industry Corporation and the China National Space Administration (CNSA) were established.

In 1998 the organization and supervision of facilities, payroll, and other similar tasks were attributed to a ministerial-level department, that was the State Commission of Science, Technology and Industry for National Defense (the COSTIND). The CNSA was re-structured to be an internal structure of the COSTIND[13] and the general direction of the System Engineering of COSTIND was responsible for CNSA's day-to-day work. In March 2008, China reorganized its ministerial and departmental structure and the CONSTIND became an institution of the newly established Ministry of Industry and Information Technology. It was renamed the National Bureau of Science, Technology and Industry for National Defense (the BUSTIND) and is in charge of the administration of Chinese civil space sector. The CNSA has consequently become an internally established institution within the Ministry of Industry and Information Technology.

In practice, a crucial role in the management and implementation of Chinese space activities is played by the China Aerospace Science and Technology Corporation (CASC).[14] The CASC, which was established in 1999 as part of the Chinese government reform drive, is the main contractor for the Chinese space program. It is state-owned and has a number of subordinate entities which design, develop and manufacture a range of spacecrafts, launch vehicles, strategic and tactical missile systems, and ground equipment. Particularly important is the China Great Wall Industry Corporation (CGWIC), which is the sole commercial organization authorized by the Chinese government to provide satellites, commercial launch services and to carry out international space cooperation.[15]

[13] Pursuant to this decision the CNSA is responsible for: (a) signing governmental agreements in the space sector on behalf of the Chinese government; (b) organizing inter-governmental scientific and technical exchanges; (c) enforcing National space policies; (d) managing National space science, technology and industry. See at http://www.cnsa.gov.cn/n615709/n620681/n771918/index.html (last accessed January 16, 2014).

[14] See at http://www.spacechina.com/n25/index.html (last accessed on 27 February 2015).

[15] For more information see http://www.cgwic.com/About/ (last accessed on 27 February 2015).

The Legislative Framework Regulating Chinese Space Activities

The International Legal Framework

At the international level space activities are regulated by 5 international treaties[16] and a series of resolutions adopted by the General Assembly of the United Nations. The space treaties provide the fundamental principles governing activities in outer space and impose a series of obligations on the state parties.

The Outer Space Treaty establishes, *inter alia*, the right of all states to freely explore and use outer space,[17] the non-appropriative nature of outer space,[18] the applicability of public international law to space activities,[19] the international responsibility of states for 'national activities' in outer space, including those carried out by governmental and non-governmental entities, and the obligation for states to authorize and supervise private space activities.[20]

The Outer Space Treaty further lays down that a state is internationally liable for damage to another state or its natural and juridical persons, specifically Art. VII of the Treaty provides that:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.

The liability of such a state is elaborated by the 1972 Liability Convention, which provides that the 'launching state' is liable for certain damages caused by a space object if: (a) it launches the space object; (b) procures the launching; (c) the object is launched from its territory; or (d) the object its launched from its facilities.[21]

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[16] Apart from the Outer Space Treaty, Rescue Agreement, Liability Convention and Registration Convention described above, the fifth UN space treaty is the: Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (hereafter Moon Agreement), New York, done 18 December 1979, entered into force 11 July 1984; 1363 UNTS 3; ATS 1986 No. 14; 18 ILM 1434 (1979).

[17] Art. I, Outer Space Treaty.

[18] Art. II, Outer Space Treaty.

[19] Art. III, Outer Space Treaty.

[20] Art. VI, Outer Space Treaty.

[21] A detailed analysis of the provisions of the Liability Convention is provided for in A. Kerrest, Liability for damage caused by space activities, in M. Benkö/K.U. Schrogl (eds.), *Space law: current problems and perspectives for future regulations*, Eleven International Publishing 2005, pp. 91–112; A. Kerrest, L.J. Smith, F. Tronchetti, Liability Convention, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Cologne Commentary on Space Law*, Vol. II, Carl Heymanns Verlag, 2013, pp. 83–226.

The 1968 Rescue and Return Agreement, which elaborates upon Article V of the Outer Space Treaty, establishes the obligation for States Parties to provide assistance and help to astronauts experiencing a situation of danger or distress and to lay down the conditions under which such help should be given.[22]

The 1975 Registration Convention, which is based on Article VIII of the Outer Space Treaty, obligates states to set up an appropriate national registry for the purpose of identifying and registering objects launched into outer space and requires them to furnish relevant information about their space objects to the UN Secretary-General for insertion in an international register.[23]

The Moon Agreement lays down rules to govern the exploration, use, and exploitation of the Moon and its natural resources.[24]

As noted above, China is a party to the Outer Space Treaty, the Rescue Agreement, the Liability Convention and the Registration Convention.

National Space Legislation: Aims and Structure

The space treaties do not expressly require the adoption of national space legislation.[25] Nevertheless, in recent years an increasing number of States have decided to

[22] For a detailed analysis of the Rescue Agreement see F.G. von der Dunk, A sleeping beauty awakens: the 1968 Rescue Agreement after 40 years, 34 Journal of Space Law (2008), pp. 411–434; I. Marboe, J. Neumann, K.U. Schrogl, The Rescue and Return Agreement, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Cologne Commentary on Space Law*, Vol. II, Carl Heymanns Verlag, 2013, pp. 9–82.

[23] For a detailed analysis of the 1975 Registration Convention see N. Rodrigues, The United Nations register of objects launched into outer space, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Current issues in the registration of space objects*, Proceedings of the Project 2001 Workshop, Cologne 2005, pp. 25 et seq.; B. Schmidt-Tedd/M. Gerhard, Registration of space objects: which are the advantages for States resulting from registration, in M. Benkö/K.U. Schrogl (eds.), *Space law: current problems and perspectives for future regulations*, Eleven International Publishing 2005, pp. 121–140; Schmidt-Tedd, U. Bohlmann, N. Malysheva, O. Stelmakh, L. Tennen, The Registration Convention, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Cologne Commentary on Space Law*, Vol. II, Carl Heymanns Verlag 2013, pp. 232–324.

[24] For an analysis of the Moon Agreement see F. Tronchetti, *The exploitation of natural resources of the Moon and other celestial bodies: a legal proposal*, Martinus Nijhoff/Brill (2009), 38–60, 225–230; S. Hobe, R. Jakhu, S. Freeland, F. Tronchetti, The Moon Agreement, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Cologne Commentary on Space Law, Vol. II*, Carl Heymanns Verlag (2013); F.G. von der Dunk, The Moon Agreement and the prospect of commercial exploitation of lunar resources, XXXII Annals Air & Space L. 91, (2007).

[25] This view is shared by the majority of scholars see, e.g. J. Hermida, Legal basis for a national space legislation (2004), 29; V. Kaiser, Commercial exploitation of space: domestic documents regulation, XVII Annals Air & Space L. (1992), 190; I. Marboe/F. Hafner, National authorization mechanisms in implementation of the UN treaties, in F.G. von der Dunk (ed.), *National Space Legislation in Europe,* Martinus Nijhoff Publishers, Leiden, Boston (2011), 32. Other authors, however, claim that the Outer Space Treaty requires states to adopt national space legislation. See, inter alia, M. Bourély, Quelques réflexions au sujet des legislations spatiales nationals, XVI Annals Air & Space L (1991), 247.

formulate specific legislation[26] to regulate national activities in outer space.[27] The following reasons can be put forward to explain such a growing trend:[28]

Authorization and Supervision of Private Space Activities

States are internationally responsible for the space activities of their 'national' non-governmental entities. This means that any violation of international obligations committed by these entities in the course of space operations will fall upon their national state and that this state will be also obliged to compensate for the damage resulting from these violations. It is, thus, in the interest of the state to establish mechanisms to verify the reliability of a private entity and to supervise its conduct.

Pursuant to Article VI, sentence 2, of the Outer Space Treaty non-governmental entities shall require authorization from their national state in order to carry out activities in outer space. Once this authorization has been granted, the state shall continuously supervise the authorized activity. Consequently, in practice states have put in place procedures to license private space activities and to exercise continuous control over the authorized private activities.

Compliance with International Obligations

The Space Treaties impose upon states parties a series of obligations, such as registering the objects launched into outer space and to compensate for damage caused

[26] On the issue of national space legislation see generally F.G. von der Dunk (ed.), *National Space Legislation in Europe,* Martinus Nijhoff Publishers, Leiden, Boston (2011); R. S. Jakhu (ed.), *National Regulation of Space Activities* Springer, Dordrecht et al. (2010); Christian Brünner/Edith Walter (eds.), *National Space Law. Development in Europe – Challenges for Small Countries*, Böhlau, Vienna, Graz (2008); M. Gerhard/K.U. Schrogl, 'Report of the 'Project 2001' Working Group on National Space Legislation', in: Karl-Heinz. Böckstiegel (ed.), *'Project 2001' – Legal Framework for the Commercial Use of Outer Space* (Carl Heymanns, Cologne et al., 2002) 529, 552–558.

[27] The interpretation of the expression 'national activities' in outer space is debated in legal literature, see e.g. F.G. von der Dunk, The origin of authorization: Article VI of the Outer Space Treaty and international law, in F.G. von der Dunk (ed.), *National Space Legislation in Europe,* Martinus Nijhoff Publishers, Leiden, Boston (2011), 9–17; M. Gerhard, Article VI, in S. Hobe/B. Schmidt-Tedd/K.U. Schrogl (eds.), *Cologne Commentary on Space Law, Vol. I*, Carl Heymanns Verlag (2009), 109–111; H.A. Wassenbergh, *Principles of outer space law in hindsight*, Martinus Nijhoff Publishers, (1991), 23.

[28] See/Cf. I. Marboe/Hafner, *supra* footnote 25, at 31-2; Michael Gerhard/Kristina Moll, 'The Gradual Change from "Building Blocks" to a Common shape of National Space Legislation in Europe – Summary of Findings and Conclusions', in: Hobe/Bernhard Schmidt-Tedd/Kai-Uwe Schrogl (eds.), *Project 2001 Plus – Towards a Harmonised Approach for National Space Legislation in Europe* (Deutsches Zentrum für Luft- und Raumfahrt, Cologne, 2004), 7, 48–49; Revised text of the draft recommendations on national legislation relevant to the peaceful exploration and use of outer space, UNGA Doc. A/AC.105/C.2/L.289, 26 February, 2013; Resolution No. 6/2012 adopting the 'Sofia Guidelines for a Model Law on National Space Legislation', adopted at the ILA Conference in Sofia, Bulgaria, in September 2012, available at http://www.ila-hq.org/en/committees/index.cfm/cid/29 (last accessed January 16, 2014).

by these objects. The treaties do not indicate how these obligations should be implemented. In practice states have adopted legislation which clarify how these requirements shall be complied with at the national level.[29]

National space legislation always pays particular attention to the legal issues arising in connection to private space activities, in particular those concerning liability. The international liability of the launching state laid down in the space treaties by implication applies to damage caused by space objects launched with partial or complete private involvement.[30] In simple terms, the particular system of attribution of private entities with respect to international liability is implied by the criteria for defining the liable states. A state is liable for a private activity and the damage it causes in case the activity involves a space object and the state concerned was involved in the launch of the space object in any of the four modes described above. In any of these circumstances the state will have to cover the damage caused by a private space operator. Normally, states protect their position by establishing procedures to obtain compensation of the amount paid from the private operator, often by requiring the operator to obtain insurance covering damage occurring in the launch and operation of the space object.

Organization of National Space Activities

National space legislation can contribute to better organize and manage national space activities. Due to the numerous applications of space technologies, several ministries and departments within a state can be involved in space matters and take part in the formulation of legislation and regulation relevant to space operations. This can create problems of harmonization and communication among the competent authorities and, ultimately, slow down the decision-making in the space sector. A well structured national space legislation can clearly attribute tasks among the relevant entities and facilitate a smooth administration of space activities.

Promotion and Regulation of Commercial Space Operations

In recent years the phenomenon of 'commercialization' has contributed to substantially change the nature and purpose of space activities. Broadly speaking the term 'commercialization' refers to the provision of space services in return of a certain

[29] M. Gerhard, *supra* footnote 27, at 120–22; J.F. Mayence, Granting access to outer space: rights and responsibilities for states and their citizens, in F.G. von der Dunk (ed.), *National Space Legislation in Europe,* Martinus Nijhoff Publishers, Leiden, Boston (2011), 81–88; Marboe/Hafner, *supra* footnote 25, at 30–32.

[30] See/Cf. B.A. Hurwitz, *State liability for outer space activities in accordance with the 1972 Convention on International Liability for Damage Caused by Space Objects*, Kluwer (1992), 22; Hermida, *supra* footnote 25, at 13.

price.[31] Often, commercial space activities see the involvement of private entities; however, also governmental actors carry out space activities on a commercial basis. "Commercial" space activities require an adequate regulatory framework to ensure their ordinate and predictable development. The adoption of consistent and detailed national space legislation constitutes the preferential way to set up such a favorable environment.[32]

Chinese Law-Making Process and Space Legislation

Chinese law-making is a complex, multi-leveled process which involves numerous bodies and entities.[33]

The rank of Chinese law is strictly determined on the basis of its respective legislative bodies. Pursuant to the Constitution and the law governing all legislation,[34] at the top of the ladder there is the Constitution of People's Republic of China adopted by the National People's Congress. The Constitution has binding force and no other law or regulation can contravene it. In the second place are the laws enacted by the National People's Congress (NPC) and its Standing Committee, the body exercising the supreme legislative power of the State. In the third position are the administrative laws and regulations adopted by the State Council, the highest national administrative organ. These laws and regulations must be consistent with the Constitution and not contradict the laws adopted by the NPC. In the last place are the departmental regulations formulated by the Ministries and Commissions of the State Council in accordance with the above mentioned legal norms within the limits of their powers.

All laws and regulations undergo a four stage process: (a) proposal of the draft; (b) deliberation of the draft; (c) adoption of the draft; and (d) promulgation.[35] The laws belonging to the second group necessitate a long period of deliberation before approval. Instead, the procedure for the remaining laws and regulation is simpler and somewhat faster.[36]

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[31] For a description of the 'commercialization' of space activities see F. Tronchetti, *Fundamentals of Space Law and Policy,* Springer (2013); H. van-traa Engelman, *Commercial utilization of outer space: law and practice*, Springer (1993); F. Lyall/P. Larsen, *Space law: a treatise*, Ashgate Publishing (2009), 467–498; F. Lyall, The rationale, efficient and economic use of space: three suggestions, in M. Benkö (ed.), Air and Space Law in the twenty-first century: Liber Amicorum K.H. Böckstiegel, Carl Heymanns Verlag (2002), 386–395. It is important to point out that in the United States the expression 'commercial' is used with a different meaning, that is to refer to the involvement of private operator in a certain activity.

[32] See/Cf. Y. Zhao, National space legislation with reference to China's practice. XXXII Annals Air & Space L. 131 (2007).

[33] See/Cf. Y. Zhun, *Concise Chinese Law*, Law Press, China (2003).

[34] Legislation Law of the People's Republic of China (Order of President No. 31).

[35] See/Cf. Zhao – Regulation, *supra* footnote 6, at 247.

[36] *Ibid*, at 247–49.

As far as civil space activities are concerned, there are no laws or regulation currently in China, but merely a number of departmental regulations.[37] Because the space sector has numerous ramifications, including the commercialization of space services, the manufacture of aerospace products, the management of the aerospace industry and technological development, the registration of space objects, and the enhancement of national security, several bodies are involved in the law-making process relating to civil space activities. Indeed, China follows a multi-sector decentralized approach in the formulation and adoption of space legislation. In particular, the State Council, the former COSTIND, now BUSTIND, the Ministry of Foreign Affairs, the Ministry of Commerce, The Chinese Academy of Sciences, the State Development and Reform Commission, as well as other departments, are all involved in the elaboration of space laws and in charge of their interpretation, implementation and compliance.

At a closer look, it is the duty of the BUSTIND to elaborate national civil aerospace policies and administrative regulations which then need to be sent to the State Council for acceptance and promulgation. The BUSTIND also formulates the departmental regulations of the space-related activities in connection with the relevant ministries and departments. The internal regulations relating to space activities of the single departments are elaborated and promulgated by the departments themselves.

The regulation of space activities of military nature is in the hands of the Chinese People's Liberation Army (PLA) General Armament Departments. Compliance with obligations contained in international treaties is taken care of by the Ministry of Foreign Affairs. The non-proliferation and export control issues concerning aerospace products useful for military applications are in the hands of the State Council, the BUSTIND, the Ministry of Commerce and the General Armament Department.

Military and Civil Space Legislation

Military Space Legislation

Military space legislation of the People's Republic of China deals with the regulation of arms, missile and missile-related items and technology. This legislation, which aims at preventing the proliferation of weapons of mass destruction and the distribution of dangerous material and items, is of particular importance, especially if one takes into account that China is not party to any of the international arrangements and regimes dealing with the non-proliferation of nuclear weapons as well as the regulation of the market of commodities and technologies necessary to launch, carry and use such weapons.[38]

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[37] See/Cf. Zhao – Status quo, *supra* footnote 6, at 100.

[38] These include, inter alia, the Agreement on Guidelines for the Transfer of Equipment and Technology Related to Missiles (MTCR Agreement), done 16 April 1987; 26 ILM 599 (1987), the

Currently, Chinese space-related military legislation consists of: (a) Regulations of the People's Republic of China on the Administration of Arms Export; and (b) Regulations of the People's Republic of China on Export Control of Missile-related Items and Telecommunications.

The Regulations on the Administration of Arms Export which were formulated jointly by the State Council and the Central Military Commission on October 22, 1997, have been amended on October 12, 2002. According to the Regulations any request for arms export shall be examined and eventually accepted by the authority of China's export alone or together with the relevant sectors of the State Council and the Central Military Commission. Only arms trading companies designated by the Government can be licensed to conduct arms export. As demanded by the above Regulations, the ex-COSTIND and the People's Liberation Army General Armament Department promulgated the Military Products Export Control List on November 1, 2002, which includes military satellites, launch vehicles, and so on.

The Regulations on the Export Control of Missiles and Missile-Related Items and Technology, together with the corresponding Export Control List, were adopted on August 22, 2002, by the State Council. Their main goal is to preserve the national security and public interest of China and limit the proliferation of weapons of mass destruction, nuclear weapons and their delivery systems.

Civil Space Legislation

As previously pointed out, Chinese legislation governing civil space activities mostly consists of departmental regulations and regulatory documents, while a unified law governing space activities is still missing.

In order to comply with the obligations deriving from its participation to the international space law treaties China has enacted some departmental regulations, in particular the 2001 *Measures for the Administration of Registration of Objects Launched into Outer Space* (hereinafter the Registration Measures)[39] and the 2002 *Interim Measures on the Administration of Licensing the Project of Launching Civil Space* (hereinafter the Licensing Measures),[40] complemented by *Examination and Approval Procedures on the Administration of Licensing the Project of Launching Civil Space Objects* (hereinafter the Procedures). In addition the *Interim Instrument of Space Debris Mitigation and Management* (hereinafter the Space Debris Interim Instrument), entered into force in 2010.

Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies, and the Code of Conduct against Ballistic Missile Proliferation (ICOC), established on 25 November 2002.

[39] Order No. 6 of the Commission of Science, Technology, and Industry for National Defense and the Ministry of Foreign Affairs of the People's Republic of China, 8 February 2001.

[40] Order No. 12 of the Commission of Science, Technology, and Industry for National Defense of the People's Republic of China, 21 November 2002.

The Registration Measures

Main provisions

In 1988 China ratified the 1975 Convention on Registration of Objects Launched into Outer Space. The Registration Convention requires states parties to register their space objects in a national register as well as to transfer relevant information to the UN Secretary-General for inclusion in an international registry. Pursuant to such obligations as well as to safeguard its interests and position as a 'launching state' China adopted the Registration Measures.

The Registration Measures contain 16 Articles covering several issues related to the registration of space objects, such as the definition of 'space object' and the procedure for registration.

The Measures begin by defining a space object as "an artificial satellite, crewed spacecraft, space probe, space station, launch vehicle and parts thereof, and other human-made objects launched into outer space."[41] The Measures, thus, requires two elements for an objects to be classified as a 'space object', namely (1) to be man-made; (2) to enter outer space. As many objects can fulfill these conditions, the Measures explicitly exclude sounding rockets and ballistic missiles that cross outer space only temporarily.[42]

Article 4 of the Registration Measures clarifies the scope of the measures by providing that registration is requested for all space objects launched from the territory of China as well as space objects jointly launched abroad by China and other States.

The national subjects under the obligation to register are all government departments, juridical persons, other organizations and natural persons which launch or procure the launching of a space object.[43] Article 7 of the Measures goes on by providing that "The owner of a space object shall register the space object. Where there are more than one owners of a space object, the main owner shall register the space object on behalf of all the owners." Furthermore, where a space object is launched from Chinese territory but it is owned by a government, juridical or natural persons from another state, the Chinese corporation that provides the launching service shall register the object in the national registry. In short, the Chinese government and all the subjects falling under its jurisdiction are under the obligation to register in the Chinese registry objects launched into outer space. In case the space object belongs to a foreign country/entity launched from Chinese territory, China will register the space object and accept its duty and obligation as a 'launching state' even if the launch is performed by a launching corporation.

With regard to the procedure for registration of space objects the BUSTIND is in charge of maintaining the national registry and dealing with requests for (of) regis-

[41] Art. 2, Registration Measures.

[42] Art. 3, Registration Measures.

[43] Art. 4, Registration Measures.

tration.[44] In case national registration involves a joint launch with a foreign state, the BUSTIND, if necessary, decides after consultation with the Ministry of Foreign Affairs, which of them shall register the space object.[45] The Registrant shall provide the BUSTIND the following information: registration number, registrant, owner of the space object, appropriate designator of the space object, basic characteristics of the space object, launching enterprise, name of the launch vehicle, date, territory and location of the launch, basic orbital parameters, and status of the launching and orbiting of the space object.[46] This list is more comprehensive than the one included in the Registration Convention.[47] The registrant shall provide this information and complete the registration requirements within 60 days from the launch.[48] In case some significant changes occur, such as change of ownership in orbit, inoperability of the space object, break up, cessation of function and re-entry into the earth's atmosphere, the registrant shall modify the registration within 60 days accordingly.

The Registration Measures contain a section dedicated to the space objects launched by Hong Kong and the Macau Special Administrative Region. Registration of these object shall be instituted separately.[49]

Pursuant to Article 11 of the Measures relevant government departments and juridical persons, other organizations and natural persons under the authorization of the competent governmental departments may have access to the information in the national registry only with permission of the BUSTIND.

International registration with the Secretary-General of the United Nations shall be effected by the BUSTIND, via the Ministry of Foreign Affairs, within 60 days after the registration in the national registry has taken place.[50] In case of joint launch by China and other foreign states, the state of registry will be decided by the Ministry of Foreign Affairs after consultation with the other states concerned pursuant to Article II of the Registration Convention. The provisions of Article 12 of the Registration Measures are an effective means to implement the obligations set forth in the Registration Convention and to solve some of the problems that the language of this Convention generates. For example, according to Article 4, paragraph 1, of the Registration Convention, states parties shall furnish "information as soon as practicable". In short, this signifies that states are free to determine the most convenient time to provide information to the UN Secretary-General, which can be

[44] Art. 5, para. 1, Registration Measures.

[45] Art. 5, para. 2, Registration Measures.

[46] Art. 6, Registration Measures.

[47] According to Art. 4, para. 1, of the Registration Convention each state of registry shall furnish the Secretary-General of the United Nations the following information: (a) name of the launching state or states; (b) an appropriate designator of the space object or its registration number; (c) date and territory or location of launch; and (d) basic orbital parameters, including: (i) nodal period; (ii) inclination; (iii) apogee; (iv) perigee; (v) general function of the space object.

[48] Art. 8, Registration Measures.

[49] Art. 10, Registration Measures.

[50] Art. 12, Registration Measures.

1 month, 1 year or even 10 years after the registration in the national registry has taken place. In practice, this has resulted in significant delays in the process of international registration of space objects. Chinese space legislation prevents this delaying practice by imposing a strict time limit for furnishing information to the UN Secretary-General.

The Registration Measures: A Commentary

The Registration Measures enable China to comply with the main obligations laid down in the Registration Convention both at the national and international levels. However, some shortcomings can be pointed out. Firstly, while the Measures speak of objects launched in outer space they fail to address the issue of delimitation of outer space, namely where China believes that outer space begins and national airspace ends. This can cause problems with regard to the applicability of the Registration Measures to aerospace objects, such as sub-orbital spacecrafts, which fly into airspace, shortly cross outer space and then return to Earth. Although China is not currently involved in the private suborbital manned spaceflights business, the uncertain language of the Registration Measures might cause problems at a later stage. Connected to this is the fact that the definition of space object provided for in Article 2 of the Measures excludes from its scope aerospace/suborbital objects. Thus, if China will decide to participate in sub-orbital spaceflight activities an amendment to this definition might be needed. Furthermore, such a definition also does not include 'space debris', an additional problem that may call for a revision of its terms.

Secondly, some expressions used in the Measures are vague and of questionable meaning. While the Measures require a registrant to indicate the "basic characteristics of a space object" they fail to specify what these characteristics are. This leaves room for relevant information or characteristics of the space object to be hidden, especially in case it belongs to a private entity. Additionally, the Measures use the expression "main owner" of a space object. On one side, this expression is not used in the space treaties or in any other national space legislation; on the other side, it is not specified according to which criteria an entity/subject should be deemed to be the "main owner" of a space object in case other entities/subjects qualify as owners of that object. Interestingly, while the Registration Convention requires the "launching state" to register the space object, the Registration Measures demands government departments, juridical persons, other organizations and natural persons to register their space objects. This language reflects the reality of modern space activities, where the launch of a space object can be performed by a governmental and non-governmental entity. The fact that a private entity might undertake the launch does not exonerate China from registering the space object and assuming its duties as a launching state if the object is launched from Chinese territory or by a company that falls under the jurisdiction of the Chinese government. Finally, the Registration Measures do not address the issue of transfer of ownership of a space object in orbit. A provision dealing with such a practice should be added, so as to enable China to

secure its legal position in relation to the transferred space object under the UN space treaties.[51]

The Licensing Measures and Procedures

Main Provisions

Broadly speaking the Licensing Measures constitute an effort of the Chinese government to administer the project of launching civil space objects, promote the sound development of the civil space industry, maintain national security and the public interests, and fulfill the obligations of China as a contracting State to the international outer space treaties.[52]

The Measures include 5 chapters and 26 articles which lay down the legal regime for the licensing of civil, non-military, launches into outer space. The Measures deal with the application, evaluation, authorization procedures, the supervision of the authorized activity, the duties of the licensee, and the relative penalties. The Procedures cover in detail the formalities for acceptance, review, determination of a license as well its notification to the applicant.

The Licensing Measures apply to the "project of launching civil space objects", an activity that is defined as the launching of space objects from Chinese territory for non-military purposes as well as to the launching of space objects from foreign territory with the space object being owned by China or its ownership being transferred to Chinese natural or juridical persons or organizations.[53] Any person, natural or juridical or any organization undertaking such a launch project shall apply for examination and approval and it is prohibited from carrying out a project until an authorization for the project is obtained.[54] The authority competent for the administering, examining, approving and supervising the project is the BUSTIND.[55]

Article VI of the Outer Space Treaty establishes the international responsibility of states for national activities in outer space and requires the activities of non-governmental entities to be authorized and continuously supervised. From the text of the Licensing Measures it emerges that China defines national activities based on territorial and personal jurisdiction. Indeed, both launches from Chinese territory (territorial jurisdiction) and launches undertaken by Chinese natural and juridical persons outside of the territory of China require authorization/license from the Chinese government.

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[51] On the practice of transfer objects in orbit see e.g. M. Chatzipanagiotis, Registration of space objects and transfer of ownership in orbit 56(2) ZLW (2007); Gerhard, *supra* footnote 26, at 124–5.

[52] Art. 1, Licensing Measures.

[53] Art. 2, Licensing Measures.

[54] Art. 3, Licensing Measures.

[55] Art. 4, Licensing Measures.

The general project contractor or the final owner of the satellite or other spacecraft shall apply for the license. Pursuant to Article 5 of the Measures the applicant shall act in conformity with the laws and regulations of China, preserve national secrets and refrain from actions endangering national security. Additionally, it shall: (1) be in possession of all relevant documents issued by the competent state departments; (2) have financial and technical means to undertake the project; (3) not cause irremediable danger to public health, safety or property;[56] (4) comply with environmental protection law.[57]

Applications, with all the relevant documents, shall be submitted to the BUSTIND 9 months prior to the launch.[58] The BUSTIND shall review the application within 30 days from the receipt and shall grant or reject the attribution of a license. The review is carried out in accordance with the requirements laid down in the Procedures.[59] If the applicant wishes to challenge the evaluation of its application it may apply to the BUSTIND for re-evaluation or for administrative review according to the law.[60]

A license shall indicate the name and address of the licensee, the main elements of the project, the time frame of the launch and the duration of the project. A license cannot be altered or transferred[61] and it shall be immediately terminated once the project is completed.[62] If the licensee wishes to modify information in the license or cancel it shall notify the BUSTIND 90 days before expiry of the license for modification[63] or cancellation.[64]

The licensee shall obtain an insurance covering liability for damage or other losses caused to third parties and other liability cases incurred by launching a space object.[65] While the application is under review, the applicant shall be able to show pre-contract insurance commitments and provide adequate information.

The licensee shall comply with the terms of the license and with the laws and regulations of China. In case of violation the BUSTIND shall order the licensee to rectify the violation within a deadline or shall withdraw the license if the breach of the license is serious.[66] Additionally, depending on the gravity of the violation administrative penalties can be imposed on the licensee, for example if it concealed the truth, practiced fraud, or caused damage to national interests.[67] Furthermore, if any natural or juridical person, or any organization, undertakes a project of launch-

[56] Art. 5, Licensing Measures.
[57] Art. 6, Licensing Measures.
[58] Art. 6, Licensing Measures.
[59] Art. 2, Licensing Procedures.
[60] Art. 8, Licensing Measures.
[61] Art. 12, Licensing Measures.
[62] Art. 11, Licensing Measures.
[63] Art. 13, Licensing Measures.
[64] Art. 14, Licensing Measures.
[65] Art. 19, Licensing Measures.
[66] Art. 16, Licensing Measures.
[67] Art. 24, Licensing Measures.

ing without authorization, the BUSTIND shall terminate the illegal activity and impose administrative sanctions.[68] If these activities constitute criminal acts the licensee shall face charges of criminal liability. Administrative sanctions can also be imposed on organs or officials of the state in charge of the examination of the application in case such duties are neglected or they have abused their powers.

The Licensing and Procedures Measures: A commentary

The Licensing and Procedures Measures provide the essential legal foundation to comply with the requirements of Article VI, sentence 2, of the Outer Space Treaty, which demands states to authorize and continuously supervise non-governmental space activities. Indeed, the Measures lay down mechanisms to license and control private space activities and, ultimately, to ensure that non-governmental entities comply with Chinese international obligations and do not endanger the national and security interests of China while operating in space.

Despite their importance the Measures present several limits that have the potential to affect their effectiveness and implementation. Firstly, the license that operators might obtain pursuant to the Measures purely deals with the launching of objects in outer space. It remains doubtful whether the scope of the license extends to activities actually occurring in outer space, such as remote sensing or communication. In other words, as the Measures focus on the 'launching' phase only, it is uncertain whether the behavior of the licensee in space is regulated by the Measures and if the government is provided with effective means to control it. In this respect, several states have enacted remote sensing laws so as to specifically lay down the duties of a private operator licensed to carry out remote sensing activities and have put in place mechanisms to prevent and punish violations of international obligations and behaviors that threaten national security. As it might be expected that private operators in China would be interested in providing remote sensing services China might consider to extend the scope of the Measures to adequately regulate this kind of activities.

Secondly, there is the issue of insurance. According to the Licensing Measures the licensee must obtain an insurance to cover damage suffered by third parties and other liability cases incurred by launching a space object (Art. 19). This provision is, however, far from clear. Indeed, it does not indicate what type of damage should be covered by the insurance (damage occurring during the launching phase? In-orbit damage? Damage caused by debris?). Additionally, Article 19 does not specify the maximum amount recoverable under the insurance cover. Furthermore, it does not clarify if China adopts a sharing risk approach with the private company, that is if China accepts to compensate the amounts which exceed the insurance coverage (in practice, the Chinese government is committed to provide indemnification for third party claims over $100 million, although this commitment has never been tested). Finally, it does not clearly attribute to China a right of recourse against the licensee

[68] Art. 25, Licensing Measures.

in case the former had to compensate international third party liability damage caused by the latter.

Another limit of the Licensing Measures concerns the supervision of the authorized private space activities. The Licensing Measures attributes to the BUSTIND the duty to supervise licensed private space activities. However, it is not specified how this duty should be effectively implemented and by whom.

Fourthly, at times the Licensing Measures utilize an ambiguous language. Art. 2 provides that "the launch of a spacecraft…while the spacecraft is owned by, or the ownership of the spacecraft has been transferred in-orbit to persons, natural or juridical, or *other organizations* (emphasis added) of the People's Republic of China." It is not clear what these "other organizations" are, as this term is not defined in the Measures. Considering that governmental and non-governmental entities are already included in the scope of the Measures, this expression seems to be redundant.

The Space Debris Interim Instrument

Space debris can be defined as "all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional."[69] Attention towards the problem of space debris has significantly increased in recent years, mostly because of the danger that they pose to the safety of active space objects. Indeed, because of the high velocity (7500 m/s or higher) with which space debris move they may destroy or significantly reduce the operational ability of satellites by colliding with them.

The UN space treaties do not specifically address space debris:[70] this is due to the fact that when the treaties were negotiated space debris were not an issue. International discussions on the regulation of space debris started in the early 1980s but it was only in 1993, upon the initiative of the world's major space agencies, that the Inter-Agency Space Debris Coordination Committee (IADC) was established. After several years of discussions, the IADC developed space debris mitigation guidelines in 2002. These guidelines, which became the basis for the space debris mitigation guidelines developed and adopted by UNCOPUOS in 2009, establish a series of measures and good practices aimed at reducing the risk of creation of debris. These guidelines are voluntary in nature and not legally binding under international law. Consequently, no binding international norms regulating space debris exist today. Nevertheless, space agencies have been implementing the guidelines for over a decade. Furthermore, several States have included in their national space legislation provisions on space debris mitigation and prevention. These provisions

[69] See/Cf. Technical Report on space debris, United Nations General Assembly. Technical report of the Scientific and Technical Subcommittee on space debris. UN Doc. A/AC.105/720, 1999.

[70] On the issue of space debris see e.g. J. N. Pelton, *Orbital Debris and Other Space Threats*, Springer Press (2013); N. Jasentuliyana, Space debris and international law, 26 J. Space L. 139 (1998); A. Brearly, Reflections upon the notion of Liability: The instances of Kosmos 954 and Space Debris, 34 J. Space L. 291 (2008).

are obligatory for the actors, both of governmental and non-governmental nature, which have been authorized by those States to carry out activities in outer space.

The 2010 Space Debris Interim Instrument is intended to guarantee the normal operation of spacecraft, protect the space environment and implement international obligations to control and mitigate space debris.[71]

The Interim Instrument utilizes a definition of space debris that almost mirrors that of the IADC guidelines,[72] but it adds reference to non-functional satellites and last stages of rockets.

The Authority in charge of the management of space debris arising from civil spacecraft is the BUSTIND which has the task to supervise the implementation of IADC Guidelines.[73] In order to fulfill its duties the BUSTIND is expected to establish a joint working mechanism with relevant ministries to coordinate the space debris mitigation and management.

Articles 6 and 7 of the Interim Instrument lay down the Technical Standards that largely follow those of the IADC Guidelines, especially with respect to: (1) control of debris release during normal operations; (2) minimization of debris generated by accidental explosions; (3) choice of safe flight profile and operational configuration; (4) post-mission disposal of space objects, either by re- or de-orbiting.

Article 8 makes clear that every subject willing to obtain a license to launch a civil space object must include in its applications space debris mitigation measures. Article 9 imposes on licensees the duty to constantly monitor the risk of collision between their spacecraft and space debris.

Article 12 establishes the Office for Space Debris Management within the BUSTIND. This Office is in charge, inter alia, to approve space debris special research projects aimed at developing technology for early warning, protection, and mitigation.

Article 13 requires that users and developers of spacecraft shall put forward an emergency plan in case of spacecraft disintegration, collision and/or re-entry.

The entry into force of the Space Debris Interim Instrument represents an important development from a Chinese as well as international perspective for three main reasons: (1) it is the first official Chinese document dealing with debris mitigation and management; (2) for the first time Chinese space operators are formally obliged to comply with space debris prevention and mitigation practices and to follow environmental protection measures while operating in outer space; (3) it shows the commitment of China towards implementing and complying with international demands for the protection and preservation of the space environment. This has been an issue of particular concern for the international community, especially following the events of January 2007 where China intentionally destroyed one of its aging

[71] Art. 1, Space Debris Interim Instrument.

[72] Article 3.1 of the IADC Space Debris Mitigation Guidelines defines space debris as "Space debris are all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional". See at http://iadc-online.org/index.cgi?item=docs_pub (last accessed January 16, 2014).

[73] Art. 4, Space Debris Interim Instrument.

satellites by a kinetic means causing thousands of debris to be released into Low Earth Orbit (LEO).[74]

The Future of Chinese Space Legislation: Proposals and Way Forward

Main Considerations

China is gradually achieving international prominence in the space sector. Thanks to its remarkable achievements in the fields of space exploration and applications, China possesses indigenous capability to launch objects in outer space,[75] both for national and foreign customers,[76] and to carry out manned and un-manned operations in space. Furthermore, China manufactures and operates remote sensing, communication and navigation satellite systems.[77]

Despite these achievements Chinese space legislation is still at its infant stage. Not only it ranks at low level of Chinese legislation but it also deals with limited aspects of space activities necessary to comply with the international obligations set forth in the international space treaties. As China expands its range of space operations and opens up to the outside world, for example by providing commercial space services, this situation is no longer sustainable and Chinese national space legislation needs to expand its scope and size. Failure to do so could compromise advancements of the Chinese space program and be detrimental to financial opportunities.

The further development of Chinese space legislation should be directed to achieve the following four main goals: (1) increasing the organizational efficiency of national space activities; (2) improving the existing space regulations; (3) regulating of previously un- or under-addressed issues; (4) regulating of commercial activities.

(1) Increasing the organizational efficiency of national space activities
As previously described, several ministries of the Chinese government are involved in space matters, issuing space policies as well as administrative and

[74] For more information on the events of January 2007 see at http://www.space.com/19137-china-anti-satellite-launch-test.html (last accessed January 16, 2014).

[75] See at http://www.cgwic.com/LaunchServices/LaunchVehicle/LM2C.html (last accessed January 16, 2014).

[76] China has launched satellites for foreign customers, including NigcomSat (Nigeria), the Venezuelan Ministry of Technology and Science, the Turkish Ministry of Defense, and the Indonesian Space Agency. Furthermore, on 22 November 2013, China Great Wall Industry Corporation signed a satellite procurement contract with APT Satellite Company Limited, a Hong Kong based satellite operator, for the APSTAR-9 Satellite Program. See at http://www.cgwic.com/In-OrbitDelivery/Customer/index.html (last accessed January 16, 2014).

[77] See at www.spacetoday.org/China/ChinaSatellites.html (last accessed January 16, 2014); http://en.wikipedia.org/wiki/Yaogan (last accessed January 16, 2014).

departmental regulations. The overall organization of Chinese space activities is affected by a lack of harmonization, communication, and information, all factors that eventually cause overlapping competencies, uncertain determination of competent authorities and procedures, and slow decision-making. The adoption of national space law could provide a useful opportunity to improve this situation by reinforcing the governmental organization and enabling a more harmonized and transparent administration regime.

(2) Improving the existing space regulations
In the above sections the deficiencies of the Licensing and Registration Measures have been pointed out. As to the former, these include: uncertain scope of the license; lack of efficient supervisory control powers; and unclear insurance requirements for private operators. As to the latter, the shortcomings refer to the definition of space object and registration of foreign objects launched from Chinese territory. These issues should be addressed through an amendment of the Regulations that takes into account the current reality of space activities, in particular the presence of private operators and foreign customers.

(3) Regulating un-or under-addressed issues
Chinese space legislative action in the coming years should pay particular attention to regulate some specific issues that so far have been only marginally dealt with or completely disregarded.

Firstly the issue of liability. Space activities are high risk undertakings and damage can be caused to third parties both in outer space and on Earth. The launching State is liable for damage caused by governmental and non-governmental entities under the Outer Space Treaty and Liability Convention.

Despite the growing significance of liability in the context of space activities, Chinese space legislation is virtually silent on this point. This may create numerous problems in case of an accident caused by a space object in relation to which China qualifies as a launching state. Several years ago China drafted the Management of Damage Compensation of Launched Space Object and submitted it to the State Council for approval.[78] Nevertheless, this text is not available for public reading and its status remains uncertain. In any case, it is urgent that China clarifies its position in respect to liability. In particular, the Chinese legislators should: (a) provide a definition of 'damage' caused by space activities/object; (b) clarify the meaning of 'fault' in the context of the Liability Convention and according to which criteria 'fault' should be determined; (c) address the liability attributed to the Chinese government for damage caused by private Chinese space activities; (d) lay down clear insurance requirements for private space operators; (e) clarify if China acts as a *de facto* co-insurer of private operators for amounts exceeding the insurance coverage; (f) establish the procedure to be followed by the Chinese government to obtain compensation for the amount paid to cover damage caused by private space activities.

[78] See Zhao –Status quo, *supra* footnote 6, at 121.

Secondly, Chinese space legislation should clearly define the terms 'space activities' and 'national activities in outer space'. This would enable clarification of: (a) what type of activities fall within the scope of Chinese space legislation, i.e. activities in outer space per se and/or activities on Earth but connected to outer space, such as launching, control of space objects, utilization of space products; (b) which persons are under the obligation to obtain an authorization from China, for example in case of activities taking place beyond national territory.

Thirdly, China should take legislative measures to regulate and implement its obligations as a state party of the 1968 Rescue and Return Agreement, in particular to put in place procedures to search, rescue and return Chinese astronauts landing outside of Chinese territory as well as to assist and return to the national state foreign astronauts landing inside China. These measures are urgently needed as a consequence of the fast development of the Chinese manned space program.

Fourthly, China should expand the scope of its licensing regime. Until now, such a regime only covered the practice of launching objects into outer space. Additional kinds of licenses and the relative requirements could be put in place to regulate, for instance: the research and production of space products; the export and import of space-related material; the performance of satellite remote sensing and communications, etc.

(4) Commercialization of space activities

Another important factor to justify advancement and development of national space legislation is the need to adequately regulate the commercialization of space activities and services. As any other type of business, commercial space activities also need a dedicated legal framework to direct their implementation and protect the interests of all parties involved.

China is gradually opening up towards commercial opportunities in outer space. In recent years, China has launched foreign satellites and sold space-related technology to allied countries. Among the most profitable business opportunities for China in the space sector the following can be listed: (a) launching foreign space objects from Chinese territory; (b) selling Chinese manufactured space objects, components, or related technology to foreign contractors; (c) providing satellite-related services.

(A) Launching foreign space objects from Chinese territory: China has at its disposal advanced space transportation systems and modern launching facilities.[79] Thus, it may offer its services to foreign space operators willing to launch spacecrafts but that do not possess independent space vectors. In recent years China has launched foreign satellites, such as the Turkish Gokturk. However, in order to expand its range of foreign customers China needs to put in place a

[79] See at http://www.cgwic.com/LaunchServices/index.html (last accessed January 16, 2014); http://www.globalsecurity.org/space/world/china/launch-intro.htm (last accessed January 16, 2014).

clear and predictable legal environment regulating the launching business. An environment with these characteristics is currently absent. China law-makers should concentrate their action on clarifying the issues of liability, registration, licensing procedure and protection of intellectual property rights in connection with the launch of foreign space objects.

According to the Liability Convention China qualifies as a launching state, as the satellite is launched from its territory. China will thus be liable for damage caused by this object for the duration of the operational life of the object and even beyond (for example, once it has turned into a space-debris). Liability, however, will be shared with the foreign state that has procured the launch. In the event of an accident caused by that space object, the victim could seek compensation from all the launching states, including China. When accepting to launch a satellite on behalf of a foreign government, it would be advisable for China to agree with the other launching state/s how to deal with liability claims. The existing Chinese space legislation is silent on this issue. Although this would be a decision to be taken, usually, on a case by case basis, it would be helpful if Chinese regulation could give some general guidance on the matter.

Connected to this problem there is also the question of which state should register and effectively control the launched space object. Looking at the Chinese Registration Measures it seems that China is ready to register every object launched from its territory. The Registering State has the duty to control the activities of the registered space object. However, in practice it may happen that effective control over the activities of the launched space object is not in the hands of China but of the foreign state that has procured the launch. Most likely this issue will be dealt with bilaterally by the involved states on a case-by-case basis. However, the Registration Measures are completely silent on the resolution of such problems and, consequently, could be amended so as to provide at least some general guidance.

More complicated is the case where China launches a satellite on behalf of a private foreign company. According to Article VI of the Outer Space Treaty, a private company must receive an authorization from the "appropriate state" party to the Outer Space Treaty in order to operate in outer space. Such a state has also the duty to control the authorized space activity. The question is which would be the appropriate state in this situation, whether the state of nationality of the company, which is most likely the one capable of exercising effective control over its activities, or China as the state from which territory the object is launched. Significantly, the Chinese Licensing Measures provide that every natural and juridical person shall apply for a license from the Chinese competent authority. However, China may lack the authority to effectively control the authorized activity and, in any case, the Measures do not make any specific reference to foreign natural and juridical persons. Additionally, the national state of the company may wish to license its activity too. Further clarity should be provided in connection with the procedure to be followed by a foreign entity willing to launch its space object from Chinese territory. In particular, the com-

petent authorities, the timeframe of the procedure, and the mandatory requirements, such as mandatory third-party insurance, need to be openly spelled out.

An additional element to be taken care of concerns the protection of intellectual property rights.[80] Legal safeguards need to be put in place to guarantee the owner of the foreign space object that the technology and IPR related to its satellites are not going to be stolen. Prior to the launch China would be entitled to verify the safety of the object to be launched; however, this control should be clearly regulated by procedures known to both sides and not lead to violation of protected information. This is a very sensitive point for foreign states/operators, which can refrain from utilizing Chinese services if these conditions are not guaranteed.

It would also be recommendable that provisions dealing with the settlement of pre-launch and launch-related disputes need to be formulated. Disputes of this kind may arise in connection with the breach of the launch contract, for example in case of unjustifiable delay or refusal to undertake the launch.

(B) Selling Chinese manufactured space objects, components, or related technology: Considering the advanced status of the Chinese space program it is evident that a possible source of profit is the marketing of Chinese manufactured space objects, components, and technologies upon request from a foreign governmental or non-governmental entity. The commercial sale of space products/technology, however, must be undertaken in compliance with the existing Chinese laws regulating the export of military products.[81] If a component or technology has military nature or potential military application, the exporter needs to apply for an export authorization to the competent authority. The Chinese government might consider enacting regulations aimed at speeding up the revision procedure and facilitating the release of military free technology.

(C) Providing satellite-related services: One of the major sources of profits in the space sector is the commercial sale of satellite-derived products, data, and services.[82] This is particularly true for the fields of telecommunication, remote sensing, and navigation, that have, indeed, the potential to attract national and

[80] For an overview of the system of intellectual property rights protection in China see G.C.K. Cheung, *Intellectual property rights in China*, Routledge (2009). See also "Intellectual Property Protection in China", Permanent Mission of the People's Republic of China to the United Nations Office at Geneva and Other International Organization in Switzerland, available at http://www.china-un.ch/eng/bjzl/t176937.htm; "Protecting your intellectual property in China", available at http://mac.doc.gov/China/Docs/businessguides/IntellectualPropertyRights.htm (last accessed January 16, 2014). Additionally, see Zhao – Regulation, *supra* footnote 6, at 262–4.

[81] For example, the Regulation on Control of Military Products Export, first released in 1997 and revised in 2002; Regulations on Export Control of Missiles and Missile-related Items and Technologies.

[82] See/Cf. C. Venet, The economic dimension, in C. Brünner/A. Soucek, *Outer space in society, politics and law*, Springer (2011), 55–72; E. Walter, The privatization and commercialization of outer space, in C. Brünner/A. Soucek, *Outer space in society, politics and law*, Springer (2011), 493–518; The Space Report 2012, available at http://www.spacefoundation.org/media/press-releases/space-foundations-2012-report-reveals-122-percent-global-space-industry-growth (last accessed January 16, 2014).

foreign private investors. Commercial practice in these sectors, however, needs to be properly regulated so as to ensure fair competition and not to endanger the national security interests of China.

Generally speaking, in the field of remote sensing private satellite operators establish policies determining the distribution, pricing and use of their data.[83] However, national governments have the right to impose restrictions on the release of these data (especially high-resolution images) based on national security considerations and to obtain priority access to the system capabilities in times of crisis. China, which has adopted some policies regulating remote sensing activities,[84] should develop comprehensive legislation on remote sensing in order to regulate the legal issues that the commercial release of remote sensing products generate. The same reasoning could be applied to the commercialization of global navigation services by China. Such a practice should be duly regulated from a legal point of view, so as to clarify the conditions for the release of the signal to foreign users, responsibility and liability of China for damage arising in connection with the use of this service, and the obligations of the foreign receivers. In the field of telecommunication China has adopted legislation that have introduced the criteria of competition.[85] However, in order to attract foreign service providers, it is necessary to formulate a coherent telecommunications policy to safeguard competition between national and foreign operators, avoid cross-subsidy, distorted tariffs, and prevent restriction of liberalization of telecommunication services.[86]

The Way Forward

The formulation of a more specific space legislation ranks among the top priorities on the agenda of the China National Space Administration (CNSA). A confirmation of this commitment came from the setting up of a special task force within the CNSA to study the issue of national space legislation a few years ago. Further awareness of the need for developing the legislative framework governing Chinese

[83] A. Ito, *Legal aspects of satellite remote sensing*, Martinus Nijhoff Publishers, 2011; L. J. Smith and C. Doldrina, Remote Sensing Data: Some Critical Comments on the Current State of Regulation and Reflection on reform, Proceedings of the Forty-Ninth Colloquium on the Law of Outer Space (2007), 253; R. Harris and R. Browning, Data policy assessment for GMES final report, EVK2-CT-2002-80012-DPAG, University of London, 2004.

[84] L. Yang, Remote Sensing Data Distribution and Application in the Environmental Protection, Disaster Prevention, and Urban Planning in China, 36(2) J. Space L. 435 (2010).

[85] See/Cf. Zhao, Regulation, *supra* footnote 6, at 253–55.

[86] *Ibid*.

space activities was highlighted in the 2011 White Paper on Space Activities published by the China's Information Office of the State Council.[87]

In the long run China should aim at enacting a comprehensive space law act holding a strong legal status among the rank of Chinese laws. However, this is not a goal that can be achieved all at once. Instead, China should follow a gradual, step-by-step approach. The first step should consist in the adoption of rules and regulations on the most urgent aspects of space activities. Once these regulations have proven their relevance and practicability, they could be assembled in one document and included in the agenda of the national legislation plan of the National People's Congress for adoption. Ultimately, the goal should be to have a comprehensive space law on outer space supplemented by a set of administrative regulations and departmental rules.

Conclusion

As far as space activities are concerned China has come a long way in a short time. China possesses the technological capability to carry out independent manned and un-manned space activities and to provide space-related services on a national and international basis.

The more China enters into cooperative projects, expands the range of its space activities and offers space-related services and products to foreign customers, the more it needs to improve the status and scope of its national space legislation. Comprehensive and detailed laws are indeed instrumental to provide the level of legal certainty necessary for the flourishing of civil and commercial space activities.

Chinese legislators appear to be fully aware of this need. Thus, despite the difficulties inherent to law-making in China, developments in the legal regulation of Chinese space activities are to be expected in the near future.

[87] The 2011 China's Space Activities White Paper of 2011, Section IV – Development Policies and Measures: states as follows: "The Chinese Government intends to…Strengthening legislative work. To actively carry out research on a national space law, gradually formulate and improve related laws, regulations and space industrial policies guiding and regulating space activities, and create a legislative environment favorable to the development of space activities". See also at http://www.space.com/14076-china-unveils-space-mission-plans-2016.html (last accessed January 16, 2014). The text of the 2011 White Paper is available at http://news.xinhuanet.com/english/china/2011-12/29/c_131332974.htm (last accessed January 16, 2014).

Applying the *Jus in Bello* to Military Uses of Outer Space: A Square Peg in a Round Hole?

Steven Freeland

Abstract The development of satellite technology to enhance the exploration and use of outer space has continued at a rapid rate ever since the space age began in 1957. Satellites play a vital part of many aspects of daily life, and also with respect to the conduct of armed conflict. Most military leaders regard space-related technology as an integral element of their strategic battle platform. This reflects the changing technological nature of armed conflict, which challenges many aspects of international law, including the regulation of warfare. This is particularly the case with respect to the use of satellite technology. Moreover, the continuing development of this technology challenges the core of the 'peaceful purposes' doctrine that underpins the international regulation of outer space. This chapter discusses the application of the United Nations Space Treaties and the laws of war to the use of outer space during armed conflict, and offers some reflections as to what is required to properly address the issue.

Outer Space – The Need for Law in This New Domain of Human Activity

On October 4, 1957, the Soviet Union launched a space object, Sputnik I, which subsequently orbited the Earth over 1400 times during the following 3 month period. This momentous achievement heralded the dawn of the space age, the space race (initially between the Soviet Union and the United States), and the legal regulation of the use and exploration of outer space.

This chapter is based on research in the Yearbook on Space Policy 'Space in a Changing World', distributed by the European Space Policy Institute (ESPI) in Vienna.

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Some earlier scholarship had, of course, considered the nature and scope of laws that might apply to outer space, but only at a hypothetical level.[1] However, history changed forever on that day in 1957. Suddenly, the reality of humankind's aspirations and capabilities with respect to outer space became apparent. The world had to react, quickly, to an unprecedented event in an unregulated legal environment, particularly because it was clear that this was just the dawn of a quest to undertake a wide range of space activities. Since then, a range of law has developed that relate to activities in outer space. Much of this legal regulation has served to significantly improve the standard of living for all humanity through, for example, the facilitation of public services such as satellite telecommunications, global positioning systems, remote sensing technology for weather forecasting and disaster management, and television broadcast from satellites.

In some senses, this still represents a reflection of the relatively early stages of our adventures in outer space. We have moved on from the first quite tentative steps into outer space, but there is more that is yet to be attempted. There is no doubt that the prospects for the future use of outer space offer both tremendous opportunities and challenges for humankind, and law will undoubtedly continue to play a crucial role in this regard.

The journey of Sputnik I immediately gave rise to difficult and controversial legal questions, involving previously undetermined concepts. Although the Soviet Union had not sought the permission of other States to undertake the Sputnik mission, there were no significant protests that this artificial satellite had infringed on any country's sovereignty as it circled the Earth. This international (in)action confirmed that this new frontier of human activity – outer space – did not possess the elements of sovereignty that had already been well established under the international law principles regulating land, sea and air space on Earth.

The law of outer space has developed within the context of general public international law. Since the launch of Sputnik I, this process of evolution has been remarkably rapid. That said, the United Nations Space Treaties were formulated in an era when only a small number of countries had space-faring capability. The international law of outer space thus, at least partially, reflects the political pressures imposed by the superpowers at that time. Indeed, even the question of where air space ends and outer space begins has not been definitively determined from a legal viewpoint, although more recently a consensus as to a demarcation point (100 km above mean sea level) has begun to emerge.[2]

Nevertheless, there is now a substantial body of law dealing with many aspects of the use and exploration of outer space, mainly codified in and evidenced by the United Nations Space Law Treaties as well as some other treaty law, United Nations

[1] For a summary of the main academic theories relating to 'space law' in the period prior to the launch of Sputnik I, see, for example, Lyall, Francis, and Paul B. Larsen. 2009. *Space Law: A Treatise*. Surrey: Ashgate Publishing Limited, 3–9.

[2] See, for example, Freeland, Steven. 2009. The 2008 Russia / China Proposal for a Treaty to Ban Weapons in Space: A Missed Opportunity or an Opening Gambit? In *Proceedings of the Colloquium on the Law of Outer Space 2008*, ed. Corinne M. Contant Jorgenson, 51:261–271. Washington: American Institute of Aeronautics and Astronautics.

General Assembly Resolutions, national legislation, the decisions of national courts, bilateral arrangements, and determinations by Intergovernmental Organizations.

Yet, the complexity of human activities involving outer space has become ever more intricate, particularly in light of the rapid development of space-related technology over these past 50 plus years and, thus, there are myriad factors to consider when assessing what form the future regulation of outer space may take. This is so for many reasons, not the least that outer space is a dynamic technological area. As is the case in many areas of scientific development, the technology that drives outer space activities has progressed far more rapidly than the specific laws that regulate it, which appear to be lagging behind. It is clear that many of these new activities could not even have been within the contemplation of the drafters of the United Nations Space Treaties. The fundamental space law principles that are set out in those instruments, as important as they are for the regulation of outer space, may not be enough to provide clarity with respect to yet-untested space activities, and we will thus need to establish appropriate modes by which general international law principles can be utilized to fill these lacunae.

This is complicated further by the fact that outer space, once primarily the domain of States (and, even then, only a small number of them), is now 'host' to a vast array of actors, each with differing goals, capacities, agendas and expectations. The growing numbers of space-capable States are still crucial players – and will probably remain the principal space participants for the foreseeable future – but they are now complemented by a range of alternate space-interested entities, including intergovernmental organizations, public and private corporations, universities and scientists, and even individual space entrepreneurs.

How to Regulate the Military Uses of Outer Space

One of the crucial elements in this matrix of legal regulation is to establish and implement binding legal arrangements that promote the avoidance of armed conflict in outer space. It is no coincidence that the space race emerged at the height of the Cold War, when both the United States and the Soviet Union strove to flex their respective technological 'muscles'. This was a period of quite considerable tension, with the possibility of large scale and potentially highly destructive military conflict between the (space) superpowers of the time always lurking in the background. Indeed, it was only a few short years after Sputnik I that the world held its breath during the so-called 'Cuban Missile Crisis' in October 1962. Within this highly sensitive context, it was vital that efforts were made by the international community to regulate outer space in a manner so as to avoid a build-up of weapons in space (in more modern parlance, a strategy referred to as the 'Prevention of an Arms Race in Outer Space' (PAROS)).[3]

[3] Refer to the numerous United Nations General Assembly Resolutions, beginning with Resolution 36/97C. 1981, which have been directed towards the 'Prevention of an arms race in outer space.'

However, the conventional obligations and restrictions that were eventually agreed and codified in the major United Nations Space Treaties were then, and still remain neither entirely clear nor sufficiently comprehensive to meet all of these challenges. Whilst most space scholars would interpret the relevant provisions of those instruments as prohibiting military space activities in outer space, this was not followed by the practice of those who had the capability to utilize space technology. With the benefit of hindsight, it is now clear that space has been utilized for military activities almost from the time of the very infancy of space activities.

Since those early days, the situation has, if anything, become significantly more complex, with potentially drastic and catastrophic consequences. Just as the major space-faring nations have been undertaking what might be termed 'passive' military activities in outer space since the advent of space technology, outer space is increasingly now being used as part of active engagement in the conduct of armed conflict.[4] Not only is information gathered from outer space – through, for example, the use of remote satellite technology and communications satellites – used to plan military engagement on Earth, but space assets are now used to direct military activity, and represent an integral part of the military hardware of the major powers. It is now within the realms of reality to imagine outer space becoming an emerging theatre of warfare.

With these developments in mind, this chapter focuses on the (possible) application of the current laws of war (otherwise known as international humanitarian law or the *jus in bello*) to the use of outer space. Whilst it is clear that outer space has been and is being used for military purposes, what is not straightforward is precisely how various aspects of these activities are regulated at the international level. Instead, what appears from an analysis of the current position is that, to the extent that the existing *jus in bello* principles are applicable to space-related activities, there are undoubtedly some circumstances in which their scope of application might not be satisfactory or appropriate, particularly given the unique legal environment of outer space.

It is therefore important that law plays a clear(er) role in the regulation of military uses of outer space, and contributes in a strong way to the prevention of the 'weaponization' of space. Given, in particular, the advent of space weapons-related technology, these are issues of vital significance that are deserving of our utmost attention and efforts. This is for a number of reasons:

They are topical – there is much current discussion about how best to regulate the increasingly ominous development of space-related weapons technology;[5]

The political dimensions of this issue in the early 1980s were indicated by a split, along ideological grounds, on the main thrust of these resolutions: see Jasentuliyana, Nandasiri. 1999. *International Space Law and the United Nations*. The Hague: Kluwer Law International, 82.

[4] See Maogoto, Jackson, and Steven Freeland. 2007. The Final Frontier: The Laws of Armed Conflict and Space Warfare. *Connecticut Journal of International Law* 23(1):165–195: and Thomas Ricks. 2001. Space Is Playing Field for Newest War Game; Air Force Exercise Shows Shift in Focus. *The Washington Post*, 29 January, A1.

[5] See, for example, Krepon, Michael. 2013. Will Gravity Lift the Space Code of Conduct? http://krepon.armscontrolwonk.com/archive/3944/will-gravity-lift-the-space-code-of-conduct#more4051. Accessed 27 March 2014.

They are challenging – given the vested interests of the main space-faring States, and the emergence of the space arms race that seems to motivate military research and development even as it poses significant concerns for the wider community, it is by no means clear as to when, or indeed whether, a binding regulatory mechanism (treaty) directed towards 'de-weaponizing' outer space will be concluded among the major stakeholders anytime soon; and

They are crucial – indications suggest that, if we proceed down the current path, there is an increasing likelihood that outer space will not only be used to facilitate armed conflict (as it already is), but may ultimately become a theatre of war in the future, with consequences almost too frightening to contemplate.

A starting point for this exercise is the acknowledgement of a number of truisms: first, as noted above, that the international regulation of outer space – past, present and future – is 'embedded' in international law. It is not an esoteric and separate paradigm. In a sense, this is an obvious point, but one that is worthwhile emphasizing. It is also a logical consequence of the wording of article III of the Outer Space Treaty,[6] which requires that activities in the exploration and use of outer space are to be carried out 'in accordance with international law, including the Charter of the United Nations'.

Secondly, international law is dynamic and evolving, as has been made clear by the International Court of Justice on a number of occasions.[7] It has tremendous breadth and tremendous depth and extends to include non-traditional areas that are not 'territorial' in nature, therefore encompassing outer space. Likewise, the application of public international law principles to the regulation of outer space is equally dynamic and evolving.

Thirdly, it is obvious that the future will see an even greater range of space activities evolve. This will give rise to considerable opportunities, but also considerable challenges. There is clearly a need for regulation of such activities in an appropriate way, and international law – supplemented by national space law – represents one important and appropriate mechanism to facilitate this continuing evolution.

So far so good – the general concept is relatively simple to state – general principles of international law apply to activities in outer space. What is far more difficult and unclear is to determine precisely *how* this may work for specific situations, and precisely *which* principles are (or might be) directly applicable to particular space activities. In the absence of specific provisions in the *lex specialis* of international space law, can we simply 'transpose' terrestrial international law regimes to outer space? This question seems directly pertinent in relation to two

[6] Treaty on Principles governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 610 UNTS 205, 6 ILM 386 (1967) (Outer Space Treaty).

[7] See, for example, *Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) [1996] ICJ Rep 226.

international regulatory regimes in particular – international environmental law,[8] and international humanitarian law, to which this chapter now turns.

The *Jus in Bello* Principles – A Brief Description

Wars have been with us since time immemorial and minimum international standards have been developed to regulate *how*, *with what* and *against whom* they could be fought. In effect these rules are 'intended to limit the terrible effects of war'.[9] Even though 'war' as a concept was declared illegal by the 1928 Pact of Paris,[10] it is evident that armed conflict still continues and has become more complex, particularly given the increasing role of non-State actors. Moreover, the scope for cataclysmic destruction and loss of life has also increased due to the development of sophisticated weaponry, which includes the use of space technology.

The disastrous consequences of armed conflict upon civilians has led to an evolving international consensus that international legal rules should be introduced and implemented in an effort to alleviate human suffering during times of hostilities. This has seen the emergence of a number of legal principles that limit the methods and means of warfare, and prescribe the rights and protections both of civilians and non-civilians in times of hostilities.

These laws and customs of war had their origins in the customary practices of armies on the battlefield. These have existed in various forms almost since antiquity.[11] In 1625, Hugo Grotius, regarded by many as the 'father' of international law, published his seminal work,[12] in which he set out what he perceived to be the relevant rules relating to the proper conduct of armed conflict of the time. Since then, the rules have been significantly augmented and codified by a series of important treaty instruments, with the most significant probably being the Hague Conventions

[8] For a discussion of the applicability (or otherwise) of the terrestrial international environmental law regime to the regulation of outer space, see, for example, Bohlmann, Ulrike, and Steven Freeland. 2013. The Regulation of Space Activities and the Space Environment. In *Routledge Handbook of International Environmental Law*, ed. Alam, Shawkat, Md Jahid Hossain Bhuiyan, Tareq M.R. Chowdhury, and Erika J. Techera, 375–391. London: Routledge.

[9] Dissenting Opinion of Judge Koroma in *Legality of the Threat or Use of Nuclear Weapons* [1996] 1 ICJ Rep. 245.

[10] Article I of the General Treaty for the Renunciation of War U.K.T.S. (1929) 29 provides:

'The High Contracting Parties solemnly declare in the names of their respective peoples that they condemn recourse to war for the solution of international controversies, and renounce it as an instrument of national policy in their relations with one another.'

[11] For a discussion of the historical evolution of the regulation of armed conflict going back some 5000 years, see ed. Bassiouni, M. Cherif. 2000. *A Manual on International Humanitarian Law and Arms Control Agreements*. USA: Transnational Publishers, 5–15.

[12] Grotius, Hugo. 1625. *De Jure Belli ac Pacis.* English edition: 1814. On the Law of War and Peace (trans: Campbell, A.C.). Constitution Society. http://www.constitution.org/gro/djbp.htm. Accessed 21 November 2013.

of 1899 and 1907, the four Geneva Conventions of 1949, and the Additional Protocols I and II to the Geneva Conventions of 1977.[13]

In (overly) simplistic terms, the principal rules under the *jus in bello* can be described as follows:[14]

1. Principle of distinction – deliberate attacks against civilians and non-combatants are prohibited. In addition, those engaged in armed conflict must not use weapons that are incapable of distinguishing between combatants and non-combatants;
2. Principle of military necessity – acts of military force undertaken during armed conflict must, as a minimum, be necessary from a military perspective and must be weighed against any 'definite military advantage', so that they can only be justified if they can be regarded as imperatively demanded by the needs of war; and
3. Principle of proportionality – even when attacking a legitimate military objective, the extent of military force used and any injury and damage to civilians and civilian property should not be disproportionate to any expected military advantage. This demands an assessment of any potential 'collateral damage' in the case of military action. However, it is often difficult to apply the proportionality principle in practice, given that different people ascribe differing relative 'value' to military advantage *vis-à-vis* civilian injury and damage. One only need recall the Advisory Opinion in the *Legality of the Threat or Use of Nuclear Weapons*, where the International Court of Justice could not say categorically that the threat or use of nuclear weapons would in every circumstance constitute a violation of international law.[15]

How 'New' Warfare Impacts Upon the *Jus in Bello* Principles

At a conference in Bruges in 2010, at which the International Committee of the Red Cross (ICRC) had invited me to speak, I questioned whether the existing *jus in bello* principles, whilst necessary, would be sufficient to regulate all aspects of a space conflict. I suggested that we should aim towards a complete prohibition of all types of weapons and weapons-related systems involving outer space as an additional *jus in bello specialis* for outer space.[16] However, the prevailing view at the time of many

[13] For a comprehensive discussion of the various *jus in bello* treaty instruments, see ed. Roberts, Adam and Richard Guelff. 2005 (3rd edition). *Documents on the Laws of War*. New York: Oxford University Press.

[14] For further details, see Freeland, Steven. 2015. The Laws of War in Outer Space. In *Handbook of Space Security*, ed. Schrogl, Kai-Uwe, 81–112. New York: Springer.

[15] On this issue, the Court was divided equally, with the casting vote of President Bedjaoui deciding the matter.

[16] See Freeland, Steven. 2011. Legal Regulation of the Military Use of Outer Space. *Collegium – the Journal of the College of Europe* 41:87–97.

who attended that conference seemed to be that the existing principles *were* adequate and that 'new' forms of armed conflict would somehow 'fit into' the existing fundamental rules.

I am not entirely in agreement on this point for a number of reasons. For one thing, the principles of international humanitarian law have traditionally been regarded as being 'one war too late'. This reflects the typically 'reactive' nature of international law, where, rather than seeking to establish rules beforehand, it develops new rules (or adapts existing international law rules) to *respond* to certain, perhaps unforeseen, situations that arise. Whilst it is true that certain fundamental customary law principles codified in the space law treaties – including those that were aimed at minimizing the possibility of conflict and the risk of contamination – might be exceptions to this rule of thumb in that they were designed to *prevent* certain situations from arising, the reality is that much of the codification of international law, particularly, as noted above, in areas where technology moves forward very quickly, is (and can only be) responsive in approach. This certainly extends to areas where humans are engaged in conflict – as demonstrated in the area of international humanitarian law, as well as in international criminal law and international human rights law.

Indeed, with reference to space activities, the question arises as to whether, even if we wanted to, we are in a position to be proactive in relation to areas where we still do not fully understand the technology, and the risks and consequences associated with the utilization of that technology, even where the activity may be 'desirable' and, in theory, 'permissible'. One example is that of commercial space tourism – are we really able to create international legal standards at this point, before the fact? Isn't there a risk that, if we attempt to do so, we may be setting standards that subsequent experience will show were not appropriate?[17]

With regard to regulating the conduct of armed conflict, however – which, by contrast, involves the specification of 'undesirable' and, in many instances, 'impermissible' actions – I would suggest that a more proactive approach *is* warranted. Weapons-related technology, as well as the advent of different type of (non-State actor) participants in armed conflict has meant that the traditional mode of warfare no longer represents the absolute norm. More and more we will see the incorporation of sophisticated weapons related systems, involving cyber technology, remote controlled weapons systems (for example, drones), robotics and, of course, satellites to help to fight wars. These present very significant challenges to the application of existing legal frameworks without further adaptation and addition. One might argue that to continue to rely *solely* on existing rules that were developed in a previous technological era – as important as they are – is akin to applying nineteenth/twentieth century rules to twenty first century technology.

[17] For a discussion of the legal challenges posed by the predicted advent of (large-scale) commercial space tourism at some stage in the future, see Freeland, Steven. 2010. Fly Me to the Moon: How Will International Law Cope with Commercial Space Tourism? *Melbourne Journal of International Law* 11(1):90–118.

As Judge Lachs of the International Court of Justice has observed:[18]

> the great acceleration of social and economic change, combined with that of *science and technology*, have confronted law with a serious challenge: one it must meet, lest it lag even farther behind events than it has been wont to do.

Indeed, the advent of this weapons-related technology also offers both opportunities and challenges. One interesting opportunity that deserves further consideration is that, to the extent that it allows for greater target selectivity and accuracy, it might actually have the capacity to both minimize casualties during armed conflict and reduce the probability of collateral damage. Both of these consequences would, of course, be welcome and in keeping with the fundamental *jus in bello* principles; so much so that one might be tempted to argue that it therefore obligates a combatant to *use* this technology during the conduct of armed conflict.

On the other hand, there are real dangers inherent in this continued resort to 'long-distance' or 'zero casualty' warfare – that is, zero casualty from the user's perspective. Apart from the increased likelihood of error during the course of any long distance engagement,[19] there is a real possibility that the physical detachment of the perpetrator from the injury/destruction caused by the use of this technology may give rise to a greater moral and even ethical disengagement, and perhaps even lower the minimum threshold of adherence to standards of military conduct. Some commentators have spoken about a 'play station mentality', given that the operation of many of these systems is not dissimilar to using a computer keyboard, which represents an every-day occurrence in many people's lives.

Moreover, whilst I am in no way qualified to comment on these suggestions in a meaningful way, history has repeatedly shown that the greater the sense of moral disengagement, the greater the likelihood that the *jus in bello* principles will be violated. This is clearly a cause for considerable concern and reflection.

Applying the *Jus in Bello* Principles to Space Activities

As noted above, the existing principles of international humanitarian law, as an integral part of international law, are, in theory, applicable to the military use of outer space. There is no specific 'territorial' limitation to the laws and customs of war, which apply both to the area where the hostilities actually take place, as well as to other areas affected by those hostilities. If, for example, direct military action takes place in one area, but the effects of that action impact on civilians elsewhere,

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[18] Dissenting Opinion of Judge Lachs in *North Sea Continental Shelf Cases (Federal Republic of Germany v. Denmark and Federal Republic of Germany v. The Netherlands)* [1969] ICJ Rep 3, 230 (emphasis added).

[19] See, for example, an analysis of the various bombing errors giving rise to significant civilian casualties during the NATO bombing campaign in Serbia and Kosovo in 1999 ('Operation Allied Force') in Freeland, Steven. 2002. The Bombing of Kosovo and the Milosevic Trial: Reflections on Some Legal Issues. *Australian International Law Journal* 150–175.

that represents a relevant consideration in determining whether such action is consistent with, for example, the principle of proportionality. As a consequence, any military activity that takes place in outer space will *prima facie* be subject to the *jus in bello* principles in relation not only to that direct action, but also as to its effects elsewhere, including on Earth.

Having reached this conclusion, it is then necessary to determine whether this is just an issue of academic curiosity or, alternately, that the rules of war are 'relevant' to activities in outer space. The answer, unfortunately, appears self-evident.

The United Nations Space Treaties confirm *inter alia* that outer space is to be regarded as a 'global common' area and that the use and exploration of outer space is to be for 'peaceful purposes', although this latter principle has been highly controversial. Indeed, the 'peaceful purposes' provision set out in Article IV of the Outer Space Treaty has been the subject of much analytical discussion as to its scope and meaning. While there is general agreement – but not complete unanimity – among space law commentators that this is directed against 'non-military' rather than merely 'non-aggressive' activities,[20] the reality has, unfortunately, been different. As noted, it is undeniable that, in addition to the many commercial, civilian and scientific uses, outer space has and continues to be used for an expanding array of military activities. Unless concrete steps are taken to arrest this trend – which will require a significant shift in political will, particularly among the major powers – it is likely that space will increasingly be utilized to further the military and strategic aims of specific countries, particularly as military and space technology continues to evolve and develop.

In this context, if one were to adopt a hard-line pragmatic view, it seems that the 'non-military vs. non-aggressive' debate relating to the peaceful purposes requirement is a redundant argument, even though it represents an extremely important issue of interpretation of the strict principles of international space law. In one sense, this assumes that the militarization of space is a given, as much as it pains international and space lawyers to admit this. [21]

These circumstances starkly illustrate that outer space has been used for military purposes since the very early days – indeed, it has been the military forces of the two space superpowers that has driven the initial impetus for the development of

[20] See, for example, Schrogl, Kai-Uwe, and Julia Neumann. 2009. Article IV. In *Cologne Commentary on Space Law, Volume I – Outer Space Treaty*, ed. Hobe, Stephan, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl, 70–93, 82. Cologne: Wolters Kluwer.

[21] One should note that, by virtue of Article 31(3) (a) and (b) of the Vienna Convention on the Law of Treaties (1155 UNTS 331) the provisions of the Outer Space Treaty may be interpreted differently, or their meaning might be changed by subsequent agreements among, and the subsequent practice of, States Parties to the Treaty. In this regard, for example, one may note the practice of some States Parties to the Outer Space Treaty that consider 'peaceful uses' of outer space to include military but non-aggressive uses, even though, in general terms, peaceful uses was initially widely regarded as encompassing only to non-military uses: see Jakhu, Ram S., and Steven Freeland. 2014. The Sources of International Space Law. In *Proceedings of the International Institute of Space Law 2013*, ed. Corinne M. Contant Jorgenson, 56:461–478. The Netherlands: Eleven International Publishing.

much of the space technology we use today, as well as the space policy that still directs many space activities. These factors remain pivotal even in more modern times, are highly troubling, and perhaps also contradictory to the general principles set out in the Outer Space Treaty. Yet, it would be naive to ignore the realities – rather it is important both to understand what (and how) existing legal principles, including the rules of the laws of war, apply to any military activities involving outer space and to determine what needs to be done to provide, at least from a regulatory perspective, an appropriate framework to protect humankind in the future.

In 2001, prior to the attacks on September 11, a commission headed by former United States Secretary of Defense Donald Rumsfeld suggested that an 'attack on elements of U.S. space systems during a crisis or conflict should not be considered an improbable act.'[22] The Report went on to (in)famously warn of the possibility of a 'Space Pearl Harbor' – a surprise attack on the space assets of the United States.

It was during the Gulf War in the early 1990s that the military value of space assets for the conduct of warfare began to be utilized to a significant degree. Indeed, 'Operation Desert Storm' is regarded as 'the first space war'.[23] It was recognized that the use of space technology would create an 'integrated battle platform' to aid in the implementation of military strategy. Following the attacks of 9/11, the United States Administration embarked on a policy designed to dominate the space dimension of military operations. This necessitates having the ability to protect critical United States infrastructure and assets in outer space. Although the Obama administration has more recently issued updated space policy statements that emphasize cooperation to a far greater degree,[24] these sentiments still represent the approach of the United States military, and this trend has ratcheted up considerably in the two decades, in parallel with a period of increasing commercialization of outer space. This has led to the growing reliance of States on continuous and reliable access to privately operated satellites, in order to protect their (real or perceived) national security interests.

A combination of factors – the increasing dependence by military and strategic forces within (the major) powers on the use of satellite technology; the inability of Governments to themselves satisfy such demands for reasons associated either with costs or the lack of technological expertise (or both); and the advent of commercial satellite infrastructure and services that are responsive, technologically advanced, available and appropriate to meet these demands – means that military 'customers' now can utilize commercial satellites to undertake their (military) activities.

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[22] See Stoullig, Jean-Michel. 2001. Rumsfeld Commission Warns Against "Space Pearl Harbor". Space Daily. http://www.spacedaily.com/news/bmdo-01b.html. Accessed 27 March 2014.

[23] Maogoto, Jackson and Steven Freeland. 2007. Space Weaponization and the United Nations Charter: A Thick Legal Fog or a Receding Mist?. *The International Lawyer* 41(4): 1091–1119, 1107.

[24] See President of the United States of America. 2010. National Space Policy of the United States of America. http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf. Accessed 28 March 2014.

Thus, we have become familiar with the concept of 'dual-use' satellites. Indeed, the concept of a dual-use facility or resource – typically a commercial facility or resource that is also utilized by the military for military purposes – has become a common feature of contemporary technological society. It is also one with which international law has had considerable difficulties.

This presents particular challenges for those conducting armed conflict, since an asset that could *prima facie* be regarded as a legitimate military target on the basis of the *jus in bello* principles might also – even at the same time – be operating for civilian and/or commercial uses. It is sometimes very difficult, or indeed impossible, to 'quarantine' what is the civilian/commercial aspect of a facility from the military component. Given that such an increasingly important group of space assets used for military purposes are these dual-use satellites, one is also drawn to the question of whether, and in what circumstances, such a satellite can (ever) be regarded as a legitimate target of war. Certainly, it is possible that, taking into account at least the first two *jus in bello* principles described above (distinction and military necessity), one could construct an argument that, in particular circumstances, a satellite *would* in fact constitute such a target.

This issue seemingly conflicts with the fundamental principles of article IV of the Outer Space Treaty. To use military force, for example, to disable or even destroy a satellite appears to contradict the underlying 'peaceful purposes' rationale although, as noted above, the meaning of this expression has been the subject of some debate. In addition, the resolution of the question involves not only a consideration of the *jus in bello*, but also the rules relating to the prohibition of the use of force – the *jus ad bellum*. Also relevant will be the scope of the inherent right to self-defense as articulated under article 51 of the United Nations Charter, and possibly as modified under customary international law (for example, is there now a right of pre-emptive self-defense under customary international law?).

Moreover, very significant – perhaps insurmountable – difficulties would arise in attempting to apply the principle of proportionality in assessing the legality of a strike against a satellite. Once again, we simply do not fully understand the consequences of such an action, which makes an objective (in reality subjective) evaluation of that threshold requirement mere guesswork in most cases, particularly with respect to a dual-use satellite.

Concluding Remarks – Can We Agree on Appropriate Binding Principles?

In these circumstances, therefore, my suggested proactive approach would ideally involve the conclusion of a binding treaty instrument that would comprehensively prohibit *all* weapons in outer space, as well as an acts designed to permanently damage or destroy an operative satellite. Naturally, the devil would be in the detail, and great care would be required to craft the most appropriate wording for such

an instrument. This is not to say that the important *jus in bello* principles would not also be relevant; rather, this would add to and complement those principles to the extent that they apply to the regulation of outer space activities. I am not naïve enough to suggest that agreeing to the most appropriate regulatory framework would be an easy task, but, given the uncertainties of relying solely upon the existing principles, I firmly believe that it is a necessary one.

Of course, when one moves to such considerations, one is dealing with areas that are heavily influenced with political considerations. This translates into a willingness – or not, as the case may be – on the part of States to conclude, let alone adhere to, binding international law agreements in relation to the legal regulation of outer space. Discussions among international lawyers are, at times, predicated on an assumption that States actually want such binding rules. But do they really in every circumstance?

In 2011, I was invited by UNIDIR to address a conference in Geneva on the issue of the legal regulation of military aspects of outer space, which was attended by delegates of the Member States of the Conference of Disarmament. I believe that I was the only (practicing) lawyer in a room full of diplomats and senior military officials. They listened politely as I spoke about the need for binding principles that, ideally, would prohibit any weaponisation of outer space, as well as any 'active' armed conflict in outer space.

Yet, almost as soon as I finished my presentation, the discussion quickly moved away from a path forward based on binding legal rules to one that was centered on that increasingly turned-to mode of 'transparency and confidence building measures' (TCBMs). For many complicated and mainly political reasons, it seems clear that the main space powers do not yet feel that there is sufficient mutual trust such as would 'justify' negotiations leading to a binding instrument addressing this issue. Indeed, given the difficulties that some see as far as verification is concerned, it is certainly not likely that such a treaty will be concluded in the foreseeable future.

Of course, reference to TCBMs is quite common in the United Nations General Assembly Resolutions that deal with various aspects of the use and exploration of outer space,[25] so those involved in areas relating to space law are not unfamiliar with the concept. Indeed, it does make sense for the protagonists to develop cooperative and friendly relations in matters relating to space security, so as to increase the possibility that we might eventually see binding rules.

However, the concern as I see it is that non-binding TCBMs are, in fact, for all practical purposes considered as the 'end game' on this issue, so that the formalization of binding obligations may *never* eventuate. This makes the application of general principles of international law more complicated with respect to this very important area and, in any event, is not satisfactory given the added flexibility that such measures may give to States, who may feel at some point that they no longer

[25] See, for example, United Nations General Assembly Resolution 65/68. 2011. Transparency and confidence-building measures in outer space activities, http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/65/68. Accessed 28 March 2014.

wish to abide by whatever voluntary guidelines have been specified, irrespective of the political cost.

This highlights again the increasing reliance in the regulation of outer space on so-called 'soft law'. Putting aside my objections to that title, there is much debate about the legal status of such instruments.[26] Certainly, it appears that some non-binding space instruments have a higher legal 'value' than others. However, in (again overly) simplistic terms, at their core they are merely guidelines or recommendations that do not necessarily have the force of law, unless they are to be regarded as reflecting rules of customary international law. Given our increasing reliance on such measures in a whole range of space-related matters, do we run the risk that they will work only until they don't? Shouldn't they always be regarded only as interim measures, until traditional international law principles can be agreed and applied? And, indeed, is this approach feasible given the multitude of risks associated with the continued development of space related weapons technology?

These are difficult questions that require a lot of thought. They very much reflect the challenges of regulating outer space in a changing world. Law must play an integral role in addressing these issues. No doubt the terrestrial principles of the *jus in bello* are very important elements in a broader framework – but I believe that, whilst necessary, they are not necessarily sufficient binding norms to cover the challenges that lie ahead. Additional specific legal principles will be necessary. This will require political will, close cooperation and greater trust between the major space powers, supported by other States and the international community, and a real sense of the fundamental sentiment of 'humanity' that underpins both space law and international humanitarian law. Only if we can achieve this in its entirety do we have the chance to agree to a comprehensive legal regime that is capable of providing more certainty and comfort, so as to lessen the chances of a conflagration involving space assets, with all of the negative and unknown consequences that this would entail.

[26] See Freeland, Steven. 2011. For Better or For Worse? The Use of 'Soft Law' within the International Legal Regulation of Outer Space. *Annals of Air and Space Law* XXXVI:409–446.

Outer Space as Private Property and Theater of War?

José Monserrat Filho

It is now time for some considerations about the private economic power and its autonomy, understood as a tendency to escape the grip of the state -centric-law (both domestic and international) and to employ self-regulation.

–Luigi Condorelli and Antonio Cassese[1]

Abstract This article discusses two contemporary trends strongly related pressing in growing scale the global space political game for the establishment in outer space and celestial bodies of the right to private property and for the installation of weapons in outer space. These trends are not only supported by space powers, but also and in particular by some large private corporations, involved in the high military industry, as well as in the exploitation of space natural resources, mainly precious minerals from the Moon and asteroids. The article tries to demonstrate that so far there is no international legal basis for the recognition of the right to private property in outer space and celestial bodies. Quite the contrary, the Article II of Outer Space Treaty is very clear in rejecting any kind of appropriation in outer space and also in celestial bodies. The author defends an international regime for the exploitation of space natural resources, beneficial for the development of all countries, and criticizes the installation of weapons in Earth orbits which can transform the outer space into theater of war and tease immeasurable dangers for our already so threatened planet and its inhabitants.

This article reflects exclusively the author's view.

[1] In the article "Is Leviathan Still Holding Sway Over International Dealings", published in the book "Realizing Utopia – The Future of International Law", set forth by Antonio Cessese, United Kingdom: Oxford University Press, 2012, pg. 20.

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Introduction

There are two growing pressures in the game of space policy in the world of today, which are strongly related. One forces the establishment in outer space and in celestial bodies of the right to private property, especially in the interests of large corporations. The other one forces the installation of weapons in outer space, which can turn it into the fourth field of battle, in addition to the land, the sea and the airspace. This article aims to discuss both trends.

Private Property in Space: A Sixteenth-Century Paradigm?

The present chapter already was written, when – in 25 November 2015 – President of the United States signed into law the US Commercial Space Launch Competitiveness Act (HR 2262), whose Title IV regulates the Space Resources and Utilization. The Section 402 of the Title IV refers to the facilitation of "commercial exploitation for and commercial recovery of space resources by United States citizens", and the promotion of "the right of United States citizens to engage in commercial explorations for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government". According to the § 51,303, US citizens engaged in commercial recovery of an asteroid resource or a space resource under this chapter "shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States."

In its turn, the Act's Section 403 assures that the US does not assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body (See https://www.congress.gov/bill/114th-congress/house-bill/2262/text).

In fact, this is a US national law that legislates on an activity performed outside the US jurisdiction. No country is given the right to regulate an activity carried on by its citizens in a place that can not belong to any particular country, under current international space law.

The critical remarks made in this chapter about attempts to legally justify the exploitation by one country of natural celestial bodies and space in general, also apply to this law, as we shall see.

Attorney Wayne N. White Jr., among others, has advocated for property rights in space, and proposed "a regime of real property rights which would provide an element of legal certainty and incentive for private ventures. The concept of real property rights is intimately tied to the sovereignty which nation states exercise over territory."[2]

[2] White, Jr., Wayne N, Real Property Rights in Outer Space, Proceedings, 40th Colloquium on the Law of Outer Space, p. 370 (IISL 1997). Published by American Institute of Aeronautics and Astronautics, 1998.

On the other hand, William Hartmann, a senior scientist at the Planetary Science Institute headquartered in Tucson, Arizona, commented that:

> the proposals put forth by the entrepreneurial community — namely, that whoever plants a flag on an 'island in space' such as the moon or an asteroid can claim private/corporate ownership — are perpetuating a 16th-century paradigm. That paradigm, arguably, in the long run, led to greater separation of the 'haves' and 'have-not' nations and families, and ultimately led to international warfare, which continues today, to control the resource-rich parts of the globe. Surely, we must take some time to work out more innovative, realistic legal frameworks aimed at making life better for everyone.[3]

In turn, concerned with the development of this question, the Board of Directors of the International Institute of Space Law (IISL) published two Statements on the issue of Property Rights Regarding The Moon and Other Celestial Bodies, in 2004 and 2009. The first Statement concluded that "to comply with their obligations under Articles II and VI of the Outer Space Treaty,[4] States Parties are under a duty to ensure that, in their legal systems, transactions regarding claims to property rights to the Moon and other celestial bodies or parts thereof, have no legal significance or recognized legal effect." The second Statement points out that "any purported attempt to claim ownership of any part of outer space, including the Moon and other celestial bodies, or authorization of such claims by national legislation, is forbidden as following from the explicit prohibition of appropriation, and consequently is prohibited and unlawful." (See the complete texts of both IISL Statements in Annexes).

Is War in Space Closer Than Ever?

As to the pressure to deploy weapons in outer space, a recent article entitled *War in Space May Be Closer Than Ever* published in *Scientific American* affirms that "China, Russia and the U.S. are developing and testing controversial new capabilities to wage war in space." It also states that "shifts in U.S. policy are giving China and Russia more reasons for further suspicion. Congress has been pressing the U.S. national security community to turn its attentions to the role of offensive rather than defensive capabilities, even dictating that most of the fiscal year 2015 funding for the Pentagon's Space Security and Defense Program go toward 'development of offensive space control and active defense strategies and capabilities.'"[5]

It is important to point out, as did the Reaching Critical Will organization, that "the overwhelming majority of UN member states are concerned that the weaponization of outer space will lead to an arms race and insist that a multilateral treaty is

[3] David, Leonard, *Mining the moon? Space property rights still unclear, experts say*, Space.com, 25 July 2014.

[4] See http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares_21_2222.html

[5] *War in Space May Be Closer Than Ever*, Lee Billings, *Scientific American*, 10 August 2015.

the only way to prevent such an arms race, emphasizing that this treaty would not limit space access, but would prevent such limitations."[6]

It is timely also to highlight the opinion of the Editorial Board of The New York Times – entitled *Preventing a Space War* – which noted "all of the major powers have much to lose if the potential for conflicts in space escalates further."[7]

The major powers and all the global community have serious motives to be quite concerned with the possible connection between the space weapons and the risk of nuclear exchanges. As the Bulletin of Atomic Scientists has observed:

> more than one nation has successfully tested destructive anti satellite weapons in space and many more are presumed to possess anti satellite capabilities. Meanwhile, important strategic capabilities such as early warning, secure communications, intelligence gathering, and command and control increasingly run through space. This raises the troubling possibility that the use of anti satellite weapons amid a crisis between nuclear-armed nations might lead to a nuclear exchange – indeed, US war games have repeatedly demonstrated that anti satellite weapons can cause crises to escalate in unpredictable ways.[8]

Let's Create a Village on the Moon?

Johann-Dietrich Wörner, former chairman of the German Aerospace Center (DLR) and new Director-General of the European Space Agency (ESA), has proposed at the UK Space Conference in July 2015 the creation of a *village on the Moon*, probably from 2024, after the decommissioning of the International Space Station.

For Wörner, the concept of a village on the Moon:

> means different actors joining together in the same place – be it different states, individuals or private companies – to establish an infrastructure on the Moon that has the ability to do first-class fundamental research. That can be Moon science, but also cosmology, with a telescope on the far side. At the same time, it means having a development there, using Moon soil to produce structures, as a stepping-stone to going beyond.[9]

This is in principle an excellent project, especially because it seems to be based on the close cooperation among different countries, international organizations and enterprises, and carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development.

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[6] *Outer space: Militarization, weaponization, and the prevention of an arms race.* See www.reachingcriticalwill.org/resources/fact-sheets/critical-issues/5448-outer-space. Reaching Critical Will is a project of the Women's International League for Peace and Freedom (WILPF), an international non-governmental organization with an International Secretariat based in Geneva, and a New York office focused on the work of the United Nations.

[7] *Preventing a Space War*, Editorial Board, The New York Times, 29 June 2015.

[8] See http://thebulletin.org/space-weapons-and-risk-nuclear-exchanges8346

[9] Gibney, Elizabeth, *Moon village would host first class research – Europe's new space chief Johann-Dietrich Wörner explains his lunar ambitions*, Nature, 22 July 2015.

It is worth noting that Wörner, at the occasion of launching the idea of creating a village on the Moon, made a point of not talking about how to regulate such settlement. At the same time, what he defines as the main objectives of the initiative – establish an infrastructure for the local human life, and conduct fundamental science – is in perfect harmony with Article I of the Outer Space Treaty.

However, this does not mean that in the future, sooner or later, individuals, public and private companies cannot exploit lunar resources in industrial and commercial bases. But to do so, the global community of States will necessarily have to establish an international legal regime for this activity, which does not yet exist. The best way forward today is the same that led to the Outer Space Treaty: a solution with the broadest possible support.

Why a Moon Agreement?

The first article on property rights in outer space was *High Altitude Flight and National Sovereignty*[10] written in 1951 before the beginning of the Space Age by John Cobb Cooper, a legal scholar of the US Princeton University and pioneer of airspace law. Intense theoretical discussions followed, with some scholars arguing that the Moon had to be treated differently than earthbound properties and others claiming that property laws in space shouldn't differ from those on Earth.[11]

In the early 1960s, it became clear that both the US and the Soviet Union wanted to reach the moon first but, in fact, each was more worried about the results of this competition in terms of national sovereignty and property rights on the lunar soil. Fearing that the space race could lead to World War III, they decided to adopt the principle of the peaceful uses of outer space, which was partially materialized in several United Nations General Assembly (UNGA) resolutions,[12] but above all in the Outer Space Treaty, written in just three years (1964-65-66) and in force since 1967.

In the late 1960s, it became clear that a US astronaut or a Soviet cosmonaut would put his foot on the Moon for the first time. The US won the race on 20 July 1969, with great impact worldwide. The spectacular event has made clear that the Outer Space Treaty by itself was not enough. It was necessary to draw up an agreement specific to the Moon. In 1979, after about ten years of intense discussion in the United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS), the UNGA unanimously approved the *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*,[13] known as Moon Agreement,

[10] 4 Int'l. L.Q. 411 (1951).

[11] Glenn Harlan Reynolds, *Who Owns the Moon? The Case for Lunar Property Rights*, 31 May 2008. See http://www.popularmechanics.com/space/moon-mars/a3358/4264325/

[12] UNGA Resolutions 1348 (XIII), of 1958; 1472 (XIV), of 1959; 1721 (XVI), of 1961; 1802 (XVII), of 1962; 1962 (XVIII) of 1963; among others. See www.unoosa.org/oosa/documents-and-resolutions/search.jspx?&view=resolutions

[13] See www.unoosa.org/pdf/gares/ARES_34_68E.pdf

which entered into force in 1984, after the deposit of the fifth instrument of ratification. Today it is ratified by 16 States and signed by another four.[14]

Article 11 of the Moon Agreement repeats and develops Article II of Outer Space Treaty: § 2 – "The Moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means;" and § 3:

> Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non- governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof.

The same Article 11, in § 5, creates an international regime "to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible." For the first time is used the expression "exploitation of the natural resources of the Moon" which extends also to all celestial bodies. Section 7 highlights the main purposes of the international regime:

> (a) The orderly and safe development of the natural resources of the Moon; (b) The rational management of those resources; (c) The expansion of opportunities in the use of those resources; (d) An equitable sharing by all States Parties [of the Moon Agreement] in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.[15]

Naturally, the equitable sharing principle soon provoked strong and angry opposition from large corporations and their States. But the equitable sharing principle has some virtues: it does not disorganize the global market of highly contested mineral products, it does not further concentrate wealth in few countries and companies, it does not increase the already immense inequality existing among people and countries, as we witness in today's world. It is fully possible that "the vast wealth likely to flow to Earth from outer space will cause ever-greater inequality and instability in our already unequal and unstable world," as Edythe Weeks warns.[16] It should be noted that the Jimmy Carter administration (1977–1981) liked the Moon Agreement, but the business community, fearful that the sharing approach would subjugate American mineral claims to international partners, pressured the Senate, ensuring that the US did not ratify it.[17]

In sum, there are certainly many more benefits and advantages for everyone to apply the principle of cooperative undertaking and equitable sharing rather than purely private initiative, which tends to be selfish and irrational, rejecting the idea of the common good.

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[14] See http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP08E.pdf

[15] See http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html

[16] Weeks, Edythe E., *Outer Space Development, International Relations and Space Law*, US: Cambridge Scholars Publishing, 2012, p. XIII.

[17] Reynolds, Glenn Harlan, supra note 11.

Can a National Law Regulate Property Rights in Outer Space?

Several companies have been formed recently with the purpose of mining asteroids or the moon for valuable resources. Among such enterprises are Planetary Resources (founded in 2012), Robotic Asteroid Prospector (2012), Deep Space Industries (2013), and Kepler Energy and Space Engineering – KESE (2013). They have good reasons to exist. On 20 May 2012 Planetary Resources announced that one single asteroid in our solar system – 241 Germania – has US $95.8 trillion of mineral wealth inside it – nearly the same as the annual GDP of the entire world.[18]

No more than three years later, **o**n 21 May 2015, the US House of Representatives passed the *Space Resource Exploration and Utilization Act of 2015* (H.R.1508)[19] included as part of the *SPACE Act* (H.R. 2262), aiming at protecting property rights for American companies that obtain asteroid resources in outer space. Although the bill originally referenced only asteroid resources, it would be valid also for the lunar ones.

The H.R. 1508, in its section 51303 dedicated to legal framework, establishes the following norm on property rights: "Any asteroid resources obtained in outer space are the property of the entity that obtained such resources, which shall be entitled to all property rights thereto, consistent with applicable provisions of Federal law and existing international obligations."

This means that a domestic law is giving itself the prerogative to regulate property rights in outer space, therefore outside its national jurisdiction. So such domestic law did no less than to take the place of the United Nations, which since the first years of the Space Age has been discussing and adopting the more important space legal treaties and resolutions. This domestic law also displaces other countries which also have the right to participate in drafting the law on this space subject, as outer space and celestial bodies are defined as a public good open for all. Hence we are facing an absolutely unsustainable decision, from the juridical point of view both internationally and nationally – no matter the country.

A Controversial Property Rights Regime?

Meanwhile, in the opinion of Tim LeFebvre, the H.R. 1508:

> includes a very lax regulatory scheme whereby the FAA is prohibited from proposing any passenger safety regulations until the end of 2025 and requires spaceflight passengers to waive liability against launch providers and other parties. These provisions are very favorable to the industry but have critics worried, particularly as passengers are waiving liability even in the instance of negligence. Critics are also concerned about what is seen as a

[18] See www.dailymail.co.uk/sciencetech/article-2147404/Found-The-single-asteroid-thats-worth-60-billion-years-financial-output-entire-WORLD.html#ixzz3jeGBxB7s

[19] See www.gpo.gov/fdsys/pkg/BILLS-114hr1508rh/pdf/BILLS-114hr1508rh.pdf

> controversial property rights regime regarding resources from outer space without full consideration, including how this law would work in light of the Outer Space Treaty. And while the bill made it through the House with bipartisan support, there is concern it will not get through the Senate…

LeFebvre adds that "the Senate may be hesitant to pass a bill which clashes with an international treaty to which the U.S. is a signatory – the Outer Space Treaty. Traditionally the Senate is more in tune with the diplomatic ramifications of the legislation it passes compared to the House."

In this context, LeFebvre put some fundamental questions and comments:

> Can you actually own an asteroid, or if not the entire space-rock itself, can you own real estate on an asteroid in the form of a mine? Can you own the resources you extract from an asteroid? What are the rules governing property rights in space? … While there exists some legal precedent with regards to ownership of resources harvested in space, such as lunar samples, the issue remains largely open. And when it comes to actually owning a part of space property, like the asteroid or lunar location you obtained your resources from, well, there simply isn't a framework for that at present.[20]

Notwithstanding these concerns, the act was passed into law on 25 November, 2015.

Is Collecting Lunar Samples a Good Foundation for Commercial Exploitation?

Fabio Tronchetti, in turn, recognizes that there is not a legal basis for the establishment of property rights over parts of outer space, but affirms that the ownership of resources collected in space, such as the lunar sample, is lawful and can serve as a foundation for industrial and commercial exploitation of the moon or asteroid resources.

On one hand, Tronchetti argues that "all these theories aimed at allowing private property rights over parts of outer space must be refuted because they lack a solid legal basis, and because none of these proposals is able to prove that a system allowing the creation of property rights would guarantee the orderly and coordinated development of space exploitation activities."[21]

He considers that "the commercialization of outer space cannot start with the erosion or the abrogation of the fundamental concept on which the entire system of space law has been built upon, namely the non-appropriation nature of outer space." For him, "what is required is the setting out of a *corpus* of shared and internationally agreed rules which, on one side, are able to stimulate private participations in outer space explorative and exploitative activities and, on the other, respect and preserve the non-appropriative character of the space beyond the Earth's atmosphere.

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[20] LeFebvre Law, 23 May 2015. See http://timlefebvrelaw.com/uncategorized/space-law-property-rights-in-outer-space/

[21] Tronchetti, Fabio, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies – A Proposal for a Legal Regime*, Martinus Nijhoff Publishers, The Netherlands, Leiden, 2009, p. 217.

A comprehensive international juridical regime, indeed, is preferable to set (sic) of independent national legislations." On the other hand, Tronchetti proposes "movable property rights in outer space" as the basis for "the legal regime governing extraterrestrial natural resources".[22] It is worth knowing that the Apollo missions (1969–1972) collected and transported to Earth 380 kg of lunar rocks, and in the 1970s three unmanned Soviet Luna probes returned 326 g of samples.[23]

From this fact Tronchetti correctly concludes that "the appropriation of natural resources of the Moon and other celestial bodies is not forbidden under the Outer Space Treaty".[24] But can the appropriation of lunar rocks (samples) for scientific purposes – as it is obviously the case here – be interpreted at the same time as a property right for commercial purposes? Can the right of collecting material for research be seen as equivalent to the right to extract and industrialize resources to trade in the market? Is there not any difference between these two actions?

"Use of Outer Space" – What It Means?

Article I, § 1, of the Outer Space Treaty mentions the "use of outer space, including the Moon and other celestial bodies". For Tronchetti, "use" may be seen as a "synonym of exploitation." In his view, "the fact that the Outer Space Treaty does not use the term 'exploitation' while … the Moon Agreement does explicitly so, should not be used as an argument to refuse the interpretation of 'use' in the sense of 'exploitation'."[25] But there is here a non mentioned question: the Moon Agreement employs both terms "use" and "exploitation" but not as synonyms.[26] The term "use" is employed in general in the same sense of the Outer Space Treaty, while the term "exploitation" is employed only in Article 11, § 5, that creates an international regime "to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible."

If it is true, as Tronchetti notes, that the Outer Space Treaty, as well as its *traveaux préparatoires*, do not clarify the content of the term "use," it is also true that neither this Treaty, nor the Moon Agreement, contain any indication of an eventual equality between "use" and "exploitation."

Let us remember what the Moon Agreement says, for instance, in Article 6, § 2:

> In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such

[22] Id. pp. 217–218.

[23] See http://www.lpi.usra.edu/lunar/samples/

[24] Tronchetti, Fabio, supra note 21, pp. 19–20.

[25] Id. p. 223.

[26] See text of Moon Agreement, supra note 15. Its Preamble, for instance, speaks on "exploration and use", while Article 11, § 5, refers to "exploitation".

> samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions.

From this norm it is possible to infer that "use" signifies collection and removal of lunar mineral and other substances for scientific research, and for supporting lunar scientific missions. This is not related to "the exploitation of the natural resources of the Moon" that is established in Article 11 exclusively. At the same time, it is important to clarify that the term "exploration" – very frequent in outer space treaties, on the side of "use" – does not mean "exploitation", as it seems for some people, but to study, research, investigate, and seek more information and deeper understanding.

That is why Tronchetti is right in saying that "the building of a permanent manned base on the lunar surface … is nearly inconceivable without the opportunity to extract and utilize in situ the extracted resources."[27] It is vital for supporting *in situ* the base. But this has nothing to do with commercializing lunar resources, that is another history with completely different consequences.

Are the Market Forces Reliable Drivers?

It is true that since the 1960's many private companies – presumably authorized and controlled by the respective States – utilize outer space to develop their business in several areas, starting with telecommunications, without establishing any property rights over the parts of outer space from which they earn their profits. The orbits, for example, cannot be subject to appropriation by any means, although some experts see this principle as "ambiguous" and "ill-defined", especially ensuring the interests of the powers that already use these locations in space.[28]

In fact there is a considerable difference of physical characteristics and potentialities of use between outer space itself and celestial bodies. The Moon Agreement refers only to the Moon and celestial bodies' orbits and trajectories in accordance with Article I, §§ 1 and 2. Hence the effects of the commercialization on Earth of natural resources coming from outer space and celestial bodies can be rather distinct. If the commercialization of celestial bodies natural resources will be conducted just by market forces, its social and economic consequences can become uncontrolled and unpredictable, causing profound disorder in the Earthen global economy.

It should not be forgotten, as John W. Cioffi points out, that the "new financially driven economic order" – existing today – "may yet foster greater innovation,

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[27] Tronchetti, Fabio, supra note 21, p. 224.

[28] Roth, Armand D., *La prohibition de l'appropriation et les régimes d'accès aux espaces extra-terrestres* (The prohibition of appropriation and access regimes to extraterrestrial space), France, Paris: Presses Universitaires de France (PUF), 1992, p. 90.

efficiency, and productivity, but it may also sharpen distributional conflict, erode political economic legitimacy, and herald an era of greater stagnation and instability."[29] It would be so in the best hypothesis, of course.

In such critical context, it is very positive the legalistic position of Tronchetti in his "final consideration": "The future use and exploration of the lunar and other celestial bodies' natural resources requires the setting up of a comprehensive *corpus* of legal rules aimed at ensure (sic) the compatibility of such activities with the fundamental principles of the space law system, such as those contained in Articles I, II, III, VI of the Outer Space Treaty."[30]

In sum, these principles imply carrying out the space activities for the benefit and in the interests of all countries; in accordance with international law; as well as under the responsibility, authorization and control of the appropriate State; while avoiding any potentially harmful interference to the activities of other States.

The biggest challenge today is finding the best way to make a reality of all these principles. The best way seems to be the creation of an international regime, as the Moon Agreement proposes. It is necessary to negotiate a well structured international regime, in view of ensuring the participation of developed countries and its corporations in cooperation with developing countries and its enterprises, without neglecting the need to prevent the wealth concentration in a few hands and the consequent increase of inequality among nations, as well as the instability and disorder in the global economy. International cooperation should be as wide as possible, as Article 4, § 2, of the Moon Agreement indicates.

Non-appropriation Principle

The article "Laws of Property on the Moon: a future need?", by Boris Pavlischev,[31] is one of those that reflect the pressure to change the existing legal regime, which began to be articulated right at the beginning of the Space Age – led off with the flight of Sputnik-1, on 4 October 1957.

That regime was consolidated by the 1967 Outer Space Treaty, which today is ratified by 103 countries, signed by 25, and, in addition, is considered a valid custom for all the other countries, because none of them expressed any restriction to the Treaty in the more than 48 years of its existence in force.[32] According to Article II of the Outer Space Treaty, "outer space, including the Moon and other celestial

[29] Cioffi, John W., *Public Law and Private Power: Corporate Governance Reform in the Age of Finance Capitalism*, US: Cornell University Press, 2010, p. 21.

[30] Tronchetti, Fabio, supra note 21, p. 231.

[31] Published by the newspaper "Voice of Russia", Moscow, on February 20, 2014.

[32] The 1967 Outer Space Treaty today is ratified by 103 countries and signed by another 25. The United Nations has 193 Member States. 66 Member States have neither ratified nor signed the Treaty. The Holy See is a signatory, but not a member of the UN. Currently at least 201 countries are accepted to exist in our planet.

bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." This principle is so comprehensive that it leaves no room for any other interpretation. There are no loopholes, despite the efforts of some lawyers and politicians.

It is worth to remember, as the already quoted first IISL Statement remarks, that, according to international law, and pursuant to Article VI of the Outer Space Treaty, the activities of non-governmental entities – it means private enterprises – are national activities. So, "the prohibition of national appropriation by Article II thus includes appropriation by non-governmental entities (i.e. private entities whether individuals or corporations) since that would be a national activity." The second IISL Statement, in turn, affirms that "since there is no territorial jurisdiction in outer space or on celestial bodies, there can be no private ownership of parts thereof, as this would presuppose the existence of a territorial sovereign competent to confer such titles of ownership."

All modes and possibilities of private property in space and on the celestial bodies are prohibited, beginning with the Moon, for whose industrial and commercial exploitation numerous business venture projects are now being discussed.

Is It Consistent with the Outer Space Treaty?

The non-appropriation principle harmonizes perfectly with the two first paragraphs of Article I of the Outer Space Treaty:

(1) "The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."; and
(2) "Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies."

That is why outer space and the celestial bodies are "areas of common use". There is a similar case here on Earth. The Antarctica is also an "area of common use" under the Treaty of 1959, because no State can exercise its sovereignty there. Therefore, this is the legal framework in force today: outer space and the celestial bodies cannot be objects of ownership.

Could the Outer Space Treaty Be Possibly Changed?

The right answer for this question is "yes". Art. XV expresses that: "Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their

acceptance by a majority of the States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it." Legally it is relatively simple and easy to amend the Outer Space Treaty.

But politically it is another question. The overwhelming majority of its Member States, including the major powers such as the US and Russia, do not agree to amend the Treaty. Any amendment, in this case, would require a broad consensus, which does not exist today and is not even predictable.

How to Change the Outer Space Treaty?

This is the question that at this moment is faced by all entrepreneurs and those interested in extending the right of private property in outer space and on celestial bodies. Perhaps that is why they are increasing the pressure in this direction. But their arguments are fragile, unsustainable, while sometimes primarily mistaken.

Boris Pavlischev begins his Article by saying that the Outer Space Treaty "will probably have to be amended to include the activity of private entrepreneurs".

Is it Right? No, it is Wrong. The space activities of private entrepreneurs are already provided for in the Treaty. It is enough to read its Article VI:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non- governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.

Where it reads "non-governmental entities", substitute "private companies", and everything becomes clear. To the effect of that Article, the non-governmental entities (private companies) can only act in space and on celestial bodies with "authorization" and under "continuous supervision" by their respective States.

This of course may limit the action of private companies, forcing them to comply with the Treaty. As it is well known, especially the major private corporations usually have certain aversion to regulations and prefer to act within a context of the greatest possible freedom.

Territorial Disputes on the Moon?

According to Boris Pavlischev, the US entrepreneur Robert Bigelow believes that future settlements and private companies of extraction of raw materials on the Moon will provoke territorial disputes between their owners. Owner of Bigelow Aerospace Company, he designs and builds inflatable modules for dwellings, which may be used in the creation of a lunar base, with industries and hotels.

Bigelow wonders whether the owners of these facilities, including, for example, the owners of a company of gas extraction helium-3 (He-3) – so plentiful on the Moon as scanty on Earth, although very useful for research on nuclear fusion – will also be owners of the underlying area and whether they may prevent any other competitor company from entering.

For Bigelow, the lunar industry is impracticable without the guarantee of exclusive rights over the areas of extraction of natural resources.

By doing things his way, he committed an elementary error: he wrote to the Department of Commercial Space Transportation, linked to the Federal Aviation Administration of the United States, sure that this institution could issue licenses for each interested company to become owner of certain areas of lunar exploration. He was convinced that granting of titles of ownership on celestial bodies does not violate the Outer Space Treaty, according to the report of the Russian journalist. What happens is that, by the Treaty in force, no country has jurisdiction over the Moon or any other celestial body, and their parts. Thus, no country is enabled to assign titles of ownership to anyone at all.

Conflict of Laws

Pavlischev also quotes the opinion of his press fellow Igor Lisov, vice-chief editor of news in the Cosmonaut Journal, who sees a conflict of rules related to this subject: On the one hand, the Outer Space Treaty does not allow that the celestial bodies be claimed by any country, but on the other hand, he says nothing about the private use of such bodies, as we have already seen.

Lisov hit one target and missed the other. It is true, as we have seen, that the Moon and other celestial bodies are not subject to appropriation. But it is not true, as we have also seen, that the Outer Space Treaty does not mention anything about the private use of these bodies. Such use by private entities – and this is worth repeating – must be both authorized and supervised by the States.

Cases of Dennis Hope and Gregory Nemitz

Not by chance, the authorities have already dismissed claims of ownership in space by two Americans, Dennis Hope[33] and Gregory Nemitz.[34] Hope claimed to be owner of lands on the Moon and to be able to sell them, as he began to do in 1980.

[33] See www.china.org.cn/english/China/203329.htm (Xinhua News Agency 17 March 2007). See also Tronchetti, Fabio, supra note 21, pp. 203–209.

[34] See Memorandum Opinion, U.S. 9th Circuit Court of Appeals, Case No. 04–16223, February 10, 2005, www.erosproject.com/appeal/apindex.html See also Lyall, Francis, and Larsen, Paul B., Space Law: a Treatise, England, USA: Ashgate Publishing Company, 2009, p. 185.

Nemitz declared himself the owner of the asteroid Eros, and sought to collect the rent of US $20, when a NASA spaceship landed there in 2001. NASA dismissed Nemitz' demands and refused to pay, and Nemitz sued in Federal court. NASA considered Nemitz' demands an illegal action, as based on a false interpretation of the Outer Space Treaty.

The opinion of Alexander Zheleznyakov, member of the Russian Academy of Cosmonautics, was also reproduced by Pavlischev:

> Private unmanned spaceships are already flying, but soon they will be operated by aeronauts. This means that people will spend more time in the space.
>
> It is evident that some legal relationships will be established between them, as well as between representatives of different companies. Such relations will have to be regulated somehow.

Correct. It is necessary to systematize the intense commercialization of the space activities on a global level, the relationships between the companies and the countries and their populations, as well as the relations between the companies themselves.

Replace the Principle of Common Use by Private Ownership?

But this does not necessarily imply to change the Outer Space Treaty to substitute the principle of common use for private ownership. Insofar as the experience has already demonstrated in the 58 years of the Space Age, this is not necessary in order to put the benefits and wealth of space at the service of mankind.[35] What we need is to drive, with more benefits and riches, the development and well-being of more and more countries and peoples, eliminating hunger and poverty and reducing the brutal inequalities on our planet. "Due regard shall be paid to the interests of present and future generations as well as to the need to promote higher standards of living and conditions of economic and social progress and development in accordance with the Charter of the United Nations," as the Article 4, § 1, of Moon Agreement says.

Corporations can continue to contribute to major advances in the exploration and use of space, all the while under the authorization and continuing supervision of states. However, states, acting individually and within the auspices of intergovernmental organizations, such as the United Nations, are committed, as well as capable of promoting the public interest, which as it is well known, does not always coincide with the private interests.

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[35] Jakhu, Ram, Legal Issues Relating to the Global Public Interest in Outer Space, Journal of Space Law 32, no. 1, 31–110, Summer, 2006. See www.cissm.umd.edu/publications/legal-issues-relating-global-public-interestouter-space-0; Monserrat Filho, José, On Private, States and International Public Interest in Space Law, Proceedings of the 38th Colloquium on the Law of Outer Space, International Institute of Space Law, October 2–6, 1995, pp. 238–245; Monserrat Filho, José, Globalização, interesse público e direito internacional (Globalization, public interest and international law), Estudos Avançados (Journal Advanced Studies), Brazil, Sao Paulo, vol. 9, no. 25, Sept./Dec. 1995, On-line version ISSN 1806–9592; http://dx.doi.org/10.1590/S0103-40141995000300006

Military-Industrial Complex in Outer Space?

As to the pressures for installation of weapons in space, they serve above all to the interests of the corporations which today are involved with the development and production of these weapons and of the whole indispensable complex apparatus of immense global power, which amounts annually to many billions of dollars, much more than a great part of the countries are able to produce.

President of the United States (and five-star general during World War II) Dwight D. Eisenhower used the term "military-industrial complex" in his Farewell Address to the Nation on January 17, 1961, at the inauguration of the new President John Fitzgerald Kennedy.

Eisenhower advised:

> A vital element in keeping the peace is our military establishment. Our arms must be mighty, ready for instant action, so that no potential aggressor may be tempted to risk his own destruction… This conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence — economic, political, even spiritual — is felt in every city, every statehouse, every office of the federal government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications. Our toil, resources and livelihood are all involved; so is the very structure of our society. In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military–industrial complex. The potential for the disastrous rise of misplaced power exists, and will persist. We must never let the weight of this combination endanger our liberties or democratic processes. We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals so that security and liberty may prosper together.[36]

The Eisenhower alert had real grounds and over time was confirmed.

In 2003, the then journalist Theresa Hitchens (today, a Senior Research Scholar at Center for International & Security Studies at Maryland – CISSM) wrote that "corporate chieftains at major defense and space firms already are citing missile defense as much (sic) more lucrative future market than commercial/civil space operations." It came from an assessment made by the US industry, and led Hitchens to add carefully: "Considering that is the industry, rather than DoD (Department of Defense) and NASA, that carries out the bulk of R&D (Research and Development) work in the defense and civil space area, there is some possibility that an emphasis on space weaponization could shift technology investment from the commercial to the defense world."[37]

At the same time, the then US Col. John E. Hyten (today, Air Force General, Commander, Air Force Space Command, Peterson Air Force Base, Colorado) affirmed that "conflict in space is inevitable. No frontier exploited or occupied by

[36] See http://en.wikipedia.org/wiki/Military%E2%80%93industrial_complex

[37] Hitchens, Theresa, *Weapons in Space: Silver Bullet or Russian Roulette? The Policy Implications of US Pursuit of Space-Based Weapons*, *in* Space Weapons – Are They Needed?, John M. Logsdon and Gordon Adams, Space Policy Institute, The George Washington University, Washington, DC, October 2003, p. 108.

humans has ever been free from strife, but the United States has a chance to mold and shape the resolution of such conflict in the future."[38]

The danger of war in outer space has increased on a large scale in the past decade. Probably more than ever we are witness today to an accelerated space arms race. Some call it a "new Cold War."

Today, there are at least three important drafts dealing with the increasing threat of a war in outer space: (1) The Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT),[39] presented in February 2008 by Russia and China to the Conference on Disarmament (CD) in Geneva, Switzerland; (2) International Code for Space Activities[40] (last version issued on 31 March 2014), proposed by the European Union, and (3) Guidelines for the long-term sustainability of outer space activities,[41] being prepared and discussed since 2010 at the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS).

The PPWT is the most direct, consequent, and effective of these drafts, if the major goal is to not deploy weapons and to not use force in outer space, preventing it from becoming a theater of war. But the other Proposals – especially during the discussion on the question – are helping to raise awareness of many people about the crucial necessity of ensuring the use of outer space exclusively for peaceful purposes.

Concluding Questions

The complex of these today globalized corporations in fact became extremely powerful all over Earth – financially, technologically, militarily, and politically.

If they will be able to become owners in outer space and in celestial bodies, which entities actually would have the best conditions to master outer space and the space activities? In this event, which entities will be able to act with the indispensable zeal necessary for taking care of the public interests vis-à-vis the hegemonic private interests?

And the question that does not give up: must space activities be mainly governed by the law of the marketplace which puts first the interests of corporations, or by the international public interests, whose priority is established in Article I of Outer Space Treaty?

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[38] Hyten, John E., *A Sea of Peace or a Theater of War? Dealing with the Inevitable Conflict* in Space, in Space Weapons – Are They Needed?, John M. Logsdon and Gordon Adams, Space Policy Institute, The George Washington University, Washington, DC, October 2003, pp. 229–258.

[39] See www.reachingcriticalwill.org/images/documents/Disarmament-fora/cd/2014/documents/PPWT2014.pdf

[40] See http://eu-un.europa.eu/documents/en/draft_Space_Code_of_Conduct.pdf

[41] See document A/AC.105/L.298 in www.unoosa.org/

Annex I

Statement by the Board of Directors[42] of the International Institute of Space Law (IISL) on Claims to Property Rights Regarding the Moon and Other Celestial Bodies

2004

Claims to own the Moon or parts thereof by private parties have been made for many years, but so far such claims have not been taken very seriously. However, this could change, as "deeds to lunar property" have started to appear, raising the opportunity for individuals to be misled. In addition, the scope of such claims has been extended recently to other celestial bodies. Thus, the Board of Directors of the International Institute of Space Law (IISL) has concluded that there is a need for a statement regarding the current legal situation concerning claims to private property rights to the Moon and other celestial bodies or parts thereof. While this issue is only a small part of a much broader context surrounding private sector activities on the Moon and other celestial bodies, this statement is limited only to the topic of claims to private property rights to the Moon and other celestial bodies or parts thereof.

Article II of the 1967 Outer Space Treaty states that "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." The object and purpose of this provision was to exclude all territorial claims to outer space, including the Moon and other celestial bodies. As of March 2004, the Outer Space Treaty has been ratified by 98 nations, and signed by an additional 27 countries. [In 2015, there are 103 ratifications and 25 signatures.]

Article VI of the Outer Space Treaty provides that "States bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities", that is, private parties, and "for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty". Article VI further provides that "the activities of nongovernmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty."

Therefore, according to international law, and pursuant to Article VI, the activities of non-governmental entities (private parties) are national activities.

The prohibition of national appropriation by Article II thus includes appropriation by non-governmental entities (i.e. private entities whether individuals or corporations)

[42] The views expressed in this Statement represent a consensus of the Members of the IISL Board of Directors acting in their personal capacity, and do not necessarily reflect the views of any entities with which they may be affiliated. See http://www.iislweb.org/docs/IISL_Outer_Space_Treaty_Statement.pdf

since that would be a national activity. The prohibition of national appropriation also precludes the application of any national legislation on a territorial basis to validate a 'private claim'. Hence, it is not sufficient for sellers of lunar deeds to point to national law, or the silence of national authorities, to justify their ostensible claims. The sellers of such deeds are unable to acquire legal title to their claims. Accordingly, the deeds they sell have no legal value or significance, and convey no recognized rights whatsoever.

According to international law, States party to a treaty are under a duty to implement the terms of that treaty within their national legal systems. Therefore, to comply with their obligations under Articles II and VI of the Outer Space Treaty, States Parties are under a duty to ensure that, in their legal systems, transactions regarding claims to property rights to the Moon and other celestial bodies or parts thereof, have no legal significance or recognized legal effect.

Note: Notwithstanding matters covered in the above Statement, the Board of Directors of the IISL recognizes that other private activities on the Moon and other celestial bodies are permitted. Article VI of the Outer Space Treaty affirms that non-governmental entities, including private individuals, companies, and organizations, have the right to conduct activities in space in accordance with international space law, and subject to the authorization and continuing supervision of the appropriate State Party. The IISL plans to convene a Workshop to explore issues regarding the relationship of government and private sector in space.

Annex II

Statement of the Board of Directors of the International Institute of Space Law (IISL)

22 March 2009

In 2004, the Board of Directors of the IISL, an international non-governmental organization, issued a statement relating to the issue of 'property rights' in outer space. The statement can be found on the website of the IISL, at http://www.iislweb.org/publications.html.

In view of recent misleading views and discussions on this subject in the press, the Board considers that it is appropriate to further clarify a number of salient points as follows:

International Law establishes a number of unambiguous principles, according to which the exploration and use of outer space, including the Moon and other celestial bodies, is permitted for the benefit of mankind, but any purported attempt to claim ownership of any part of outer space, including the Moon and other celestial bodies, or authorization of such claims by national legislation, is forbidden as following from the explicit prohibition of appropriation, and consequently is prohibited and unlawful. Since there is no territorial jurisdiction in outer space or on celestial bodies, there can be no private ownership of parts thereof, as this would presuppose the existence of a territorial sovereign competent to confer such titles of ownership.

The current international legal regime is binding both on States and, through the precise wording of Article VI of the Outer Space Treaty of 1967, which has been ratified by 100 (in 2015, 103) countries, including all the space-faring countries, also on non-governmental entities, i.e. individuals, legal persons and private companies. The clear goal of such a regime is to preserve outer space, including the Moon and other celestial bodies, for the exploration and use of all mankind, not only for those States and private enterprises that are capable of doing so at any particular time.

At present, international space legislation does not include detailed provisions with regard to the exploitation of natural resources of outer space, the Moon and other celestial bodies, although it does set down a general framework for the conduct of all space activities, including those of private persons and companies, with respect to such natural resources.

The IISL is of the opinion that a specific legal regime for the exploitation of such resources should be elaborated through the United Nations, on the basis of present international space law, for the purposes of clarity and legal certainty in the near future. The IISL will continue to play an active role in any such discussions as they develop.

Annex III

Position Paper on Space Resources Mining

Adopted by consensus by the Board of Directors on 20 December 2015.

I. The U.S. Commercial Space Launch Competitiveness Act

On 25 November 2015, the President of the United States signed into law the U.S. Commercial Space Launch Competitiveness Act (H.R. 2262).[43]
1. It consists of four Titles:

I. Spurring Private Aerospace Competitiveness and Entrepreneurship;
II. Commercial Remote Sensing;
III. Office of Space Commerce; and
IV. Space Resource Exploration and Utilization.

Title IV, which is of interest here, addresses in preliminary way space resource exploitation. It consists of three sections, whereby Section 402 with its amendments contains most of the substantial legal provisions and envisions:

[43] See https://www.congress.gov/bill/114th-congress/house-bill/2262/text

the facilitation of "commercial exploitation for and commercial recovery of space resources by United States citizens";

discouragement of "government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration"; and

promotion of "the right of United States citizens to engage in commercial explorations for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government".

The Act determines in § 51,303 that United States citizens engaged in commercial recovery of an asteroid resource or a space resource under this chapter "shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States."[44]

II. The Legal Situation Relating to Space Resource Exploitation Under International Space Law

1. In 2004 and 2009, the Board of Directors of the IISL addressed questions regarding the appropriation of the Moon, other celestial bodies and their resources, in two statements to which reference is made. The adoption of the United States law gives rise to the following evaluation of the current legal situation:

   (a) First, the Outer Space Treaty of 1967 contains the basic legal regulation for outer space and celestial bodies. In its Article II, it provides that "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."

   (b) Second, it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies is prohibited, it is less clear whether this Article also prohibits the taking of resources. Article I para. 2 of the Outer Space Treaty specifies the right of the free exploration and use of outer space and celestial bodies, without discrimination of any kind, on the basis of equality and in accordance within international law. Yet, there is no international agreement, whether the right of "free use" includes the right to take and consume non-renewable natural resources, including minerals and water on celestial bodies.

[44] Finally, Section 403 of the Act assures that the United States does not assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.

(c) Third, according to the Moon Agreement of 1979, concluded twelve years after the Outer Space Treaty and adopted by consensus in the United Nations General Assembly, natural resources cannot become "property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person" (Article 11 para. 3). State Parties to the Moon Agreement agreed to establish an international regime to "govern the exploitation" of mineral resources "as such exploitation is about to become feasible". This clause, be it interpreted as a moratorium or not, is binding upon the sixteen States that have so far ratified the Moon. Agreement, but not upon the United States. Moreover, Article 11 has not gained the status of a rule of customary international law.

2. Therefore, in view of the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty. Whether and to what extent this interpretation is shared by other States remains to be seen.
3. This is independent from the claim of sovereign rights over celestial bodies, which the United States explicitly does not make (Section 403). The purpose of the Act is to entitle its citizens to these resources if "obtained in accordance with applicable law, including the international obligations of the United States". The Act thus pays respect to the international legal obligations of the United States and applicable law on which the property rights to space resources will continue to depend.

III. Future Perspectives

It is an open question whether this legal situation is satisfactory. Whether the United States' interpretation of Art. II of the Outer Space Treaty is followed by other states will be central to the future understanding and development of the non-appropriation principle. It can be a starting point for the development of international rules to be evaluated by means of an international dialogue in order to coordinate the free exploration and use of outer space, including resource extraction, for the benefit and in the interests of all countries.

SETI and the IAA SETI Permanent Committee: Past, Present and Possible Future

Claudio Maccone

Abstract This chapter is a short history of SETI, the Search for ExtraTerrestrial Intelligence, and the role of the IAA SETI Permanent Committee. The origins and development of SETI are traced from a seminal paper published in 1959 by Giuseppe Cocconi and Philip Morrison showing mathematically that radio communications between nearby stars were indeed possible. The first radio SETI Search was conducted by Frank D. Drake in 1960 on two nearby stars that are now known to have planets. In the following half century, SETI unrolled through the brief period of formal support by NASA to the current era of privately funded SETI research, and the activities were conducted not only in the USA, but also, independently, in the then Soviet Union, in some European countries, and in Australia and Argentina. In the meantime, the International Academy of Astronautics (IAA, based in Paris) had created in 1966 what is now the "IAA SETI Permanent Committee" to promote scholarly studies in the SETI field. For most of its existence, the activities of the Committee have been almost exclusively conducted through the two SETI Sessions (SETI 1, about SETI Science and Technology, and SETI 2, about SETI and Society) during the annual International Astronautical Congress (IAC). In recent years the Committee has been reformulated with new leadership, and its activities have expanded as scientific advances, including the discovery of exoplanets (now known to be in the thousands, but estimated to be in the billions all over our galaxy, the Milky Way). These recent developments greatly enhanced the need for SETI to be taken seriously not only by scientists, but also by lay people and politicians. This trend will continue, as in 2015 a new $100 million SETI Program was announced to be sponsored by a private entrepreneur (Yuri Milner), so that the chances of Humanity being capable of discovering the first (nearby) ExtraTerrestrial Civilization are ever and ever increasing.

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DOI 10.1007/978-3-319-27087-6_8

The Origins of SETI: The Classical Radio Scheme

SETI, the Search for ExtraTerrestrial Intelligence, had its scientific start in 1959 with the publication of the paper "Searching for Interstellar Communications" by Giuseppe Cocconi and Philip Morrison.[1] 30-year old Frank Drake immediately (1960) turned the theory into observations by "Project Ozma."[2] He only examined two nearby stars, Epsilon Eridani and Tau Ceti for "intelligent" radio emissions nearby the hydrogen line (i.e. 1420 MHz, or 21 cm) and found no ET message for us.

The hydrogen line is the hyperfine transition in the neutral (i.e. not electrically charged) hydrogen atom when the spin of the proton and the spin of the electron flip from parallel to antiparallel or vice-versa. The mathematical calculations leading to the discovery that this hyperfine transition is characterized by the two values 1420 MHz, or 21 cm, had been done around 1944–1945 by Hendrik van de Hulst in the Netherlands, and, independently, by Josif Shklowskii in Moscow. Later, in the early 1950s, the American physicists, Doc Ewen and Ed Purcell (Nobel Laureate in Physics, 1952, but not for this discovery) found experimentally the hydrogen line in the sky.

By 1960 the whole Milky Way galaxy had been mapped from the inside, where we are, by exploiting this radiation: it was then definitely confirmed that we live inside a big spiral galaxy, 100 thousand light years in diameter and we live about half way between the center (the bulge) and the outer edge. This was and continues to be the main "research territory" for SETI for the next 56 years (1960–2016).

The underlying concept is that an ET radio signal must come from a planet orbiting a "suitable" star in the Galaxy. This is based on the rationale that:

(1) Every radio astronomer (whether human or alien) knows that the hydrogen line is the most important one in the universe and
(2) Every planet orbits around its own parent star. Thus
(3) We must search for an ET message **Doppler-shifted** around the hydrogen line.
(4) We can chop the Fourier spectrum around the hydrogen line into very small bandwidths (less than 1 Hz each) and then search for a **peak of energy** into each such small band (called "bin"),
(5) If we find one such peak of energy on a precise bin, it means that a **sinusoidal carrier** is there. That is a **candidate ET signal**.
(6) Then we try to pick up the signal with traditional radio astronomy techniques and finally…
(7) We try to decipher it.

This can be called **the Classical SETI Scheme**, which was especially promoted by Jill Tarter. Only the Fast Fourier Transform (FFT) is used in order to pick up the

[1] Nature, Vol. 184, Number 4690, pp. 844–846, September 19, 1959, text reprinted in: http://www.coseti.org/morris_0.htm

[2] Drake, F. D. "Project Ozma," Physics Today, 14, 140 (1961).

signal out of the noise. However, since the FFT works well only for very narrow-band signals, wide-band signals cannot be detected at all by this classical SETI scheme.

NASA was very reticent to accept SETI as a program worthy of investing resources. It was not until 1971 that NASA Ames Research Center in Mountain View, California, with the support of Stanford University, began Project Cyclops as the first SETI study conducted under the auspices of NASA. The two leading figures were Bernard Oliver (nicknamed "Barney Oliver" by colleagues), and John Billingham. Barney Oliver was a Director of R&D at Hewlett-Packard for many years and had become one of the twenty richest persons in the United States as creator of one of the first pocket calculators produced by Hewlett-Packard.[3] John Billingham was a British medical doctor who had come to NASA Ames to medically assist the Apollo astronauts and was interested in the new research field that we now call Exobiology. In the years before 1992, Oliver and Billingham convinced NASA to start the NASA SETI Program.

The NASA SETI Program was comprised of two different parts:

(1) The ALL-SKY SURVEY to be conducted by the Goldstone (Mojave desert, CA) Deep Space Network 75-m antenna (run by JPL) and
(2) The TARGETED SEARCH on 778 stars similar to the Sun to be conducted at the Arecibo 305-m radio telescope (the largest in the world still in 2016), run by Cornell University.

The opening of both programs took place at their respective venues on October 12, 1992, exactly 500 years after the discovery of America by Christopher Columbus. There were twelve buses full of invited scientists and journalists attending the ceremonies at Goldstone. The opening speech was given by Carl Sagan and the organization by NASA was perfect. It was one of the most important events in SETI up to that date, but… surprisingly enough, they did **not** mention the word SETI at all. They were calling SETI by the unheard new acronym of HRMS for High Resolution Microwave Survey. Why? Because NASA had decided to avoid the word "ExtraTerrestrial."

In this author's view, the religious lobbies in the US Congress as well as in the country were already plotting **against** SETI. They were basically afraid that, if NASA put its best technology in the service of SETI, there was a real chance of success, and that some actual contact with ETs, or at least evidence of the existence of alien intelligent beings, might have been achieved. That would have forced the religious groups to admit that religions are based on human speculations, rather than on the scientific and astronomical facts, and thereby risk their continued religious

[3] Oliver was an excellent electronic engineer but not open to profound mathematical innovations. When this author first suggested to him in 1987 to use the KLT (Karhunen-Loève Transform) for SETI instead of the Fourier Transform (universally used to extract a feeble signal from the background noise), Barney immediately rejected the idea by saying that the FFT was quite enough for SETI. On the contrary, young Jill Tarter, even though she was referred to as "Barney's ear" by the small SETI Group at NASA-Ames, understood the KLT novelty and encouraged the pursuit of the concept. In this way Jill helped to guide this author's career in SETI, despite being located in Italy rather than in the United States.

grip on the "believers." In point of fact, after only one year, the NASA-SETI program was forced to **shut down** by Congress on October 3, 1993. The ostensible justification for this reversal in NASA policy and funding was the desire of Senator William Proxmire to kill SETI to "save money." Nevertheless, the reality is that SETI represented too great an existential danger to entrenched institutions that were able to successfully lobby for the end of US governmental funding for SETI research. This was but one more manifestation of religious intolerance of scientific advancement which has existed for centuries.[4] But the shuttering of the NASA SETI program did not put an end to SETI research, because heroic Jill Tarter did not give up.

In 1984 the SETI Institute was created and Barney Oliver contributed a very large amount of his personal funds. Over the next several years others also contributed financially and with key electronic equipment. For instance, Tarter was able to "purchase" (nearly for free) from NASA Ames the key MCSA (Million Channel Spectrum Analyzer) that had been 70 % completed at NASA Ames by October 1993. Thus, SETI was resumed by Tarter's "Project Phoenix", like the mythological Phoenix that was able to resurrect from its own ashes.[5] By the year 2000, we entered into the age of contemporary SETI.

Technological Evolution in RADIO SETI Over 55 Years (1960–2015): FFT to KLT

The recent history of telecommunications on Earth shows that **wider and wider bands are being used**: just look at mobile phones, with dual, triple and now quadruple bands. This is called frequency hopping or spread spectrum and is now used by everyone from the military to the mobile phone industry, etc. Therefore, it is better to replace the FFT by another algorithm, capable of detecting a weak ET sinusoidal carrier inside a lot of colored noise. This alternate algorithm is the KLT, or Karhunen-Loève Transform, also called the "principal axes" method in the Hilbert space.[6]

The essence of the issue can be stated as follows: Engineers only like the FFT, namely sines and cosines. They generally are not aware of many other systems of orthonormal functions, like Bessel Functions, Prolate Spheroidal Functions, Orthogonal Polynomials, etc. that are used every day in quantum physics by mathematicians and physicists. These "higher transcendental functions" (as mathematicians call them) are very suitable orthonormal bases in the Hilbert space by

[4] One example which is particularly apropos is that of Giordano Bruno, who was burned at the stake by the Catholic Inquisition in Rome on February 17, 1600, officially for being a "heretic" but in reality for claiming that the Copernican system was right and Aliens could possibly live on planets orbiting stars other than the Sun ("De l'Infinito, Universo e Mondi", written in Italian, 1582, http://en.wikipedia.org/wiki/Giordano_Bruno).

[5] http://www.seti.org/seti-institute/project/details/project-phoenix

[6] http://en.wikipedia.org/wiki/Karhunen%E2%80%93Lo%C3%A8ve_theorem

which to represent a spread-spectrum signal. The KLT just uses that mathematical apparatus, and thus many engineers are not familiar with it.

This author had written his Ph. D. Thesis in Mathematics about the KLT at King's College London (UK) in 1980. Then he made his first presentation of the KLT for SETI at the NASA Ames Group in January 1987. Jill Tarter came to appreciate the advantages of KLT for SETI later in 1987 when she was doing SETI at the Nançay radio telescope in France (near Orléans) with the French radio astronomer François Biraud and this author. Biraud's brother was a mathematician, and he also had alerted François about the benefits of the KLT for SETI. François published in 1993, in the journal Acta Astronautica, the first paper about the KLT for SETI, misleadingly simply entitled "SETI at the Nançay Radiotelescope." The merits of KLT thus became apparent.

After 1990, this author frequently visited "the Nançay of Italy," namely the set of radio telescopes at Medicina, near Bologna, which were directed by an open-minded electronic engineer, Stelio Montebugnoli. Over the next ten years (1990–2000) Stelio Montebugnoli and this author, together with many students, were able to write the code and install the KLT for SETI at Medicina. Italian SETI was further bolstered by virtue of the Serendip IV spectral analyzer, **donated** by the Berkeley SETI Group, headed by Dan Werthimer, to the Medicina group and also to the Australian SETI program. Finally, Italy completed by 2011 the construction of the 64-m dish Sardinia Radio Telescope (SRT) which will be used in part for SETI. Enhancements to the KLT implementation on radio telescopes were also recently achieved by this author's Canadian "pupil" Stephane Dumas.

Australia started conducting SETI searches at the 64-m CSIRO Parkes radio telescope in January 1998. The Australian SETI Program was then utilizing the same spectral analyzer (Serendip IV) donated by the Berkeley group to both the Italians and Australians.

The path of SETI in France was significantly altered in 2000, when Jean Heidmann, a major influence in SETI research, passed away. That same year saw the retirement of François Biraud. As a result, France stopped conducting SETI research at Nançay. It was only after the First IAA Conference of Searching for Life Signatures, held at UNESCO, in 2008, that the French tried to revive SETI. In particular, the efforts of Jean-Michel Martin and Pierre Colomb, with the organizational support of Florence Raulin, and the aid of Jean Schneider and Alain Labeque, are noteworthy. The "Atelier Formule de Drake" was the next important SETI meeting in France, and took place on November 21–22, 2011, at CNES in Paris.

SETI Institute and Allen Telescope Array (ATA) as the World-Leading SETI Institution (1984–2012): But Is That Still True in 2016?

The SETI Institute in Mountain View (Silicon Valley), California, has long been regarded as the leading SETI institution in the world. In practice, it was led by Jill Tarter since its creation in 1984 until she retired in 2012, even if formally it was led

by Frank Drake in the first few years, and by Tom Pierson later. For many years the main source of funding was a bequest by Barney Oliver, who passed away in 1995. The 1990s were "the rich years" for the SETI Institute. Jill Tarter was going around the world buying radio telescope time to do SETI at existing radio telescopes, like Nançay in France, Parkes in Australia (the largest telescope in the southern hemisphere) and the National Radio Astronomy Observatory (NRAO), in the Appalachian mountains at Green Bank West Virginia, USA. This was the age of Project Phoenix, an ambitious endeavor that began its search in February 1995 utilizing the Parkes radio telescope in Australia, and between September 1996 and April 1998, utilized the NRAO in the USA.

Project Phoenix focused the scope of its search to a list of about 800 candidate stars located within 200 light-years of Earth. These candidates were chosen based on their similarity to our own sun, in that they were probably hosting planets capable of supporting life. Unlike most SETI searches, the Project scanned for radio signals in a broad bandwidth, that of 1000 and 3000 MHz. Project Phoenix was capable of detecting a signal as narrow as 1 Hz, and concluded the search of the candidate stars in March, 2004. However, no evidence of extraterrestrial signals was found, leading Project Phoenix leader Peter Backus to make the oft quoted remark that "we live in a quiet neighborhood."

After the conclusion of Project Phoenix Jill Tarter and co-workers came to the conclusion that a brand-new radio telescope, **dedicated to SETI only**, had to be constructed. This was the Allen Telescope Array (ATA), the culmination of a concept by Frank Drake, and long an ambition of the SETI Institute. As its name implies, the ATA is an array of multiple linked antennae, which has the effect of increasing the sensitivity of the array beyond that of the individual components. The ATA is named for Paul Allen, a co-founder of Microsoft, and the Paul G. Allen Family Foundation has contributed more than $30 million since 2001 for planning, development and construction.

The completed array is to consist of 350 antennae, and the first phase of 42 antennae commenced operations in 2007. The ATA is located approximately 500 km northwest of San Francisco, California, by the Hat Creek Radio Observatory. Unfortunately, funding for operations and additional construction has been a constant challenge, and the array was placed in operational hibernation for a few months in 2011. Since then some short-term funding has been obtained, but the future is uncertain. However, the key point about today's ATA is that its **overall collecting area** equals the area of a 30-m dish, similar to the SETI-Italia facility at Medicina, and this is not large enough to conduct searches in the Galaxy beyond a radius of a few hundred light-years from Earth at best. Moreover, the number of scientists devoted to SETI research is much more limited than in the past, for example only a small fraction of the SETI Institute employees are directly engaged in radio-astronomical SETI research, with many SETI Institute researchers engaged in research in Astrobiology.

The Discovery of EXOPLANETS, the Rise of ASTROBIOLOGY and Its Bearing on SETI

The discovery of exoplanets, i.e. planets orbiting stars other than the Sun in our galactic neighborhood, began in 1995, when the Geneva Observatory group led by Michel Mayor found the first planet outside of the solar system. This led to a true explosion in the study of Astrobiology, the new science resulting from the merging of Astronomy and Biology, with heavy theoretical consequences on SETI. The progress in exoplanet discovery has been so rapid that the number of reported exoplanets can change almost daily. As of May, 2015, nearly 2000 exoplanets have been confirmed in more than 1200 planetary systems. Almost half of these planetary systems (approximately 500) are systems with multiple planets. Many of these discoveries have come from the Kepler Space Telescope, which has helped to determine that exoplanets are ubiquitous, and that there is an average of one planet per star.

The implications for SETI are enormous. Based on the data from exoplanets discovered to date, it can be concluded that approximately 20 % of stars are host to an Earth size planet in the habitable zone, that is, the area where environmental conditions may be conducive to the presence of water and therefore hospitable to life as we know it. It has been estimated that there could be as many as 40 billion potentially habitable Earth sized planets in the Milky Way alone. The discovery of a multitude of exoplanets has at least two significant ramifications for SETI: first, it can help to provide criteria by which star systems can be targeted for searching for signals and messages; and second, it both helps to quantify factors in the Drake Equation[7] as well as increase the positive result of the function of the Equation. Thus, the discovery of exoplanets adds credence, credibility, and relevance to SETI.

The Berkeley SETI Group as the Current, True Leader of World-Wide SETI

Faced with the enormous growth of Exoplanet Astronomy and Astrobiology, SETI technologies also have advanced spectacularly in this first part of the twenty-first century. Computer technologies have played a key role in this revolution, and it thus is no surprise that Silicon Valley is the world center of SETI as of 2016. But there has been a shift also: the SETI Group at the University of California at Berkeley now seems to be the leading world-wide SETI Group. In fact, the pre-eminent American discoverer of exoplanets, Geoff Marcy, also became strongly interested in SETI at Berkeley. Dan Werthimer, Associate Professor of Astronomy at Berkeley and the Berkeley Space Sciences Lab (SSL), leads the top Berkeley SETI Group together with Andrew Siemion. In 1999 Werthimer invented the SETI@home project,

[7] Maccone, C. (2010). "The Statistical Drake Equation". Acta Astronautica 67 (11–12): 1366–1383.

by which millions of users world-wide are personally involved and engaged in the search for extraterrestrial intelligence, by virtue of utilizing the excess capacity of their computers to process data from the Arecibo 305- m radio telescope, the largest in the world. Above all, Werthimer is leading the search for signals from the more than 1200 new exoplanets discovered by the Kepler Telescope with the largest steerable radio telescope in the world, at Green Bank.

The Russian SETI Program Since Kardashev (1960s)

When the Soviet Union was still standing, there was a clear rivalry between the Soviets and the Americans in SETI. Leader of Soviet SETI, and still today the "moral leader," was and is Nikolay Kardashev. He created the Kardashev Scale of ET civilizations, which is based on the **energy** that each civilization is capable of utilizing. He also suggested the use of the positronium line at 203 GHz instead of the hydrogen line for SETI searches, which would be millimetric and sub-millimetric SETI, and which has never been attempted to this author's knowledge. After the collapse of the Soviet Union, however, Kardashev was entirely concentrated on his RADIOASTRON space mission, that he was unable to pursue for over 15 years (1992–2007) due to lack of funds in Russia. Eventually, the mission was launched on July 18, 2011.

The Chinese Largest Radiotelescope in the World (FAST)

China has not publicly conducted SETI searches. However, China is currently constructing the largest radio telescope in the world, namely an Arecibo-like Five hundred meter [dish] Aperture Spherical Telescope (FAST). Upon completion, estimated in 2017, China will be in a technical position to conduct the most sophisticated SETI in the world. However, it must be stressed that the SETI "culture" in China simply does not seem to exist yet.

The UK Entering SETI Research, At Long Last, Since About 2010

It stands to reason that a country like Great Britain would be expected to have joined the SETI research long ago, but that was **not** the case. The "culprit" for this self-exclusion of Britain from SETI was no less than the 1974 Nobel Laureate and top radio astronomer Sir Martin Ryle. Ryle, who passed away in 1984, was very critical of the pioneering work that Frank Drake was doing in the United States. In particular,

he was against sending the famous "Arecibo message" transmitted by Drake toward the globular cluster M13 on November 16, 1974. Ryle dismissed the Arecibo message by saying that "when you are in a forest, it is better to listen than to shout", and his great authority blocked SETI research in the UK for over 30 years. The situation started to change, however, when Lord Martin Rees of Ludlow became President of the Royal Society in 2005. His position about SETI is that "absence of evidence is not evidence of absence" and he encouraged the small but enthusiastic British SETI community to join in what now is known as the UK SETI Research Network.[8] Particularly important to this end was the Meeting held at the Royal Society in London on January 26, 2010.

The International Academy of Astronautics SETI Permanent Committee and Its 50 Years-Long Story

Parisian space manager Jean-Michel Contant is the Secretary General of the International Academy of Astronautics (IAA), established in 1960 to foster space cooperation at the highest international, world-wide level. Contant has always been supportive of SETI and, starting with 2008, authorized this author to organize no less than six different "IAA Symposia on Search for Life Signatures":

(1) At UNESCO in Paris on September 22–26, 2008[9]
(2) At Chicheley Hall, a Royal Society conference venue in Buckinghamshire, UK, on October 6–8, 2010[10]
(3) At St. Petersburg, Russia, on June 27–29, 2011[11]
(4) In the Republic of San Marino, on September 25–28, 2012[12]
(5) At UNESCO in Paris again, on March 20–21, 2014[13]
(6) At the IAA in Paris again, on March 26–27, 2015.[14]

These international conferences on SETI were an essential meeting opportunity for SETI scientists from all over the world, and were organized under the auspices of the IAA SETI Permanent Committee. The evolution of the Permanent Committee can trace its origins to the Madrid Congress of the International Astronautical Federation (IAF) in 1966, where the first meeting was held devoted to Communication with Extraterrestrial Intelligence (CETI). Thereafter, the CETI Committee of the IAA was formed, and Rudolph Pešek, Chairman of the Astronautics Commission of

[8] http://www.seti.ac.uk/

[9] https://astrobiology.nasa.gov/articles/2008/6/28/first-iaa-symposium-on-searching-for-life-signatures/ and http://avsport.org/IAA/searchingforlife.htm

[10] http://iaaweb.org/content/view/413/572/

[11] http://iaaweb.org/content/view/437/599/

[12] http://iaaweb.org/content/view/455/615/

[13] http://iaaweb.org/content/view/555/739/

[14] http://iaaweb.org/content/view/622/818/

the Czechoslovak Academy of Sciences, became the first Chairman. The Committee provided a forum for the individuals engaged in the discipline from around the globe to meet once each year in the context of the larger annual Congress of the IAF. This created regular opportunities for the exchange of the latest ideas as well as the dissemination of cutting edge information and results of experiments and studies.

The emphasis on "communications" in the CETI acronym led to some confusion and dissatisfaction, and in the 1970s the name was changed to SETI. According to the IAA SETI Permanent Committee web site,[15] the change was precipitated by the belief that an extraterrestrial civilization would need to be detected before communications could be established. The name of the committee went through various permutations since then, and currently is the IAA SETI Permanent Committee.

The mission of the Committee is to provide a forum for the SETI scientists from all over the world where they can meet and discuss progress in the field of SETI. It currently has about forty members, who are elected by the already existing members by virtue of a peer review process. The purposes of the SETI Permanent Committee, as set forth on the IAA website, are:

> to lead in discussions of the implications of detecting extraterrestrial signals: for example, in the areas of philosophy, historical analogs, anthropology, legal, political and institutional issues, sociology, psychology and theology, and interactions with the media and the educational system. All issues concerning possible future transmissions from Earth deliberately intended for ETI will also be included. Continuing collaboration will be sought with the International Institute of Space Law on some of these questions.
>
> In addressing all of the above, the SETI Permanent Committee will seek learned papers for presentation at the SETI sessions of the International Astronautical Congress, publish the best of these papers in Acta Astronautica or elsewhere, generate and conduct, or support special Academy conferences or studies on important topics, and play a proactive role in the continuing study of extraterrestrial life and intelligence. Where appropriate, the SETI Permanent Committee will collaborate also with other committees of the Academy and the Federation, with the Bioastronomy Commission of the International Astronomical Union, and other national and international bodies and societies with an interest in SETI. These terms of reference exclude any consideration of UFO phenomena.

The selection of papers for presentation at the annual IAC has been one of the primary functions performed by the Committee. Over the years the number of papers submitted and accepted for the IAC warranted that two full sessions at each Congress be dedicated to SETI: SETI I, devoted to SETI Science and Technology; and SETI II, SETI and Society. The SETI Permanent Committee has had four areas of particular concern:

1. Issues of Policy Concerning Communications with Extraterrestrial Intelligence
2. SETI Post-Detection Science and Technology
3. Lunar SETI Studies
4. Media and Education.

[15] http://avsport.org/IAA/

Renovating the IAA SETI Permanent Committee at the IAC in Toronto, October 3, 2014

This author was elected Chair of the IAA SETI Permanent Committee on October 3rd, 2012. At that time, the work of the Committee had slowed considerably, and the Committee membership had been static, with almost no young scientists ready to take the burden of hard SETI research and push it forward. The preceding leadership, Jill Tarter (Chair up to 2002) and Seth Shostak (Chair for two terms, 2002–2007 and 2007–2012) were engaged with the Allen Telescope Array and unable to come to Paris for the annual IAF-IAA-IISL and COSPAR Spring Meetings at which, among other things, the determination of the papers to be accepted or rejected for presentation at the upcoming IAC's two SETI Session would be made. Participation of SETI Institute scientists in the IACs also decreased due to funding constraints.

This situation lasted for about 15 years, from 1997 to 2012. During this time, in fact as in the 42 years 1971–2013, the IAA SETI Permanent Committee only met once a year during the International Astronautical Congress, wherever it was held. This only-once-per-year meeting schedule clearly slowed down the Committee activity, hampering progress in the election of new Members and in keeping up with the fantastic progress in radio astronomy technology that opened up SETI to more and more new generations.

In 2006 at the IAC in Valencia (October 2–6), a controversy was sparked by Seth Shostak and Doug Vakoch, who urged the Committee to endorse Messaging to Extra-Terrestrial Intelligence (METI), also known as Active SETI, asking for radio messages to be sent by us to the Universe. The argument in favor of this resolution was "if no ET Civilization sends messages in the Universe, then there is no SETI going on in the Universe". This author and many others had always been against Active SETI because we humans are just a "young" civilization in the Galaxy, and so are "immature" in some sense. In other words, if nearby ET Civilizations are NOT benign, and if they are capable of interstellar flight (which we are not), then they might travel to the Earth and destroy us. Nevertheless, Shostak and Vakoch succeeded in "legalizing Active SETI" and their resolution was passed in Valencia in 2006 by a majority of the limited number of Committee members present at the meeting.

When this resolution became known, John Billingham and Michael Michaud resigned from the IAA SETI Permanent Committee in protest. Worst still, almost immediately after the resolution was adopted, certain private entrepreneurs offered some SETI Committee members large amounts of money to have them shouting to the galaxy commercial advertisements like "Drink Our Cola," or much worse, messages like "we speak for Earth because we are the representatives of God on Earth," reminiscent of the Nazi "Gott mit uns", and so on. Then, the international press threw discredit on the Committee itself.

Clearly this situation was hardly tolerable, and the position of the IAA SETI Permanent Committee needed to be re-evaluated from a policy perspective, and the scientific credibility of the Committee restored.

The current leadership, including this author as Chair, began to institute measures to face – and solve – the problems confronting the Committee. Specifically, the following actions have been taken:

(1) The confirmation of H. Paul Shuch, Director Emeritus of the SETI League as Co-Vice Chair.
(2) The appointment of Michael Garrett, director of ASTRON in the Netherlands, as new Co-Vice Chair of the Committee.
(3) The appointment of a new Secretary of the IAA SETI Permanent Committee, the young and energetic SETI radio astronomer Andrew Siemion of the Berkeley SETI Group.
(4) The organization of the two SETI IAA Symposia on Search for Life Signatures in Paris in March 2014 and March 2015, mentioned above.
(5) The convening of a second Committee Meeting each of the past two years in conjunction with the Symposia on Search for Life Signatures at the same venues in Paris during the spring meetings of the IAF-IISL-IAA.

The Future, as of October 2015

Up to now, we only mentioned Radio SETI as the right tool to seek for Aliens around us, but Radio SETI no longer is the **only** way of doing SETI. In the late 1990s British engineer Stuart Kingsley created an optical apparatus capable of picking up laser flashes lasting about a nanosecond (a billionth of a second), as suggested already back in 1964 by Nobel Laureate Charles Hard Townes. Now OSETI (Optical SETI) is a reality not only in the United States but also in countries with modest scientific funding like Italy.[16]

A third, imaginable way of doing SETI, in the sense of picking up on Earth radiation/particles travelling at the speed of light, would be Neutrino SETI, since each of the three neutrino types is known to travel nearly at the speed of light. But this is a job for particle physicists, not for ordinary astronomers or radio astronomers, since only particle physicists know how to measure the fluxes of an extremely small and light particle like a neutrino arriving from space. Neutrino detectors like IceCube in Antarctica, Super-Kamiokande in Japan, Gran Sasso in Italy and other neutrino detectors all over the world might perhaps one day start to conduct Neutrino SETI. As of 2015 this is just a dream of some advanced theoretical physicists.

Not to mention a fourth method, that of Gravitational Waves SETI, which have not even been investigated theoretically. The basic idea potentially supporting SETI based on Gravitational Waves is obviously the fact the Gravitational Waves are

[16] See Maccone, Intended OSETI Activities at Foam 13 Observatory (Italy), presented to the 65th IAC, Toronto, Ontario, Canada, October, 2014.

expected to travel at the speed of light, just like photons and neutrinos. However, General Relativity shows that Gravitational waves could only be the result of huge catastrophic events like a collapsing star, and so it seems unlikely that an ET Civilization, however advanced, might be able to let a star either explode or implode.

Much more "down-to-Earth", that is to say, for the immediate future of SETI are the current experimental and theoretical works in Astrobiology. This field is huge and growing, resulting from the merging of topics that, prior to the discovery of exoplanets in 1995, were regarded as belonging to different branches of science: astronomy on one side and biology on the other side. But the international community of Astrobiologists is growing enormously, as demonstrated from the two leading international Conferences in this field: the Astrobiology Science Conference (ABSCICON) in the USA and the European Astrobiology Network Association (EANA) Conference in Europe. SETI scientists are now an accepted and respected branch of the study of Astrobiology, and a few SETI talks are usually given at these Conferences.

From a highly cultural point of view, one more "recent new field" related to SETI is Big History which covers the whole history of the Universe since the Big Bang of 13.8 billion years ago up to modern humans and computers. Big History is comprised of just word descriptions, and while there is no use of mathematics yet, the concept can be quite useful to an understanding of evolution. In fact, Big History is an easy-to-read description of the sequence of discoveries in modern science (say after about 1500 A.D.) that changed the Western Civilization faster and faster up to our times, dominated by difficult-to-understand technologies and computer science.

Finally, the true future of SETI can only be in **space missions**, of which many have been proposed but none realized yet. Space missions require decades of dedicated study just to be designed, and that means a lot of financial and other resources, and a lot of competition between managers, scientists, engineers and companies. For instance, the FOCAL space mission, which would enable us to "read the plates of cars driving on extrasolar planets…"[17] was formally proposed by this author to the European Space Agency (ESA) in 2000, is now only starting to be considered by NASA-JPL also.

But the most important event affecting SETI in 2015 was the announcement by the Breakthrough Prize Foundation on July 20, 2015, that several major SETI programs had received $100 M (US) of committed funding by the Foundation. Breakthrough Listen includes 20 % of the time on the Green Bank Radio Telescope devoted to a SETI search and 20 % of the time on the CSIRO Parkes Radio telescope. In addition the Breakthrough Prize Foundation will be using the Lick Observatory Automated Planet Finder Telescope to conduct an optical SETI search.

[17] Maccone, Claudio, Deep Space Flight and Communications: Exploiting the Sun as a Gravitational Lens. (2009), Berlin, Springer Science & Business Media, and "Mathematical SETI", a 724-page book published by Praxis-Springer in the fall of 2012. ISBN, ISBN-10: 3642274366 | ISBN-13: 978-3642274367 | Edition: 2012.

Other SETI search programs are under consideration and development. They intend to observe the 1,000,000 nearest stars, 100 nearest galaxies and search the galactic plane for radio and optical SETI signals. Chaired by Pete Worden, former Director of NASA Ames Research Center in Mountain View, CA, they also are starting an effort to develop (but NOT send) a message from the people of earth.

And with this we have completed our eclectic review of the SETI developments in the 56 years of the period 1959-2015: Ad Astra!

SETI, Metalaw, and Social Media

Patricia Margaret Sterns and Leslie I. Tennen

Abstract The discovery of intelligent extraterrestrial life will thrust Mankind into a new relationship, and the manner in which Mankind interacts in the engagement of that relationship will be governed by the rules of Metalaw. Whether to engage in communication, and if so, the content of the communication, have direct metalegal consequences. The SETI Committee of the International Academy of Astronautics (IAA) has formulated Protocols regarding activities following the detection of ETI, and the sending of communications to ETI. These Protocols, which have received widespread acceptance within international organizations and the SETI community, implicitly reflect metalegal principles. However, these documents were formulated more than 20 years ago, and although some revisions occurred in 2010, they predate and thus do not consider social media and its implications. Social media represents a revolution in communications, and this article examines the significant implications of social media for the Protocols and application of the metalegal principles expressed therein.

Introduction

The search for extraterrestrial intelligence (SETI) is a part of the larger quest to answer the fundamental question of science: are we alone in the universe? SETI complements the inquiries that are being conducted in astronomy, astrophysics, and astrobiology, to discover exoplanets, as well as investigations in other disciplines such as biology and chemistry seeking to unlock the secrets to the origin of life. SETI proceeds on the assumption that there not only is life elsewhere than Earth,

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but also that such life is advanced in form and ability such that it is capable of communicating at interplanetary distances. The reception of a communication from an entity of a different planetary or celestial body initiates a relationship between the participants. The manner in which this relationship is conducted will be governed by the rules of Metalaw.

The international scientific community of SETI researchers, particularly through symposia, studies, and committees of the International Academy of Astronautics (IAA), has examined many of the issues and ramifications of first contact with an extraterrestrial intelligence. Notably, the IAA SETI Committee developed the Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence (SETI Post-Detection Protocols),[1] which has received widespread acceptance since it was formulated in 1989. The IAA SETI Committee subsequently produced a Draft Declaration of Principles Concerning Sending Communications with Extraterrestrial Intelligence (Proposed SETI Reply Protocols)[2] in 1995, and in 2010 amended the SETI Post-Detection Protocols to revise and streamline its provisions (Declaration of Principles).[3]

The SETI Post-Detection Protocols establish a process by which a candidate alien signal should be tested by the scientific community to confirm authenticity,[4] and the manner in which the announcement of discovery of an extraterrestrial communication should be made after confirmation. The SETI Reply Protocols, on the other hand, are directed to the issue of whether and how to respond to an alien signal.

A revolution has occurred in communications since the Post Detection and Reply Protocols and even the Declaration of Principles were formulated – a revolution in how we communicate on Earth. The second decade of the twenty-first century has seen the advent of social media, which has transformed from a nascent concept to a global phenomenon. Traditional methods of communication are being displaced, and social media has become a major if not the primary source of information for large segments of the population. Neither the Post-Detection and Reply Protocols, nor even the Declaration of Principles, could foresee the explosion of social media. Therefore it must be determined whether and to what extent those documents remain vital and viable *vis-a-vis* the revolution in communication.

[1] http://avsport.org/IAA/protdet.htm; see Annex I.

[2] http://avsport.org/IAA/reply.htm; see Annex II.

[3] http://avsport.org/IAA/protocols_rev2010.pdf; see Annex III.

[4] See also Iván Almár and Jill Tarter, The Discovery of ETI as a High-Consequence, Low-Probability Event. 2011. Acta Astronautica 68: 358–361 (discussing the Rio Scale for determining the credibility of a suspected alien communication).

The Search for Extra-Terrestrial Intelligence

Mankind has been searching for evidence of extraterrestrial life ever since he has been able to cast his gaze to the night sky and comprehend that he has a place in the universe. Ancient civilizations around the globe have left folklore, legends, artifacts, and even drawings which describe and depict interaction with far more advanced beings who came to Earth from a place in the stars. But ancient man could only observe the heavens for visual signs of otherworldly beings. Twentieth century technology expanded the ability of man to conduct the search for extraterrestrial intelligence beyond the visual to multi-sensory dimensions.

The modern scientific search for extraterrestrial intelligence can be traced to the article published in 1959 by Philip Morrison and Giuseppe Cocconi entitled *Searching for Interstellar Communication*.[5] This groundbreaking work posited that it would be relatively simple for radio messages to be sent between the stars, and that such messages might possibly be detected with radio telescopes. The following year, the first microwave search for an extraterrestrial signal was conducted by Frank Drake in Project Ozma. Drake focused on two nearby stars utilizing the Green Bank National Radio Astronomy Observatory 26 m radio telescope, tuned to the 21 cm (1420 Mhz) line of neutral hydrogen.[6]

In the past fifty years approximately 100 SETI experiments and projects have been conducted, from Green Bank to the Arecibo telescope in Puerto Rico, and from the Mendicina radio telescope near Bologna, Italy, to the Parkes radio telescope in New South Wales, Australia. Nevertheless, SETI has received only sporadic support from major space agencies such as NASA. For example, NASA formally included SETI research in its budget in 1992, to coincide with the quincentennial anniversary of the voyage of Columbus to the New World, but Congress cancelled the funding the following year. Since then, SETI researchers in the US have had to seek alternate sources of funding, notably private donors.

In this regard, the donations and contributions of Paul Allen and the Allen Foundation are particularly noteworthy, as they have enabled the construction of the first phase of the Allen Telescope Array (ATA). Located at the Hat Creek Radio Observatory northeast of San Francisco, California, the ATA is a radio interferometer designed to combine the capabilities of 350 separate antennae. The first phase, completed in 2007, consisted of 42 antennae. Unfortunately, funding for further construction and operations has been elusive. However, other SETI projects will benefit from the recently announced Breakthrough Listen Initiative, which has pledged $100,000,000 to search for ETI signals in the Milky Way.[7]

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[5] Nature 184, Number 4690: 844-846, September 19, 1959, text reprinted http://www.coseti.org/morris_0.htm.

[6] This hydrogen line is the "water hole," that is, the frequency at which radiation from the precession of interstellar hydrogen is detected. Many SETI researchers believe that an ETI would have detected the hydrogen line, and therefore searches are tuned to that frequency.

[7] See http://setiathome.berkeley.edu/forum_thread.php?id=77751.

Significantly, the SETI has not been restricted to the professional scientific community, as the public has been actively participating and assisting in the search by the SETI@home project which allows individuals to use their computer to analyze data from radio telescopes. Initiated in 1999, participants download a screen saver which runs when the computer otherwise would be idle, and thereby allows for the participation of large numbers of individuals from all walks of life and from all corners of the globe in SETI, as well as analyzing data more rapidly than otherwise would be possible without their participation.[8] The number of individuals engaged in the SETI@home project is several million worldwide.[9]

Metalaw and Relations with Alien Intelligence

Legal scholars considered the possibility of relations with intelligent alien beings even before mankind ventured into space. Perhaps the earliest discussion of relations between different intelligent beings can be found in the eighteenth century *De l'espirit des lois* by Montesquieu. This relationship was identified as a legal relationship, and subject to laws that exist independent of the beings.[10] Modern legal thought can be traced to the seminal presentation by Andrew G. Haley to the VIIth International Astronautical Congress in 1956, in which the term "metalaw" was first used.[11] Haley expressed the fundamental principle of metalaw: do unto others as they would have you do unto them.

This "Golden Rule of Metalaw" has moral underpinnings, as to treat an alien intelligence according to the way we humans desire to be treated is to impose our anthropocentric will and disregard the needs, wants and desires of the object (or target) of our actions. The moral component of metalaw was examined in detail by Ernst Fasan in his landmark *Relations with Alien Intelligences The Scientific Basis of Metalaw*. Fasan wrote that as Montesquieu recognized, the relationship between different intelligent beings will be a legal relationship, and thus forms the basis for

[8] See SETI@home website, http://setiathome.berkeley.edu/sah_about.php.

[9] According to the Free DC Distributed Computer Stat System, more than 3.5 million computers were part of the SETI@home network as of July, 2015. See http://stats.free-dc.org/stats.php?page=index http://stats.free-dc.org/stats.php?page=index.

[10] Baron Charles de Secondat Montesquieu, *The Spirit of the Law* (1769), German ed., Munich, 1967, pp. 57–58, cited by Ernst Fasan. 1970. *Relations with Alien Intelligences The Scientific Basis of Metalaw,* 13–4. Berlin: Berlin Verlag, text reprinted in *Oeuvres de Monsieur de Montesquieu V4: de L'Espirit Des Lois (1769).* 2009. English / French edition. Whitefish, Montana: Kessinger Publishing.

[11] *Space Law and Metalaw*, presented to the International Astronautical Congress Rome, Italy, September 19, 1956; see also Andrew G. Haley. 1963. *Space Law and Government*, Chapter 12. New York: Appleton Century Crofts.

metalaw.[12] Fasan drew from this historical origin and examined the concept of metalaw relative to the theory of natural law, to which he applied the construct of Immanuel Kant's Categorical Imperative.[13] In this perspective, a standard of rationality gives rise to moral requirements, which Fasan demonstrated should be deduced and detected by an alien intelligence.

According to Fasan,

> We have found that all intelligent races of the universe, with whom human contact may be possible, must have the following five characteristics in common:
>
> 1. *Life*
> 2. *Intelligence*
> 3. *Detectability (by the other race)*
> 4. *Three-dimensionality*
> 5. *The will to live*.[14]

The interplay of these characteristics will enable any intelligent race to arrive at the essential rules by which the relationship with another intelligent race must be governed: the rules of metalaw. Nevertheless, the characteristic of detectability by the other race must extend to the ability to communicate across life forms. Thus, it is implicit in metalaw that both parties intend to enter into the relationship by engaging in communication with one another. Once the relationship with an alien intelligence is established, the rules of metalaw will apply. Fasan distilled these rules to the following 11 statements:

1. *No partner of Metalaw may demand an impossibility*
2. *No rule of Metalaw must be complied with when compliance would result in the practical suicide of the obligated race*
3. *All intelligent races of the universe have in principle equal rights and values*
4. *Every partner of Metalaw has the right of self-determination*
5. *Any act which causes harm to another race must be avoided*
6. *Every race is entitled to its own living space*
7. *Every race has the right to defend itself against any harmful act performed by another race*
8. *The principle of preserving one race has priority over the development of another race*
9. *In case of damage, the damager must restore the integrity of the damaged party*
10. *Metalegal agreements and treaties must be kept*
11. *To help the other race by one's own activities is not a legal but a basic ethical principle*[15]

Haley's Golden Rule and Fasan's elaboration of the rules of metalaw have not been universally accepted by legal scholars. Critics of natural law theory, Kant's Categorical Imperative, or the reliance on morality as a motivator for human action

[12] See Fasan, supra note 10, p. 11.

[13] Immanuel Kant, *Werke*, Reclam Edition (Stuttgart, 1963).

[14] Fasan, supra note 10, p. 56.

[15] Id. pp. 71–2.

have transferred those criticisms to Haley and Fasan.[16] Moreover, the application of the Golden Rule, or of specific other rules of metalaw, can result in outcomes which can be immoral in certain contexts or otherwise contrary to the intents and purposes of metalaw.[17]

It may be questioned why humankind will act in accordance with metalegal principles and rules regarding an alien intelligence when man has failed to respect such principles in the past. Specifically, interactions between technically advanced civilizations and less developed indigenous populations have been conducted in direct contravention of the rules of metalaw.[18] Similarly, non-human intelligent beings, no matter how intelligent the species, have not been treated as intellectual beings with rights *qua* intelligent beings. The mis-treatment of indigenous peoples often was justified by the rationalization that the indigenous people were savages and less than human, more like animals, and animals were property to be exploited.[19] An alien civilization transmitting a message that we receive, whether or not directed to us, must be at least as generally technologically developed as are we, and thus it will be very difficult to claim that an alien civilization somehow is sub-human. Indeed, it is entirely possible that the extraterrestrial civilization will be technologically superior to the human race, in which event all of us on Earth will be potentially dependent upon ET to abide by the rules of metalaw, especially Haley's Golden Rule lest we be considered as "sub-alien" by ET.

Social Media and First Contact

Social media is a new phenomenon, which is barely in its infancy. Yet in only a few years it has become an ubiquitous source of information for large segments of the population. The number of participants on particular social media sites can number to more than 1 billion, and some sites include prominent SETI researchers and institutions. Under the right mix of circumstances any message, video clip, email, or other form of post could go "viral" as the early recipients resend and retransmit the message. By its nature, social media enables information to spread to all corners of the Earth virtually instantaneously, and to engage the recipients in the substance of the message in an intensely personal way by posting, resending, and participating in a global conversation. With the proliferation of mobile hotspots, even in motor vehicles, access can be achieved from virtually any location. It may be impossible to

[16] See Adam Korbitz. 2010. Metalaw and the Need for Further Elaboration 2–3. IAF Paper No. IAC-10-A4.2.10.

[17] See Patricia M. Sterns. 2000. *SETI and Space Law: Jurisprudential and Philosophical Considerations for Humankind in Relation to Extraterrestrial Life.* Acta Astronautica 46: 759–763.

[18] Lyall, Francis and Paul B. Larsen. 2009. *Space Law A Treatise* 558, note 107. Surrey: Ashgate.

[19] Of course, this same rationalization has been used to justify ethnic, racial and religious prejudices, and had led to some of mankind's darkest hours.

predict what messages or post may go viral, as the public whim can be ephemeral at best as to what phrase, image, or other meme will capture the imagination.

The number of individuals participating in social media is increasing by the thousands daily, and technology can be expected to make communications even faster. This historically unprecedented ability to disseminate information and to be interconnected presents both opportunities and challenges. Traditional media employs an editorial and supervisory structure to oversee the journalistic process and provide an institutional means to comply with standards and ethics. However, a significant attribute of social media is that it is uncensored, which facilitates the dissemination of information. Social media provides open and easy access to anyone desiring to participate, and the only standards and ethics are those which are self-imposed.[20]

The original SETI Post-Detection Protocols and the Proposed SETI Reply Protocols were prepared at a time before social media existed. Traditional forms of mass media communication such as television, radio and print were the primary means of disseminating information.[21] Although social media was beginning to be available when the Declaration of Principles was drafted and revised from 2008 to 2010, it was not yet recognized as a significant factor in society and thus was not referred to in the document. However, the subsequent growth of social media and the corresponding contraction of traditional forms of mass media necessitates that the Protocols and Declaration be re-examined and updated to reflect the changed landscape of communications.

Social media can have an impact in at least three different aspects of the detection of an alien signal: the first is in regard to the possibility of the disclosure of a potential ET signal prior to confirmation of the alien source; the second is for the disclosure of the discovery and related information; and the third is in regard to the sending of a message to ET in response and/or reaction to the alien signal. One reaction to the receipt of a confirmed communication from an ET will be inevitable – the desire to find out as much as possible about our celestial comrade, and the concomitant desire to engage in conversation.

Disclosure

The concern regarding a potential leak of the detection of a candidate signal is an extension of the ever present possibility of unauthorized disclosure of information that exists in most endeavors. However, the importance of preventing an unauthorized disclosure is magnified in the context of an alien signal, as few events conceivable to the mind could have a greater impact on human civilization.

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[20] C. Oliver. 2010. *Social Networking Implications for Post Detection Communications* 3. IAC Paper No. IAC-10-A4.2.5, presented to the 61st International Astronautical Congress, Prague, Czech Republic, 2010.

[21] Id. p. 4.

The SETI Post-Detection Protocols[22] establish a process for testing and confirming a candidate signal, and preserve to the discoverer the privilege of announcing the discovery of contact with an alien intelligence. The process for confirmation includes the collaboration with other investigators, whether or not signatories to the Protocols.[23] Signatories to the Protocols will be expected to preserve confidentiality during the confirmation process. Nevertheless, there will be a risk of unauthorized disclosure, which can increase as the process moves closer to ultimate confirmation. This risk also will be present when individuals and institutions who are not signatories to the Protocols are brought into the process.

The unauthorized announcement of an alien communication would be the holy grail of leaks, and the quickest and easiest way for the news to be spread would be by social media. Should such non-signatories be requested to execute the Protocols or a non-disclosure agreement? The mere making of such a request could be an indication of a possible discovery. Should priority be given to parties to the Protocols to participate in the confirmation collaborations? The SETI community must be especially mindful of the consequences of unauthorized disclosure, and encourage all individuals and institutions involved in the process of verification to become signatories to the Protocols. In addition, a list of signatories should be published on the IAA Permanent SETI Committee website and updated regularly. We also must consider the circumstance that the alien signal may be found by a SETI@home participant. These participants in the SETI are not parties to the Protocols, and are not bound to comply with its provisions. Moreover, the Protocols are informal instruments and are not legally binding. Compliance is voluntary, and there are no remedies contained in the documents for their violation. There are no significant efforts underway at present to formalize their provisions into a binding international agreement such as a treaty.

In the event of a leak, whether or not the information is accurate, should there be any formal acknowledgment or response by the SETI community? In appropriate circumstances, it may be necessary for disclosures to be made, even though the signal has not formally been confirmed. The question arises, even without a leak, at what point does information of an ambiguous discovery need to be disclosed? The Protocols provide that "inquiries from the media and news organizations should be responded to promptly and honestly." This means that information should be accurate and there should be no effort to engage in active deception. Nevertheless,

[22] The SETI Post-Detection Protocols were developed by the SETI Committee of the IAA, and approved by the Board of Trustees of the Academy as well as the Board of Directors of the International Institute of Space Law (IISL). The document has been endorsed by the Committee on Space Research (COSPAR), the International Astronomical Union, Commission J of the Union Radio Scientifique Internationale, and by the International Astronautical Federation (IAF). The Declaration of Principles, however, has not yet been formally approved by the IAA nor submitted for approval to other organizations and entities. As such, its status is unsettled. Nevertheless, as it generally restates the elements of the Post-Detection Protocols, the discussion in the text referencing the Post-Detection Protocols also shall apply to the Declaration unless stated otherwise.

[23] Paragraph 2 of the Post-Detection Protocols refers to all observers and research organizations party to the document. Paragraph 2 of the Declaration of Principles states that the collaborations shall be with other investigators whether or not they are signatories.

acceptable standardized responses in appropriate circumstances include "no comment," or that the person is unable to confirm or deny a report or statement, or to refer to the Post-Detection Protocols for the confirmation and disclosure procedures.

If the contact is anything other than a clear message directed to Earth, will there be an inherent element of doubt as to an alien origin?[24] Does the public have the right to the information and the corresponding right to draw their own conclusions? Do governments have this right? Do governments have the right to prohibit the announcement of the discovery of an alien communication? Similarly, do governments have the right to control the dissemination of information concerning the content of any message?

The Protocols provide that "All data necessary for confirmation of the detection should be made available to the international scientific community through publications, meetings, conferences, and other appropriate means."[25] It is unclear how this dissemination of information will take place, and at what point the information that circulates within the scientific community is to be open to the public. Whatever information is disseminated will find its way to the cloud. Information about ETI will be in high demand, but copyrights and other restrictions on the dissemination of information may limit distribution of data. Nevertheless protected intellectual property may find its way to public access with the aid of social media.

The possibility of unauthorized disclosure of a candidate signal carries with it the corresponding risk that the disclosure will contain incorrect, incomplete, or utterly erroneous information. The dissemination of mis-information could be inadvertent, or it could be intentional. In either circumstance, the consequences could be severe, and social media could play a key role in ameliorating or exacerbating the consequences of mis-information. The unauthorized leak of the detection of a candidate signal that turns out not to be of alien origin can harm the credibility of SETI research, especially if the mis-information were to go viral.

Notwithstanding the foregoing, it is most likely that the announcement of a confirmed reception of an alien communication would dominate all media, including social media, especially in the days immediately following. The announcement itself may well be made in a variety of media, including social media, simultaneously or within minutes of the initial disclosure. The interest of the public will be unprecedented, especially in the immediate aftermath of the announcement. The reactions and responses to an alien signal will be impacted by the form of discovery, and whether or not the message was intercepted or was directed to Earth.[26]

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[24] Ambiguity of origin can be exemplified on Earth by the Bimini Road on the Atlantic Ocean floor. While most scientists support the view that a natural process was responsible for the regularly shaped block formation, there are other opinions favoring the theory of human fabrication of the mysterious structure.

[25] Post Detection Protocol ¶ 5; Declaration of Principles ¶ 4.

[26] If the alien communication were made by electromagnetic signal, responses by amateurs, if not also professionals, will flood the frequency. Paragraph 7 of the Post-Detection Protocols provides a procedure by which the frequency can be protected. A mechanism should be put in place in advance to lay the preliminary groundwork so that the applications to the International

Nevertheless, the common belief that man is central to the essence of the universe will disappear in the aftermath of a detection, and the public will clamor for news and information as the planetary perspective undergoes a transformation.

Social media will erupt into an instant global conversation in real time. New spokespersons and self-appointed experts will emerge on social media, who may not necessarily be from the scientific community or have any particular background or expertise, yet will be assumed or deemed to be credible by their mere presence on social media. Parties to the Post-Detection Protocols will play a prominent role in the dissemination of information following a detection, as they will be sought after and relied upon for their expertise, perspectives and opinions.

Social media can be an effective tool to disseminate information by the discoverers of a confirmed alien communication, as well as their institution(s) and the SETI community at large. It would be beneficial for an official point of information to be identified and designated by the discoverers' institution(s) or appropriate entity, to be the definitive source of information. That is, the public can be notified that information obtained from sources other than the designated point of information is not to be considered as official, especially in the period immediately following the announcement. The designation of a formal point of information at the time of the announcement may significantly reduce the possibility that the public will be taken in by mis-information. It can later be determined whether a different and perhaps more formal point of information should be established or designated. The Post-Detection Protocol provides that "an international committee of scientists and other experts should be established to serve as a focal point for continuing analysis of all observational evidence collected in the aftermath of the discovery, and also to provide advice on the release of information to the public."[27]

An institution such as the United Nations Office for Outer Space Affairs (OOSA), or a new ad hoc entity are potential options for a formal point of information.[28] The question then arises, would such a formal contact point have any function other than to act as a clearinghouse and release information provided to it by the science community? Would it be given any authority to control or censor the information, or to withhold the release of certain information altogether? Do the researchers involved in SETI or their institutions have the right to censor or withhold the dissemination of information? These questions become more tortuous when the content of any

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Telecommunications Union to protect the frequency can be made as soon as possible upon detection of a confirmed signal. The signatories to the Protocols should pledge not to use the frequency and to support a future application to the ITU for protection of the frequency.

[27] Post Detection Protocol ¶ 9. The Declaration of Principles revised this provision and designated the Post-Detection Task Group under the auspices of the IAA SETI Permanent Study Group for this purpose, however the IAA has been restructured and the status of the Post-Detection Task Group is uncertain.

[28] Paragraph 7 of the Reply Protocols provides that consideration should be given to long term institutional arrangements for communications, in other words a dialogue, which is subject to metalaw. These communications do not refer to Messages to ETI (METI or active SETI) which could initiate communications with an alien civilization, but rather to a response to a confirmed signal.

alien communication is deemed by a government to contain information sensitive to national security. Paragraph 3 of the Draft Declaration of Principles rejects any censorship, at least at the time of announcement of the discovery, and provides that "the discoverer shall report this conclusion [of a confirmed alien communication] in a full and complete open manner to the public, the scientific community, and the Secretary General of the United Nations. The confirmation report will include the basic data, the process and results of the verification efforts, any conclusions and interpretations, *and any detected information content of the signal itself* (emphasis added)."

Post-detection Responses

Human nature will deem any confirmed alien communication to invite a response. Social media can be expected to have a major role in formulating the discussions following the announcement, at least insofar as the broad themes are concerned. To the extent that social media is constructed to maximize the feature of brevity of message, it is more suited to sound bites and catch phrases than it is to detailed discussions. Nevertheless, social media has been and can be expected to continue to be an effective mechanism for transmitting messages which "hit the highlights" and recipients desiring to obtain more in-depth information have the entire Internet and other resources at their disposal. In this way, social media is the current version of the newsboy of yesteryear, shouting the headlines to attract readers to the stories on the inside.

Whether to send a response, and the substance of any response, are subjects which so far have been discussed primarily within the SETI community, with limited participation by the public. The announcement of a confirmed alien communication will bring these matters to the forefront of public discourse. The SETI Post-Detection and Proposed Reply Protocols both reflect the desire that any response should be sent only after consultations with a broad representation of interested parties and entities. Both of these Protocols thus envision that there will be a period of time after a confirmed detection for these consultations to be conducted, and presumably, result in a response that reflects the beliefs of a broad spectrum of the nations of the world. To the extent that the signatories to the Protocols refrain from engaging in responses pending such consultations, they likely will be the only ones left out of the interplanetary conversations. The advent of social media has rendered the call for formal consultations to be largely outmoded as it will be the global forum for informal consultations, and individuals and companies will not seek the guidance nor the consent of any entity to respond to an alien communication even, perhaps, if legally required to do so.

At the time the SETI Post-Detection and Draft Response Protocols were formulated, only a limited number of individuals possessed the technical means to transmit a signal into space. While in the past it was necessary to have a satellite dish, antenna, or other means to transmit a message, that is no longer the case. There will

be a gallimaufry of responses within seconds of news of discovery of a signal from an ETI. Should there be limitations imposed on the public restricting their legal ability to send a message in response to an ET, such as a requirement for a license?[29] Such a limitation if attempted in the United States would be contrary to the First Amendment guarantee to all persons to freedom of speech. If the legal right to send a message cannot be limited, then perhaps the technology can be restricted. However, is it even possible to shut down social media? A complete disabling of the Internet may be possible, but it also may not be possible, as some remnants or alternate means of connectivity may continue to operate.

It may be feasible to disable specific social media web sites or applications, however social media is not a fixed monolith, and new and replacement portals can be created quickly. Moreover, advance preparations to shut down web sites would need to accurately predict which sites to shut down. However, there are a myriad of social media opportunities, and what is popular today may be passé tomorrow, and what may be possible tomorrow may not even be conceptualized today.[30] It is axiomatic that the realm of social media changes rapidly.

It can be hypothesized that social media itself could be a direct portal to converse with an ET. It has been theorized that alien intelligences may be monitoring our communications, including the Internet, and if so, the World Wide Web could be used to invite the aliens to communicate with us.[31] Should the first contact be a confirmed acceptance of that invitation by an ET by some form of Internet message, the web, and in particular social media, will burst forth into a cacophony of responses by millions of people that can be connected with a personal computer, smart phone, tablet, TV, or watch, headset, glasses, or goggles, with little regard for any consequences.

Even if the first confirmed alien communication does not take place on the Internet, social media will provide the ability and opportunity for almost anyone to participate in sending messages to an ET. A confirmed detection will produce unprecedented involvement by the public with interests and motivations ranging from science to egocentrism. The population of our planet will have a multitude of opportunities for sending messages in response to an extra-terrestrial message. Social media can be utilized for many purposes in this regard, including soliciting

[29] Lyall and Larsen, supra note 18, p. 554, note 92, citing § 9 UK Space Act, which requires a license for space activities.

[30] A comparison of the most popular social media sites from 2010 and 2015 reveals that half of the sites in the top 10 in 2010 were no longer on the list only five years later. Compare Top 10 Social Media Websites in September 2010, http://www.fortune3.com/blog/2010/11/top-10-social-media-websites-in-september-2010/, with Top 15 Most Popular Social Networking Sites | July 2015, http://www.ebizmba.com/articles/social-networking-websites.

[31] Allen Tough. 2002. *The Internet as a Gateway to ETI*, in Contact in Context 1, Issue 1; see also Invitation to ETI website, http://www.ieti.org/index.html. Although this is an intriguing proposition, an ETI would not need an invitation to send a communication to the Earth, and it may be questioned why such an ET that was monitoring our communications had not already made contact. That is, the ET monitoring our communications but refraining from contact could be exercising such forbearance as a matter of choice.

participants in sending a message, the composition and preparation of the message, and the financial pathways therefor. Websites and applications which have the technical means to send a signal into space exist today, and commercial services which will transmit messages for a fee can be expected to proliferate in the wake of a confirmed alien communication. Different groups will be formed for the purpose of sending particular messages with political, religious, commercial and other content.

Mankind has been sending messages into space for decades. In 1974, a radio message from the Arecibo antenna in Puerto Rico was transmitted to the M13 globular star cluster. Since then, approximately 100 dedicated messages have been transmitted to potential recipients in the cosmos. Not all of these have been scientific experiments, as many have been done as publicity stunts or otherwise for commercial purposes.[32] In 1977, NASA sent a physical message in the form of a disc attached to the Voyager spacecraft.[33] Moreover, since the advent of wireless communications, a sphere of electromagnetic signals has been emanating from this planet in all directions at the speed of light. In the event of a confirmed alien communication, any responses will be a manifestation of the legal relationship between intelligent civilizations, and therefore subject to metalegal principles. It does not necessarily follow, however, that such responses will be in compliance with metalaw.

Insofar as responses may be made by individuals and small informal groups, metalegal principles are unlikely to enter into their consideration. Nevertheless, Haley's Golden Rule, and most of Fasan's 11 Rules of Metalaw, concern actions beyond communications, and therefore there is not an overriding concern regarding violation by a mere message. Metalegal principles, however, can be relevant, especially regarding the basic question: must the substance of any message be truthful?

Neither the Golden Rule, nor the enumerated Rules of Metalaw, expressly and explicitly require that all communications be truthful. Many cultures on Earth tolerate, condone, or even expect a certain amount of deception in business and society. It may not be possible for us to determine whether an alien civilization deplores or accepts deception, and thus we would not be able to arrive at a conclusion as to how the ET would want us to deal with them in this regard. Conversely, given the disparity with which modern human societies honor truth, an ET would not be able to determine our desires and expectations in a manner that would apply uniformly across our planet. Perhaps an exchange of communications may provide some insight for all participants in the cosmic conversation and thereby enable the mutual application of the Golden Rule.

The decision whether or not to communicate the truth may have implications for one metalegal rule in particular. Fasan's 10th Rule is that metalegal agreements and treaties must be kept. Although the initial confirmed alien communication and the

[32] Many of these messages are listed in Stephane Dumas. 2014. *Message to an Intelligent Civilisation: A Historical Perspective.* IAF Paper No. IAC-14.E4.3.5.

[33] See Sagan, Carl, F.D. Drake, Ann Druyan, Timothy Ferris, Jon Lomberg, and Linda Salzman Sagan. 1978. *Murmurs of Earth: The Voyager Interstellar Record.* New York: Random House.

responses will not form an interplanetary treaty or agreement, further communications may lead in that direction. If the initial responses are not truthful, it may be difficult for us later to convince an alien civilization to conclude that they have a sufficient level of confidence that any agreement reached with humans would be kept. Conversely, it is worth noting that an Et also may not be truthful.[34] However, consideration should be given to what might be the reaction of an ETI if it were to become aware that it was the subject of intentional deception? What would our reaction be if we were misled by an alien civilization? Would deception by either party decrease the likelihood of engaging in an interplanetary dialogue and relationship?

Concerns have been expressed over whether communications sent into space should conceal our location in case an ET is malevolent. It has been suggested that a communication to an ETI should mask the origin from this planet by Doppler shift or other techniques. It further has been suggested that signals be sent only to candidate stars for which deception can be employed.[35] This would no longer be a search for an ETI, but a search only for that subset of ETI that we believe we can successfully deceive. The desire to conceal our location assumes that the probability is great that any alien civilization is hostile. Nevertheless, concealment efforts would be of dubious and doubtful utility as the fact that human beings are present on planet Earth is not a cosmic secret. The electromagnetic sphere encompassing radio, television and other wireless communications in the past century have reached all of the stars within a radius of more than 100 light years of Earth.[36]

Messages do not need to be intentionally deceptive to be misleading. In the aftermath of a confirmed alien signal, the immediate and early responses from the public, including those on and via social media, will run the gamut of subjects, viewpoints, perspectives, and opinions. Common themes will include hello and welcome; please help; peace, love, and friendship; and scientific and mathematical statements and expressions.[37] Nevertheless, contradictions and inconsistencies between and among these messages will abound. How is an ETI to make sense of this?

In the meantime, according to the Protocols, wide ranging discussions and consultations are to be conducted to consider the substance of any response. During this

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[34] Steve Trimberger. 2014. *Addressing Societal Concerns in Active SETI.* IAF Paper No. IAC-14-A4.1.9.

[35] Id.

[36] Thus, it is theoretically possible for alien civilizations within a distance of 50 light years from Earth to have intercepted a transmission and sent its own message which would have reached Earth by now. Moreover, alien civilizations anywhere in the known universe could have been transmitting wireless communications that could have reached Earth even if the origin was millions of light years away. If the planets are ubiquitous in the galaxy, and the probability that alien intelligence does in fact exist is as high as believed, and then why have we not received or intercepted any messages? See generally Paul Davies. 2010. *The Eerie Silence.* Boston, New York: Houghton Mifflin Harcourt.

[37] Douglas A. Vakoch, Timothy A. Lower, Britton A. Niles, and K. Rast. 2010. *What Should We Say to Extraterrestrial Intelligence?: An Analysis of Responses to "Earth Speaks"* 7. IAF Paper No. IAC-10-A.4.2.6.

period, the ET will be inundated with messages from Earth. Just as an official point of information should be designated by the discovering institution to be the definitive source of information to the inhabitants of this planet to prevent mis-information and misunderstanding, perhaps simultaneously with the announcement of the discovery an official message should be sent as an initial response as a warning and/or disclaimer notifying the ETI that none of the messages that will be sent are official or authoritative for the planet. Should the consultations pursuant to the Protocols result in the formulation of a planetary response, the message will need to have some manner of self-authentication to not only present itself to the ET as a planetary response, but also to establish that it has credibility as a planetary response. Although this may seem inconsistent with an initial communication that no message is to be considered as official and authoritative, any response sent on behalf of the planet would still need to establish its bona fides above the din of all other messages, many of which also will be self-proclaimed official planetary responses.

Conclusion

Social media can impact the detection of an alien signal in several ways, including the disclosure of a potential ET signal prior to confirmation of alien origin; the disclosure of a confirmed ET detection; and the sending of a message to an ET in response and/or reaction to the confirmed detection. The SETI community should encourage all institutions and individuals involved in the process of verification to become signatories to the Protocols to reduce the potential for unauthorized disclosure of information. The IAA Permanent SETI Committee website should maintain and regularly update the list of signatories.

Information that is disclosed should be truthful and accurate. There should be no effort to engage in active deception. The discoverers' institution(s) should identify and designate an official point of contact to be the definitive source of information, which will significantly reduce the possibility that the public will be taken in by mis-information. It will need to be determined whether a formal more permanent point of information should be established or designated, and if so, whether it should have any function other than to act as a clearinghouse and release information provided to it by the science community. Paragraph 3 of the Draft Declaration of Principles rejects any censorship, at least at the time of announcement of the discovery.

The SETI Post-Detection and Proposed Reply Protocols express that any response should be sent only after consultations with a broad representation of interested parties and entities. Social media can be expected to have a major role following the announcement of a confirmed detection of an ETI, both in formulating the themes of the discussion, as well as in sending messages or responses to a signal. While the Protocols presuppose that there will be a period of time after a confirmed detection during which consultations may be conducted, social media will provide a global forum for informal consultations in real time. Moreover, individuals and

companies will seek neither the guidance nor the consent of any entity to send a response to an alien communication.

Social media can be utilized to solicit participants in the sending of a message, as well as in the composition and preparation of the message. Different groups will be formed for the purpose of sending particular messages with political, religious, commercial and other content. It does not necessarily follow, however, that such responses will be in compliance with metalaw. Neither the Golden Rule, nor the enumerated Rules of Metalaw, expressly and explicitly require that all communications be truthful. It may not be possible for us to determine whether an alien civilization deplores or accepts deception, and thus we would not be able to arrive at a conclusion as to how the ET would want us to deal with them in this regard. However, Fasan's 10th Rule, that metalegal agreements and treaties must be kept, could be jeopardized if the initial responses to an ET's signal were not truthful, as it may be difficult for us later to convince an alien civilization to trust us to comply with any agreement we may make. Nevertheless, it must always be considered that an Et also may not be truthful. Finally, consideration should be given to the desirability of sending an official message as an initial response notifying the ETI that it should not consider any of the messages that it may receive to be official or authoritative for the planet. In the event it later is decided to engage in a form of interplanetary conversation with the ETI a means of self-authentication will need to be devised to establish credibility and bona fides as a planetary communication above the din of all other messages.

Annex I

Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence

We, the institutions and individuals participating in the search for extraterrestrial intelligence,

Recognizing that the search for extraterrestrial intelligence is an integral part of space exploration and is being undertaken for peaceful purposes and for the common interest of all mankind,

Inspired by the profound significance for mankind of detecting evidence of extraterrestrial intelligence, even though the probability of detection may be low,

Recalling the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, which commits States Parties to that Treaty "to inform the Secretary General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results" of their space exploration activities (Article XI),

Recognizing that any initial detection may be incomplete or ambiguous and thus require careful examination as well as confirmation, and that it is essential to maintain the highest standards of scientific responsibility and credibility,

Agree to observe the following principles for disseminating information about the detection of extraterrestrial intelligence:

1. Any individual, public or private research institution, or governmental agency that believes it has detected a signal from or other evidence of extraterrestrial intelligence (the discoverer) should seek to verify that the most plausible explanation for the evidence is the existence of extraterrestrial intelligence rather than some other natural phenomenon or anthropogenic phenomenon before making any public announcement. If the evidence cannot be confirmed as indicating the existence of extraterrestrial intelligence, the discoverer may disseminate the information as appropriate to the discovery of any unknown phenomenon.
2. Prior to making a public announcement that evidence of extraterrestrial intelligence has been detected, the discoverer should promptly inform all other observers or research organizations that are parties to this declaration, so that those other parties may seek to confirm the discovery by independent observations at other sites and so that a network can be established to enable continuous monitoring of the signal or phenomenon. Parties to this declaration should not make any public announcement of this information until it is determined whether this information is or is not credible evidence of the existence of extraterrestrial intelligence. The discoverer should inform his/her or its relevant national authorities.
3. After concluding that the discovery appears to be credible evidence of extraterrestrial intelligence, and after informing other parties to this declaration, the discoverer should inform observers throughout the world through the Central Bureau for Astronomical Telegrams of the International Astronomical Union, and should inform the Secretary General of the United Nations in accordance with Article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Bodies. Because of their demonstrated interest in and expertise concerning the question of the existence of extraterrestrial intelligence, the discoverer should simultaneously inform the following international institutions of the discovery and should provide them with all pertinent data and recorded information concerning the evidence: the International Telecommunication Union, the Committee on Space Research, of the International Council of Scientific Unions, the International Astronautical Federation, the International Academy of Astronautics, the International Institute of Space Law, Commission 51 of the International Astronomical Union and Commission J of the International Radio Science Union.
4. A confirmed detection of extraterrestrial intelligence should be disseminated promptly, openly, and widely through scientific channels and public media, observing the procedures in this declaration. The discoverer should have the privilege of making the first public announcement.

5. All data necessary for confirmation of detection should be made available to the international scientific community through publications, meetings, conferences, and other appropriate means.
6. The discovery should be confirmed and monitored and any data bearing on the evidence of extraterrestrial intelligence should be recorded and stored permanently to the greatest extent feasible and practicable, in a form that will make it available for further analysis and interpretation. These recordings should be made available to the international institutions listed above and to members of the scientific community for further objective analysis and interpretation.
7. If the evidence of detection is in the form of electromagnetic signals, the parties to this declaration should seek international agreement to protect the appropriate frequencies by exercising procedures available through the International Telecommunication Union. Immediate notice should be sent to the Secretary General of the ITU in Geneva, who may include a request to minimize transmissions on the relevant frequencies in the Weekly Circular. The Secretariat, in conjunction with advice of the Union's Administrative Council, should explore the feasibility and utility of convening an Extraordinary Administrative Radio Conference to deal with the matter, subject to the opinions of the member Administrations of the ITU.
8. No response to a signal or other evidence of extraterrestrial intelligence should be sent until appropriate international consultations have taken place. The procedures for such consultations will be the subject of a separate agreement, declaration or arrangement.
9. The SETI Committee of the International Academy of Astronautics, in coordination with Commission 51 of the International Astronomical Union, will conduct a continuing review of procedures for the detection of extraterrestrial intelligence and the subsequent handling of the data. Should credible evidence of extraterrestrial intelligence be discovered, an international committee of scientists and other experts should be established to serve as a focal point for continuing analysis of all observational evidence collected in the aftermath of the discovery, and also to provide advice on the release of information to the public. This committee should be constituted from representatives of each of the international institutions listed above and such other members as the committee may deem necessary. To facilitate the convocation of such a committee at some unknown time in the future, the SETI Committee of the International Academy of Astronautics should initiate and maintain a current list of willing representatives from each of the international institutions listed above, as well as other individuals with relevant skills, and should make that list continuously available through the Secretariat of the International Academy of Astronautics. The International Academy of Astronautics will act as the Depository for this declaration and will annually provide a current list of parties to all the parties to this declaration.

Adopted by the International Academy of Astronautics, 1989

Annex II

Draft Declaration of Principles Concerning Sending Communications with Extraterrestrial Intelligence

1. International consultations should be initiated to consider the question of sending communications to extraterrestrial civilizations.
2. Consultations on whether a message should be sent, and its content, should take place within the Committee on the Peaceful Uses of Outer Space of the United Nations and within other governmental and non-governmental organizations, and should accommodate participation by qualified, interested groups that can contribute constructively to these consultations.
3. These consultations should be open to participation by all interested States and should be intended to lead to recommendations reflecting a consensus.
4. The United Nations General Assembly should consider making the decision on whether or not to send a message to extraterrestrial intelligence, and on what the content of that message should be, based on recommendations from the Committee on the Peaceful Uses of Outer Space and from governmental and non-governmental organizations.
5. If a decision is made to send a message to extraterrestrial intelligence, it should be sent on behalf of all Humankind, rather than from individual States.
6. The content of such a message should reflect a careful concern for the broad interests and wellbeing of Humanity, and should be made available to the public in advance of transmission.
7. As the sending of a communication to extraterrestrial intelligence could lead to an exchange of communications separated by many years, consideration should be given to a long-term institutional framework for such communications.
8. No communication to extraterrestrial intelligence should be sent by any State until appropriate international consultations have taken place. States should not cooperate with attempts to communicate with extraterrestrial intelligence that do not conform to the principles of this Declaration.
9. In their deliberations on these questions, States participating in this Declaration and United Nations bodies should draw on the expertise of scientists, scholars, and other persons with relevant knowledge.

Proposed by the SETI Committee of the International Academy of Astronautics, 1995

Annex III

Declaration of Principles Concerning the Conduct of the Search for Extraterrestrial Intelligence

Preamble

The parties to this declaration are individuals and institutions participating in the scientific Search for Extraterrestrial Intelligence (SETI).

The purpose of this document is to declare our commitment to conduct this search in a scientifically valid and transparent manner and to establish uniform procedures for the announcement of a confirmed SETI detection.

This commitment is made in recognition of the profound scientific, social, ethical, legal, philosophical and other implications of a SETI detection. As this enterprise enjoys wide public interest, but engenders uncertainty about how information collected during the search will be handled, the signatories have voluntarily constructed this declaration. It, together with a current list of signatory parties, will be placed on file with the International Academy of Astronautics (IAA).

Principles

1. Searching: SETI experiments will be conducted transparently, and its practitioners will be free to present reports on activities and results in public and professional fora. They will also be responsive to news organizations and other public communications media about their work.
2. Handling candidate evidence: In the event of a suspected detection of extraterrestrial intelligence, the discoverer will make all efforts to verify the detection, using the resources available to the discoverer and with the collaboration of other investigators, whether or not signatories to this Declaration. Such efforts will include, but not be limited to, observations at more than one facility and/or by more than one organization. There is no obligation to disclose verification efforts while they are underway, and there should be no premature disclosures pending verification. Inquiries from the media and news organizations should be responded to promptly and honestly. Information about candidate signals or other detections should be treated in the same way that any scientist would treat provisional laboratory results. The Rio Scale, or its equivalent, should be used as a guide to the import and significance of candidate discoveries for the benefit of non-specialist audiences.
3. Confirmed detections: If the verification process confirms – by the consensus of the other investigators involved and to a degree of certainty judged by the discoverers to be credible – that a signal or other evidence is due to extraterrestrial intelligence, the discoverer shall report this conclusion in a full and complete

open manner to the public, the scientific community, and the Secretary General of the United Nations. The confirmation report will include the basic data, the process and results of the verification efforts, any conclusions and interpretations, and any detected information content of the signal itself. A formal report will also be made to the International Astronomical Union (IAU).

4. All data necessary for the confirmation of the detection should be made available to the international scientific community through publications, meetings, conferences, and other appropriate means.
5. The discovery should be monitored. Any data bearing on the evidence of extraterrestrial intelligence should be recorded and stored permanently to the greatest extent feasible and practicable, in a form that will make it available to observers and to the scientific community for further analysis and interpretation.
6. If the evidence of detection is in the form of electromagnetic signals, observers should seek international agreement to protect the appropriate frequencies by exercising the extraordinary procedures established within the World Administrative Radio Council of the International Telecommunication Union.
7. Post Detection: A Post-Detection Task Group under the auspices of the IAA SETI Permanent Study Group has been established to assist in matters that may arise in the event of a confirmed signal, and to support the scientific and public analysis by offering guidance, interpretation, and discussion of the wider implications of the detection.
8. Response to signals: In the case of the confirmed detection of a signal, signatories to this declaration will not respond without first seeking guidance and consent of a broadly representative international body, such as the United Nations.

As revised 2010

Appendix
Relations with Alien Intelligences – The Scientific Basis of Metalaw[1]

Ernst Fasan

DK 340.114:341.229:2:133

[1] The appendix was previously published by Berlin Verlag Arno Spitz in 1970.

P.M. Sterns, L.I. Tennen (eds.), *Private Law, Public Law, Metalaw and Public Policy in Space*, Space Regulations Library 8,
DOI 10.1007/978-3-319-27087-6

Contents

Foreword

Through the entire history of man, his concepts of the world in which he lives and the Universe that surrounds him have been undergoing constant changes. For many, many centuries he believed his home planet to be the true hub of the entire cosmos, around which the crystal dome of the heavens rotate. Today we have come to accept as indisputable that our Earth is only one of the planets revolving around the sun, the sun only one of a billion stars in our galaxy, and our galaxy only one of billions of galaxies in the Universe.

It would be presumptuous for modern man to assume that in this infinite vastness of the cosmos, the homo sapiens on Earth were the only manifestation of intelligent life. Of course, our present technological methods and scientific tools seem vastly inadequate to permit any direct contact with extrasolar civilizations. However, for the generations to come who will be able to advance far beyond the present destinations of our spacecraft or the reaches of todays' lasers and radiotelescopes, the discovery of such life is highly probable and will be an extremely fascinating and challenging task.

Ernst Fasan examines the possibilities of man's encounter with other civilizations. He emphasizes the legal and philosophical aspects of such an event and makes us aware that only through recognition of and adherence to *Kant's* Categorical Imperative can we expect to benefit from the challenges of the future and to avoid cataclysmic events.

Wernher von Braun

Introduction

Since the execution of Project "OZMA" in 1960 and the Green Bank Conference in 1961 the question of contacting extraterrestrial intelligences has been more and more the center of scientific interest and examination.

That any such contact would bring about an enormous impact on all science is obvious. One of these sciences is the legal one, since every contact between intelligent beings is performed according to some rules. These rules, rules of conduct, are at the same time basically legal in nature.

Thus such rules – the rules of Metalaw – have been discussed in numerous papers, addresses, and in books in Space Law. But up to now no book exists dealing with the entire set of problems involved.

An extensive study of Metalaw seems to also require an examination of some extralegal aspects of a possible contact with aliens – be it bodily or merely by telecommunication. Beyond this, it seems to presuppose an inquiry as to whether it is sensible to discuss legal questions before any actual encounter has occurred. Assuming an affirmative answer to the last question, it seems necessary to find a sound philosophical basis upon which all rules of Metalaw can be developed.

Metalaw will be a rule of conduct for intelligent beings. Thus, the Categorical Imperative will apply. Metalaw will be, furthermore, a natural law based on those natural characteristics which are necessarily common to all partners who subscribe to Metalaw. These characteristics are, as we shall see: Life, Intelligence, Detectability, Three-dimensionality, and Will to Live. From these starting points we have endeavored to deduce eleven rules of Metalaw with a firm scientific basis.

Our task may be considered premature. But when we realize that more and more experiments are being made to contact aliens, and when we take into account the scientific discussions such as those of the *Hermann Oberth Society* in 1968 and those of the International Astronautical Academy, scheduled for 1970 and the following years, we nevertheless feel justified in carrying out this investigation.

We should like to express our thanks to Mr. *Arno Spitz*, publisher of the Berlin Verlag, for his enterprising decision to publish this book, to Professor *Schütte* for providing the star maps and above all, to the late *Andrew G. Haley* who considered "Metalaw" and who during the last year of his life advised us to carry out the studies which have led to this publication.

Thanks are also due to Mrs. *Fasan*, to whom this book is dedicated.

I: The Possibility of Encountering Nonhuman Intelligent Beings

Opinions in Ancient Literature

Whenever we raise the question on nonhuman intelligent beings, we are confronted with the picture of the "little green men" or the "bug-eyed monsters", or even the nonsense of "flying saucers", i.e., with creations of sheer fiction or, what is worse, with fantastic results of rather wild pseudoscientists. This is the reason why the whole question is often ridiculed and is considered "sciencefictioneerish".

On the other hand, for more than 2000 years the possibility of extraterrestrial intelligent life has been discussed and has by no means been considered chimerical.

The pre-Incas were of the opinion that the stars, especially the Pleiades, were inhabited.[2] The same belief was expressed by Anaximander, Xenophanes, Democritus and Plutarch.[3] Sullivan quotes the very interesting statement of the Sung Dynasty Chinese scientist *Teg Mu*: "How unreasonable would it be to assume that there are no other skies besides the earth and the sky we see".[4]

He also points out that the holy Buddist book Saddharma Pundarika describes an assembly of Bodhisattvas from many worlds who are congregated before the face of God.[5] *Sullivan* also quotes, from more recent times, the opinion of Huygens: "… thus we must recognize all the planets which are around this huge number of suns. They must have plants and animals, and even reasoning beings which wonder about the sky and look at it much as we do …".[6]

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[2] Däniken, Erinnerungen an die Zukunft (Vienna, 1968), p. 90.

[3] Sullivan, We are not alone, German ed., 1966, pp. 14–17.

[4] Ibid., p. 17.

[5] Ibid., p. 346.

[6] *Sullivan,* op. cit., p. 28.

In a similar vein, *Sullivan* quotes from *Giordano Bruno* and *Milton's Paradise Lost,* and the opinion of *John Wilkins,* bishop and founding member of the Royal Society.

As regards seventeenth century opinions, we must not forget *Cyrano de Bergerac,* in whose novel, *L'homme dans la lune,* the hero-author flies to the moon and meets there our satellite's intelligent inhabitants.

Magno quotes in his paper "Prima del Primo Incontro" several ancient scholars, including *Metrodorus, Lucretius, Bruno,* and *Thomas Aquinas,* all of whom expressed their belief in the existence of non-human intelligent life in the universe. It is justifiable to point out the extent of *Magno's* studies and to quote some scholarly opinions verbatim as follows:

Lucretius writes in his didactic work of poetry, *De rerum natura,* the following sentence: "Necesse est confiteri esse alios aliis terrarum in partibus orbes et varias hominum gentes et scela ferarum." ("one must recognize that there are in other parts of the universe other races of men and other kinds of animals.")[7]

Thomas Aquinas wrote: "Sicut Deus potest semper novas creaturas condere, quia eius potentia per creaturas humanas non exhauritur ita etiam Filius potest, qualibet natura assumpta, iterum aliam assumere, quia potestas assumendi per naturarn assumptam non terminatur." ("As God can always create new beings because his potency is not exhausted by creation of human beings, so can likewise the Son, whatever nature he assumed, again assume another one because his capability of doing so was not exhausted by the nature which He had assumed.")[8]

From quite another angle, by extrapolating the idea of infinity, *Giordano Bruno* deduces: "As space is unlimited and the atoms therein are in everlasting motion, we can by no means believe that our world and our sky are the only ones which have been created. Therefore we must acknowledge that other systems exist similar to that which our sky holds in eager embrace …" (and that) "these worlds are peopled by living creatures."[9]

Magno quotes several more opinions from the past. Nearer to the present day, however, we may point out that the great French philosopher *Montesquieu* in his *De l'espirit des lois* starts with speculations which are based upon the conviction that mankind is not the only intelligent race. We may quote him verbatim as follows: "Laws in the broadest sense imply relationship. That necessarily follows from the nature of things. In that sense all beings have their laws: The deity, the material world, higher intellectual beings, animals, and men have their own laws. Thus there is an original reason, and laws are relationships which exist between it and the different beings as well as the relations between these beings themselves."[10]

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[7] Ibid., p. 28, *Haley,* Space Law and Government (New York. 1963) gives no references to ancient opinions but shows the universality of the "Golden Rule", See pp. 411ff.

[8] Proceedings, Sixth Colloquium on the Law of Outer Space, ed. *A.G. Haley* (Washington, D. C., 1964), p. 40. The Proceedings of the Space Law Colloquium are henceforth referred to by number only, e. g. "Sixth Colloquium".

[9] Ibid., pp. 40f.

[10] German ed., Munich, 1967, p. 57.

With that, *Montesquieu* not only considers the existence of extra-terrestrial intelligent beings, but he even envisages relations, legal relations, between them. *Montesquieu's* statement is thus one of the oldest expressions of metalegal thought. He continues: "Individual beings, gifted with intelligence, may have laws which they created themselves, but furthermore they have others, which they did not make themselves. They (the laws) were possible before there were intelligent beings: between these, relationships were possible and, with this, law was possible too. Even before laws were created, legal relations were possible. To maintain that no law and no injustice would exist apart from what positive laws order or forbid is like pretending that all radii were not the same before the first circle was drawn."[11]

Montesquieu adds that reasoning individual beings are intellectually limited by nature and are therefore subject to errors, but on the other hand they act by their own volition.[12] The great Frenchman concludes that they therefore do not always obey basic laws and not even those which they made themselves.

These contemplations of *Montesquieu* are so basically correct that they may be considered a bridge to modern literature on Metalaw, which is dealt with in a later chapter. And we shall refer to it when we deal later with the scientific basis of Metalaw, the Categorical Imperative of *Kant.*

The Results of Modern Science

The philosophical, albeit speculative, sentences cited above suggest that nonhuman intelligent life does exist. Modern science – astronomy and exobiology – is of quite the same opinion. In numerous books and papers, in congresses and conferences the opinion that nonhuman intelligences exist has been discussed and has grown from the status of a mere hypothesis to that of an almost unquestioned theory. It is not our task here to try to prove that theory. However, in order to build a platform for the following discussion of legal theories, it is necessary and justifiable to summarize the said theory as follows:

Within the range of our telescopes, which has multiplied in the last decades and even years, billions of galaxies can be detected, each similar to our own galactic system. Each of these systems consists of billions of stars, each of them a sun like our own. *Shapley* estimates a total of 10^{20} stellar systems in the universe.[13]

This whole universe and all celestial bodies consist basically of the same 92 elements that we find on our earth (and several transuraniums). Everywhere in the universe the same basic laws of nature are valid, such as gravity, diffusion of light and other electromagnetic waves, the laws of mechanics, the special and, when finally proven, the general theory of relativity,[14] the structure of matter and, as will be discussed below, the law of entropy. All these natural laws have been called natural

[11] Ibid., p. 58.

[12] p. 57ff.

[13] *Harlow Shapley,* The View From a Distant Star, (1965), p. 59.

[14] See *Born,* Die Relativitätstheorie Einsteins (Berlin, 1964).

constants. As *Planck* says: "Those constants are of such a nature, that … everyone, in fact, all intelligences existing within nature, must discover them, if they have not yet discovered them."[15]

Just how many of the inconceivable number of stars might have a planetary system is not known. Modern astronomy has proved, however, that there are many double stars or triple stars and that the bodies of several stellar systems are significantly smaller than the mother star.

The most remarkable of these systems is star 61 Cygni, a double star about 11 light years from our own system. From discrepancies in its path it was proved that 61 Cygni is accompanied by a planet the mass of which amounts to about one-hundredth of the greater of its two suns.[16]

Other examples are Barnard's star and Lalande 21185, both being accompanied by satellites containing 0.06 of their own mass. Ross 614, 13 light years distant, should especially be mentioned because its companion (one-tenth of its mass) was not only mathematically proved to exist but, in fact, was found by telescope.[17] Finally, one of the most remarkable of these planet-surrounded stars must also be mentioned. It is ε Eridani, a G-type star about 11 light years distant, one of the two goals of the 1960 Project "OZMA". *Frank D. Drake* is of the opinion that ε Eridani has a planet with a mass about six times greater than the [sic] Jupiter.

We can certainly expect many more stars surrounded by planets to be found once the universe is closely examined by the "astronomy of positions", and especially at a time when telescopes placed in outer space, for instance on the Moon, will investigate the sky without being obstructed by the Earth's atmosphere.

Assuming that all these stars might have planets of their own, we must consider that many stars are accompanied by relatively unstable systems: the double and triple stars. Rotating around each other they would mutually change the orbits of their planets in such a manner that within a relatively stable distance those would deviate from their periphery. If, on the other hand, the distance between any one planet and its mother star varies too much, the planet's surface temperature might be so drastically altered that such divergencies might be inimical to the development of life.

Nearly all astronomers discussing life within foreign stellar systems point out that there are different classes of stars to be found, i.e. that not all of them belong to the same class as our own sun. Proceeding from the "red giants" to the "red dwarfs", the stars were classified into 0, B, A, F, G, K, and M (our sun belongs to the G-category).

We may point out here that up to now it has been impossible to detect foreign planets by telescope (with the exception of Ross 614, as mentioned above). There is, however, another way of detecting them: If a star is accompanied by a satellite, it rotates, due to basic celestial mechanics, around the combined gravitational center.

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[15] *Max Planck,* Wege zur physikalischen Erkenntnis, 4th ed. (Leipzig, 1944), p. 16.

[16] *Schuette,* Die Weltraumfahrt hat begonnen (Freiburg, 1958), p. 26f. Also *Arthur C. Clarke,* The Exploration of Space (New York, 1954), p. 176.

[17] *Schuette*, Ibid., p. 28.

(The same, of course, is true for the satellite; that fact is at the moment of no consequence). The rotation of the star influences its path and thus alters its position. That deviation can be measured, and by using this method the larger planetary masses can be located and eventually detected.

But there is probably another method: The rotation impulse of any star is, according to *Struve* and others, influenced and reduced by a concomitant planetary system.[18] *Strove* has found many stars, especially of the G-, K-, M-, and F-types, with an "abnormally" slow rotation and he, like other famous astronomers, claims that (as with our own sun) this is due to the existence of a planetary system.

That observation leads us to an interesting error made by many astronomers and exobiologists. They claim that there must be planets "not suitable for the development of life". As such they consider planets which are too close to the sun "too hot" and those too far from it "too cold". Planets of stars other than type G could not develop life, they argue. Then, somewhat more carefully, they would add that "protoplasmic" life could not develop. *Urey* and *Miller* categorically deny the possibility of non-protoplasmic life, saying: "We know enough about the chemistry of other systems, as for instance silicum, ammonia fluorohydrogen, to realize that no highly complicated system of chemical reactions similar to that we call life, could be possible on the basis of such materials."

The scientists quoted above might be correct, of course. In all probability they will be correct. But from our limited knowledge of chemical reactions to conclude that non-protoplasmic life is positively impossible is not justified. Below, we shall examine which qualities of intelligent beings we may consider indispensable. Protoplasmic origin is not among them.

Astronomers and exobiologists, however, confine their investigations to protoplasmic life and thus to stars with planetary systems not inimical to the development of protoplasm. Starting with these premises, the conditions for the development of life on a planet were discussed at the famous Green Bank Conference in November, 1961. Out of this conference *Drake* evolved the following formula:[19]

$$N = R_{+} f_p n_e f_l f_i f_c L$$

In this equation is N [sic] the number of civilizations within our galaxy. It results from the following factors:

R_{+} symbolizes the velocity of development of some type stars (per annum one star).
f_p is the quota of stars with planetary systems (about 20 %).
n_e is the symbol for the number of planets within the ecosphere of the star in question, the ecosphere being a realm within which the climate of the planet, due to its distance from the star, would be neither too hot nor too cold. While the sun has two or three such planets (Earth, Mars and, possibly, Venus), the average number was estimated at 1–5 per star.

[18] *Sullivan,* op. cit., p. 66.

[19] Ibid., p. 307.

f_l is the quota of inhabited planets with relation to factor n_e. As each planet revolves around the sun for billions of years this factor was, on the proposition of *Calvin* and *Sagan,* estimated at '1'.

f_1 symbolizes the number of planets with intelligent life in relation to f_i, i.e., the 'quota of reason'. While the figure of l00 % might not be considered conservative, the discussions of factor f_i took a direction to which we cannot agree, especially when *Simpson* suggested that intelligence is not necessarily the goal of development of life.

In the following chapter we shall see that the paramount tendency of life, due to the pervading drive to live, is development of better controls of environment. The best control of environment, however, is provided not by bodily strength, or by longevity, or by especially sharp senses, or by the ability to fly, but by cognition of the environment and by the realization of its feasable control.[20] This realization increases, as we shall see, concomitant with the development of the cognitive and thinking organ.

On Earth, this is the brain. The development of the brain, however, leads ultimately to self-realization, to intelligence. It is therefore our opinion that, given enough time, life will always and on every planet reach its highest level only when it has brought about intelligence. For that reason the Green Bank Conference did not follow *Simpson's* opinion, but held the factor of 100 % correct, i.e., $f_i = 1$.[21]

f_c is the quota of intelligent communities developing the ability to communicate with other worlds. These were estimated at 10–20 % by the Green Bank scientists.

L, finally, is the most important factor of the duration of life on a f_c world. It was found that this duration must be very long; or very short, for that matter, if the civilization destroys itself. The fact that this danger exists, at least for the terrestrial civilization, is a nightmare well known to all of us. – Factor L was found to be either less than 1000 (years) or more than 100 millions.

In accordance with that last assumption the Green Bank scientists found that the statistical distance between civilizations within our galaxy is either a few dozens or some thousands of light years.

Obviously the question arises as to why it is necessary to take such great pains regarding other stars' planets, unless we have investigated those planets that we know exist, i.e., the other planets of our own star, the sun.

There are, as far as we know, nine planetary bodies revolving around the sun, some data regarding which are shown in the below table (Table 1).

Of these planets, it has been argued, only Venus, Earth, and Mars are within the ecosphere of the sun.[22] However, the Mariner experiments have shown that the temperature of Venus is so high that protoplasmic life could not have developed there. This left Earth, the life of which is known, and Mars.

Much science fiction has been written about life on Mars, but there is also a great deal of serious discussion taking place. A few data about this planet are given in the following table (Table 2).

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[20] *Robert Heinlein,* Assignment in Eternity (New York, l953), p. 45.

[21] *Sullivan,* op. cit. p. 308f.

[22] Zone where it is neither too hot nor too cold for the development of protoplasmic life. A synonym is biosphere.

Table 1 Some data regarding the solar planets

Planet	Distance from sun mill. km	rotation around sun velocity km/sec.	diameter km	surface Earth = 1	gravity g	number of moons	surface medium temperature centigrade
Mercury	57,9	47,9	5 140	0,163	0,34	0	+400 - -100
Venus	108,1	35.0	12 610	0,981	0,85	0	+426
Earth	149,5	29,8	12 757	1.	1	1	+ 14
Mars	227,8	24,1	6 860	0,288	0,37	2	- 15
Jupiter	777,8	13,1	143 640	121,9	2,51	12	- 130
Saturn	1426,1	9,7	120 570	83,9	1,07	10	- 150 ?
Uranus	2867,8	6,8	53 400	17,6	0,83	5	- 160 ?
Neptune	4493,7	5,4	49 700	15,2	1,14	2	- 165 ?
Pluto	5899,0	4,7	6 000?	?	?	0 ?	- 185 ?

Table 2 Some data regarding Mars

orbit radius: 206–250 mill. km;
orbit eccentricity: 0.0934;
rotation time around sun: 687 days;
closest distance to Earth: 55 mill. km;
rotation time around axis: 24 h 37 min 22.5 s;
mass: 10.8 % of Earth
middle density: 70 % of Earth;
volume: 15.4 % of Earth;
angle of inclination of equator plane: 25 % (Earth 23.5 %);
albedo: 0.15;
moons: 2 (Phobos, 16 km diameter, 9400 km distance from Mars centre, rotation time 0,319 days Deimos, 8 km diameter, 23500 km distance, 1263 days rotation time);
atmospheric pressure: 89 millibar (comparable: Earth in 17 km altitude);
atmospheric components: CO_2: N_2, H_2O, probably O_2;
temperature: midday North pole: −25 to −40 centigrade
midday South pole: −10 to +10 centigrade
midday Equator: +20 to +30 centigrade

There are bright (red) and dark (green) zones to be found on Mars. While the former might be deserts containing silicates the exact nature of the latter is not clear; it was sometimes suggested that Mars contains, or had even contained, intelligent life; it even has been argued that the moons of Mars might be of artificial origin.

So we have come to the conclusion that, outside man most likely there is no intelligent life in the solar system at present. We must therefore turn our attention to other stellar systems when we are looking for extraterrestrial intelligence.

Table 3 The 100 stars nearest to the sun

No. in star map	Name	Location (h, m, °)	Distance (l. y.)
1	Gom 34 A	0,13 + 43,5	11,7
2	Gom 34 B	0,13 + 43,5	11,7
3	β Hyi	0,20 - 77,8	21,3
4	η Cass A	0,43 + 57,3	18,0
5	η Cass B	0,43 + 57,3	18,0
6	v. Maanen	0,44 + 4,9	13,9
7	L 726-8 A	1,34 - 18,5	8,7
8	L 726-8 B	1,34 - 18,5	8,7
9	τ Cet	1,39 - 16,5	11,9
10	82 Eri	3,16 - 43,5	21,0
11	ϵ Eri	3,28 - 9,8	10,8
12	40 Eri A	4,11 - 7,8	16,2
13	40 Eri B	4,11 - 7,8	16,2
14	40 Eri C	4,11 - 7,8	16,2
15	-45° 1841	5,8 - 45,0	13,0
16	HD 36395	5,26 - 3,7	20,0
17	Ross 47	5,36 + 12,5	19,9
18	-21° 1377	6,6 - 21,8	19,2
19	Ross 614 A	6,24 - 2,7	13,1
20	Ross 614 B	6,24 - 2,7	13,1
21	Sirius A	6,41 - 16,6	8,7
22	Sirius B	6,41 - 16,6	8,7
23	Wulf 294	6,48 + 33,4	19,3
24	Ross 986	7,3 + 38,7	19,0
25	Luyten = +5° 1668	7,22 + 5,5	12,2
26	Procyon A	7,34 + 5,5	11,4
27	Procyon B	7,34 + 5,5	11,4
28	L 745-46 A	7,36 - 17,2	19,9
29	L 745-46 B	7,36 - 17,2	19,9
30	L 97-12	7,53 - 67,5	19,2
31	Ross 619	8,6 + 9,2	21,6
32	L 674-15	8,8 - 21,2	19,7
33	+53° 1320 A	9,8 + 53,1	20,0
34	+53° 1321 B	9,8 + 53,1	20,1
35	Gom 1618	10,5 + 50,0	14,7

(continued)

Table 3 (continued)

No. in star map	Name	Location (h, m, °)	Distance (l. y.)
36	AD Leo = +20° 2465	10,14 + 20,4	15,4
37	Wulf 359	10,52 + 7,6	7,7
38	Lal 21185	10,58 + 36,6	8,2
39	+44° 2051 A	11,1 + 44,0	19,0
40	+44° 2051 B	11,1 + 44,0	19,0
41	CC 658	11,40 - 64,3	16,1
42	AC 79° 3888	11,41 + 79,2	16,5
43	Ross 128	11,43 + 1,4	10,9
44	L 68-28 A	12,23 - 70,9	21,5
45	L 68-28 B	12,23 - 70,9	21,5
46	Wulf 424, A	12,28 + 9,6	14,2
47	Wulf 424, B	12,28 + 9,6	14,2
48	+15° 2620	13,41 + 15,4	16,2
49	Proxima Cent	14,23 - 62,2	4,3
50	-11° 3759	14,19 - 12,1	20,6
51	α Cent A	14,33 - 60,4	4,3
52	α Cent B	14,33 - 60,4	4,3
53	-20° 4125	14,52 - 20,9	19,0
54	-20° 4123	14,52 - 20,9	19,0
55	-40° 9712	15,26 - 40,9	19,7
56	-12° 4523	16,25 - 12,4	13,4
57	- 8° 4352 A	16,50 - 8,2	21,5
58	- 8° 4352 B	16,50 - 8,2	21,5
59	Wulf 629 C	16,50 - 8,2	21,5
60	+45° 2505 A	17,9 + 45,8	20,4
61	+45° 2505 B	17,9 + 45,8	20,4
62	36 Oph A	17,9 - 26,5	18,5
63	36 Oph B	17,9 - 26,5	18,5
64	36 Oph C	17,10 - 26,4	19,0
65	-46° 11540	17,21 - 46,8	15,3
66	-44° 11909	17,30 - 44,2	15,6
67	+68° 946	17,37 + 68,5	16,1
68	i (UC' 48)	17,38 - 57,2	19,5
69	Barnard = +4° 3561	17,53 + 4,4	6,0
70	70/Oph A	18,1 + 2,5	17,0
71	70/Oph B	18,1 + 2,5	17,0
72	+59° 1915 A	18,42 + 59,5	11,5
73	+59° 1915 B	18,42 + 59,5	11,5

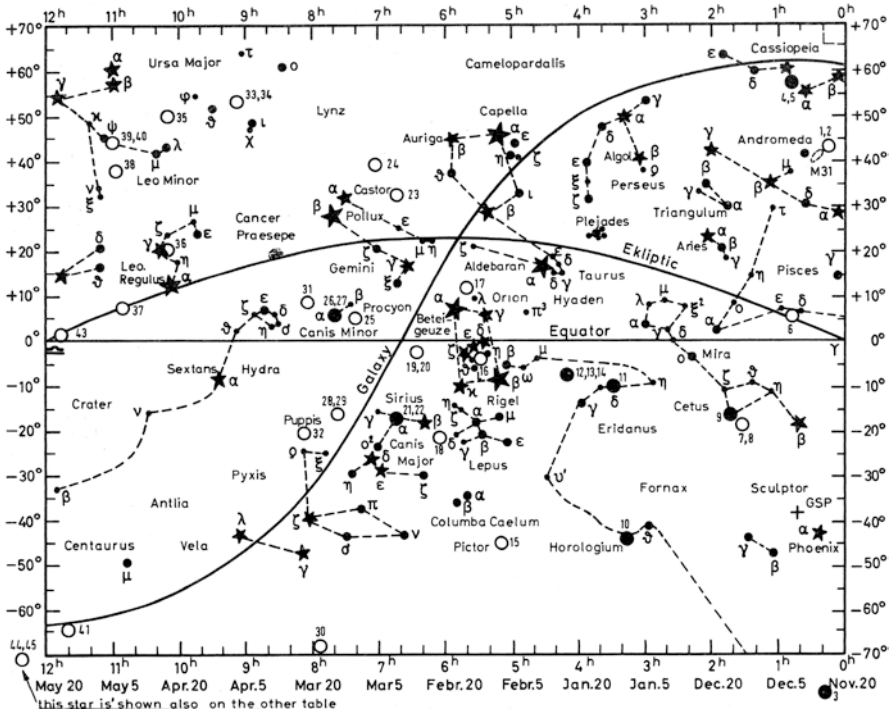
(continued)

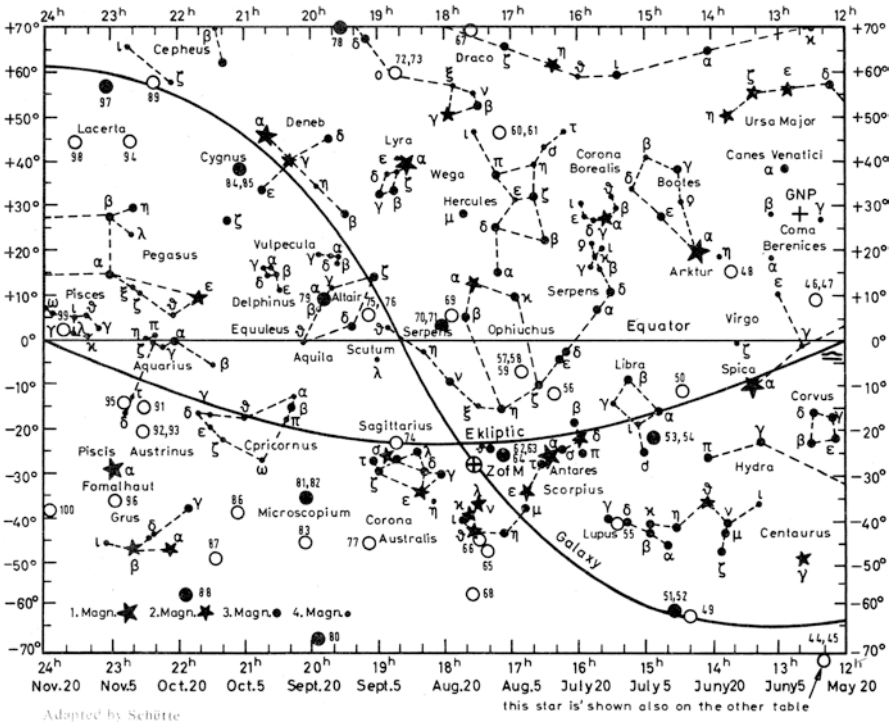
Table 3 (continued)

No. in star map	Name	Location (h, m, °)	Distance (l. y.)
74	Ross 154	18,44 - 23,9	9,3
75	+4° 4048 A	19,12 + 5,0	19,1
76	+4° 4048 B	19,12 + 5,0	19,1
77	L 347-14	19,13 - 45,7	19,3
78	σ Dra	19,33 + 69,5	18,5
79	Altair = Agl	19,46 + 8,6	16,5
80	δ Par	19,59 - 66,4	19,2
81	-36° 13940 A	20,5 - 36,4	19,0
82	-36° 13940 B	20,5 - 36,4	19,0
83	-45° 13677	20,7 - 45,5	20,5
84	61 Cyg A	21,2 + 38,3	11,2
85	61 Cyg B	21,2 + 38,3	11,2
86	-39° 14192	21,11 - 39,2	12,7
87	-49° 13515	21,27 - 49,4	14,9
88	ϵ Ind	21,56 - 57,2	11,4
89	Krüger 60 A	22,24 + 57,2	13,0
90	Krüger 60 B	22,24 + 57,2	13,0
91	L 789-6	22,33 - 15,9	11,0
92	-21° 6267 A	22,33 - 21,1	14,9
93	-21° 6267 B	22,33 - 21,1	14,9
94	+43° 4305	22,42 + 43,8	16,5
95	-15° 6290 = Ross 780	22,48 - 14,8	15,8
96	-36° 15693	22,59 - 36,4	12,0
97	+56° 2966	32,8 + 56,6	21,4
98	Ross 248	23,37 + 43,6	10,3
99	+ 1° 4774	23,44 + 1,9	20,0
100	-37° 15492	23,59 - 37,8	14,9

Data provided graciously by *Schütte*, using *Gliese's* catalogue and *C. W. Allen,* Astrophysical Quantities, 1963

See star map next page, where the No. of this table shows the location of the star in question





Adapted by Schütte

Since the Green Bank Conference the discussion of intelligent extraterrestrial life has not ceased. We would like to point out the NASA conference of 1962,[23] the panel discussion of the Hermann Oberth Society in 1968,[24] the Prague Conference, organized by the International Astronautical Academy for 1970,[25] and the various programmes for detecting organic material within meteorites.[26]

Most of these discussions have inferred that it is quite probable that intelligent life does exist in several stellar systems both inside and outside of our galaxy. Even the Catholic Church recognizes this probability, since the Bull "Summa Theologia" says: "Deus per suam omnipotentem virtutem poterat humanam naturam multis aliis modis reparere." (God in his omnipotence may repeat human nature in many other ways.)[27]

It has often been argued that very probably intelligent life exists in the universe, or even in our own galaxy, but that the large distances involved will prohibit any contact between these intelligent races. These arguments, reasonable as they seem, are based upon the present state of technology.

Nobody can definitely say whether or not travel faster than light, or travel through a fourth dimension, or at least the exchange of messages, will ever (i.e., throughout all the millions of years of future development of the human race and its civilization) be possible. In all probability it will not be possible.[28] But that does not mean that actual, physical contact with aliens would be impossible even if they were farther away than, say, 10 or 20 light years. For every journey through interstellar space with velocities nearing "c"[29] would effect time dilation and thus increase the difference between "earth time" and "board time". *Sanger* demonstrates this principle with the example of a journey from the solar system to a star at a distance of 100 light years. According to the dilation effect, a starship with an acceleration of 100 m/s^2 makes this journey in 9.79 years ship time while on Earth 101.94 years have passed.[30] The velocity of light, which is the unattainable upper limit of all velocities of material objects, is measured according to ship time and not to Earth or goal-star time. Traveling 100 light years in 9.79 years means practically a mean velocity of more than ten times "c".

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[23] Proceedings of the NASA – University Conference on the Science and Technology of Space Exploration (NASA SP – 11).

[24] Under the chairmanship of *Staats,* with *Oberth, Kooy, Nieto, Steinhoff, Fasan,* et al. Proceedings not yet published.

[25] With Czechoslovakian Academy, to be held in Prague.

[26] *Sullivan,* Chapter XI, Staplin christened two algae found in Chondrites as "Coelestis staplin" and "Clausisphaera staplin". The results are not universally agreed upon.

[27] Summa Theologia, 1a, p. 1, a.2. *Magno* quotes the same sentence and adds very clear quotations from the Catholic Encyclopedia. With regard to the Bible there are the quotations: "In my father's house there are many mansions" (John 14, 2) and "Other sheep I have which are not of this fold …" (John 10, 16), to be indicated.

[28] For a contrary opinion ("tachyons" theoretically exceeding speed of light) see *Feinberg's* experiments as reported in "The New York Times", 1/28/68.

[29] Velocity of light in empty space, "c" is 299,793 km/s.

[30] Raumfahrt heute, Morgen, Überrnorzen (Düsseldorf, 1963), p. 388ff.

This shows that a human crew, even without cryogenic preservation,[31] could travel during a normal lifetime to all stars within a sphere of l00 light years radius, and could return still in the prime of their lives. As time dilation becomes more and more effective with the prolonged time of near "c" flight (the time of acceleration and deceleration being the same for a journey of 50 and one of 500 light years). *Sanger* points out: "In a sphere around the sun of 300 light years, which confines the primarily interesting space for interstellar travel, we can count nearly half a million stars, and may expect possibly 60.000 planetary systems …".[32]

It is not possible, of course, to show in this book a star map with all these stars: the distribution of the 100 stars nearest to the sun with a distance of less than 21.7 light years is shown in Table 3.

This, then, is the outlook for the near future, for the next few centuries. Life, and above all human life, has a very strong, an almost irresisible [sic] trend to expand its living space. Already we can foresee the day when Earth alone will not be able to provide enough living space for all members of the human race. Men will go into outer space and some will remain there. Within the next 200 or 300 years there will be – after some adaption[33] – some inhabited solar planets other than Earth. Mankind will multiply more and more and will fill its living space, which is not only the Earth but the whole creation, as *Pope Pius XII*. pointed out.[34] So Man will progressively expand his living space out over the stars. The trend to multiply, and therefore from sheer necessity to expand living space, is a trend inherent in the principle of life itself. Only the very old, i.e., degenerate, races might remain stationary.

We do not know when it will happen: next year or within the next thousand centuries. If intelligent races, including our own, do not die out beforehand they will one day come into contact when their expanding living spaces will meet. From this moment of contact on there will be no way back to isolation.

On the other hand, we must realize that contact, and even substantial contact could happen between two civilizations without any actual encounter taking place. The mere possibility of making contact by telecommunication has often been discussed[35] and seems for the present time more probable than physical contact.

Due to astronomical distances any such contact would be a question-and-answer-play with very long delays. But it is certainly not impossible: in fact, our astronomers have been searching for it for several years.[36]

One year before the Green Bank Conference the American scientist *Frank D. Drake* started an experiment which was known as Project "OZMA". For 150 h in

[31] Current information concerning developments in "Cryonics Reports", Cryonics Society, New York.

[32] Ibid p. 388.

[33] As proposed by *Zwicky, Haley,* p. 238; *Clarke* op. cit. p. 158.

[34] VII. International Astronautical Congress as quoted by *Cheng,* "International Law and High Altitude Flights: Legal Problems of Space Exploration". A Symposium, US Senate, 87th Congress, 1st Session, Doc. No. 26. p. 155. Henceforth quoted as "Symposium 1961".

[35] *Arthur C. Clarke,* "When Earthmen and Aliens Meet", "Playboy", January 1968.

[36] See, for instance, *Shlovskii* and *Sagan,* Intelligent Life in the Universe (San Francisco, 1966).

the summer of 1960 he and his colleagues used the 85 ft telescope of the Green Bank Observatory for the study of the two stars τ Ceti and ε Eridani.[37] They wanted to ascertain if those two G-type stars had planetary systems inhabited by intelligent beings with a superior technology, and if perhaps they were emitting interstellar messages with the purpose of trying to contact other intelligent races. In such a case the frequency used might be 1420.4 mc, which is the frequency of hydrogen.

The experiment did not bring any results. But it was realized (and discussed at the Green Bank Conference of 1961 and during the NASA-sponsored conference in 1962)[38] that searching for or sending of radio meassages [sic] would be the most realistic method of contacting alien intelligences.

Whether some Quasars, such as OTA-21 and especially OTA-102, might be cosmic beacons set up by a supercivilization living in the Andromeda nebula, is one more question which has been seriously discussed by *Sholomitsky, Shlovskii,*[39] *and Steinhoff*[40] among others.

Of course, we do not have the capacity for making contact with another galactic system; the distances are far too great and, in fact, the time lag renders the reception of any answer impossible. But all this shows that contact by telecommunication has been at least discussed and is not completely out of the question, even at our present stage of technological development.

Such contact by itself would have a tremendous impact on all our physical, biological, astronomical, and philosophical insights. Soon enough both races would try to come into actual contact, if only by means of unmanned interstellar sondes.

Our living space, as we see it today, is Earth, For the next several decades, and possibly centuries, it will most likely be restricted to the solar system. But the results of our human activities are already far beyond these spaces. For 80 years radio waves artificially created on Earth have been speeding through interstellar space and have up to now covered a tremendous sphere with a diameter of 80 light years and a content of more than two million cubic light years.

Although, as *Clarke* pointed out, the first electromagnetic emissions were very weak, their strength has increased tremendously within the last 20 years. It may be that just now an alien race at, say a distance of 20 light years has come to the conclusion that some very feeble signals they are receiving from interstellar space seem to have been artificially created. Any day the same conclusion could be reached on Earth and then the contact would have irreversibly begun.

Finally, an encounter need not be between living races. Our travel into outer space could just as well produce archeological discoveries, possibly even on the Moon, making us realize that in the past there have been visitors from outer space, or on a planet we might find traces of a defunct intelligent race.

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[37] *Sullivan,* Chapter XIV.

[38] See [Proceedings of the NASA – University Conference on the Science and Technology of Space Exploration (NASA SP – 11).]

[39] *Sullivan,* pp. 206, 274ff.

[40] During Oberth Society conference.

Although legal consequences might or could result even from a contact by mere telecommunication, there would be practically no metalegal results if we found remnants of a dead civilization, except the fact that we would be heirs apparent. The exploration and use of outer space and the celestial bodies according to the Space Treaty of January 27, 1967 and the respective UN resolutions 1721 (XVI), 1962 (XVIII), and 2222 (XXI) are by no means restricted to natural objects in outer space, but obviously apply also to artificial objects created by a dead and vanished race and thus belonging to no one, because such objects too can be explored and used. The benefit to the whole of mankind would be very great if such artifacts were found and studied by Earth scientists.[41]

A metalegal problem, on the other hand, would arise if *res derelictae* from another race were found and appropriated for mankind, and if later on other members of that alien race, who happen to be still alife, [sic] met us and claimed the remnants of their dead fellows.

Or still another problem would arise if two races found the relics of a third, a dead one. Would they have to share the found objects? Would any kind of "will" left behind by the dead race be of any importance?

We can only raise these problems; we do not dare to solve them because, contrary to basic metalegal rules, as discussed below, any solution would depend upon the nature of our eventual legal partners and on the quality of the said artifacts. Accordingly, *leges ferendae* will have to bring the solutions.

All considerations and opinions quoted above deal with the problem from the point of view of natural science: they reach or imply the conclusion that it is possible, or even probable, that intelligent extraterrestrial life does exist and that mankind is not the only intelligent race in the universe or even in our own galaxy.

From quite a different standpoint that possibility was proved (in the sense that impossibility was disproved) by the German philosopher ***Immanuel Kant***. ***Kant*** definitely considered the existence of other intelligent races possible: two of his most famous works, the *Groundwork of the Metaphysic of Morals and Critique of Practical Reason*[42]deal explicitly with all intelligent beings, of whom, *Kant* explains, humanity is only one kind. He writes: "One may (in the pure philosophy of morals) discriminate from it, as applied to human nature. By its terminology one is at once reminded that moral principles are not based upon that which is typical of human nature, but must exist *a priori* of themselves, namely on principles from which can be deduced practical rules for every intelligent nature, and thus for the human one as well."[43] "Now I could (Kant continues) roam around within the world of intelligences: but though I have a definite idea of it, I have not the slightest knowledge by any possible effort of my natural reasoning capacity. Thus there remains the idea of

[41] Benefit of mankind as goal of space travel stated *inter alia* in Space Treaty of January 27, 1967 and UN Resolutions 1721 (XVI), 1962 (XVIII), and 2222 (XXI). *Clarke* describes the impact of finding such artifacts in "Rocket to Renaissance", Profiles of the Future (New York, 1964), p. 82.

[42] *Immanuel Kant,* Werke, Reclam Edition (Stuttgart, 1963). Translations from Kant's works into English have been made by the author.

[43] *Kant*. p. 53.

a world of pure intelligence, an aggregate of all intelligences, to which we ourselves belong … as intelligent beings".[44] "This must bring about discrimination however crude – between the world of nature and the world of intelligence: the first can greatly vary, according to the varying degree of sensuality in the spectators of these worlds, while the second one, upon which the first one is based, remains always the same."[45]

This opinion of *Kant's* will be examined in a later chapter.

[44] Ibid., p. 125.

[45] Ibid., p. 110.

II: The Physical Nature of Extraterrestrial Beings

The Necessary Characteristics

Before discussing any further problems, we must examine as far as possible the potential physical nature of alien intelligent beings. This leads us to define two basic terms: First, that of life itself, and second that of intelligence.

Life is a phenomenon on physical nature, a special condition of matter in relation to its environment [46] by which an organism copes with and masters its environment.[47] This environment is the physical, inorganic universe, consisting of matter and energy.[48] Inanimate nature, then, is universally subject to the second law of thermodynamics, the law of entropy. This means that the trend of all matter and all energy in the universe is directed towards the greatest probability of energy distribution.

Life, on the other hand, which by definition has the capacity for selection between several possibilities, necessarily selects the possibility which is least harmful to the organism concerned. This means that a living organism selects the alternative that minimizes energy losses, thus minimizing entropy. So life must necessarily fight, with every sort of movement and decision, the influence of entropy. Therefore, life may be understood as the anti-entropical, the "ectropical" principle.[49]

The trend of life is toward evolution. Evolution means the creation of less probable realities and "improbable" organisms, which gather more and more

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[46] *Pons,* Steht una der Himmel offen? (Wiesbaden, 1960), p. 65ff. and literature, quoted there.

[47] *Nieto* in the panel discussion on extraterrestrial beings, held by the Hermann Oberth Society under the chairmanship of Staats at Hannover on May 3, 1968.

[48] The interdependence of matter and energy has been finally proved by *Einstein.* Hence the following discussion on living forms of pure energy.

[49] According to *Boltzmann* (see 1, p. 43) $S = k \cdot LnW$, whereby S is entropy, k the constant for ideal gases and LnW the natural logarithm of the probability of existence of thermodynamic conditions.

"information"[50] enabling the organism to better withstand entropy. Thus we find that the principle of life is necessarily – and not only on Earth but in the entire universe – a principle of decreasing entropy and gathering and increasing information.

This gathering of information produces by mutation and selection the highest possible level of life: life coupled with reason and intelligence.[51] On Earth, this is human life. Such life then, is reasonable and intelligent if it can understand itself. *Kant* defines an intelligent being as follows: "Everything in nature operates according to laws. Only an intelligent being has the capacity to act according to the concept of laws,"[52] and further: "Therefore an intelligent being necessarily considers itself as intelligent, that is to say, its essence belongs not to its lower instincts, not to the world of senses, but to the world of reason".[53]

Intelligence, however, provides the capacity for logical thought, for recognizing the capacity for choosing between two or more possibilities. Like all living beings, the intelligent ones – but consciously so – will choose the alternative which seems to be the least harmful, which seems to be most anti-entropical.

This leads to the recognition of the freedom of the will, which is another basic attribute of intelligent life.[54] Free will, however, and the capacity to realize possible harmful effects, provide an additional freedom of choice: the freedom to deliberately harm or not harm other beings. The realization that another being, especially another intelligent being can be harmed in a certain situation is a step toward the freedom of will to cause a harmful effect on another or to abstain from such action.

Such realization, however, is not always coupled with the recognition that doing evil to others, i.e., harming them, is unethical. Even to-day there are people who do not perceive this obvious truth. We must realize that crossing the threshold of intelligence requires more than a single step; it requires a long and painful process of adaption of the organs of thinking to the laws of nature, which must be undergone by every sentient race. It might be very difficult to decide whether a race on the intellectual level of the *Homo Heidelbergensis* or *Homo Pekinensis,* or even of the *Neandertal,* should be considered intelligent or not. Such an encounter would call for qualities of wisdom and understanding in granting a kind of "inchoate title" to this race to help it reach the level of actual intelligence. – It would not be permissible to treat such an alien race as animals (or plants or any other organism not gifted with reason). Such aliens would either have to be left alone or guided and protected like children. The choice between these two possibilities is a moral, not a legal one. But to refuse to treat them as legal subjects would be a *legal* result of the biological situation found.

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[50] Ibid., p. 73. *Wiener* (Mensch und Mensehenmaschine, Frankfurt, 1952) even finds: "Man, that is a message."

[51] We fully realize, that there are some semantic differences between the words "reason", "intelligence", "rationality" and similar terms, especially "intelligence" and "reason", as synonyma.

[52] *Kant,* op. cit., p. 56

[53] Ibid., p. 112.

[54] Ibid., p. 103ff.

Once again we would have to deal with this situation – even from the legal point of view – according to the actual nature and stage of development of the aliens in question. Once again it would be a question *de lege ferenda* and is therefore not discussed below, since it is insoluble before an actual encounter has occurred.

But we have found that, apart from the questions of the stage of development or of ethics, intelligence provides the possibility of choice between inflicting or not inflicting harm on others. Harm, then increases and accelerates entropy. Avoiding harm is fighting entropy, is defending ectropy, is defending life. *Pons* has shown that harming others is congruent with fostering entropy, is "evil" and scientifically regressive.[55] This means that intelligence provides at least the inherent capacity to recognize the concepts of good and evil. This very capacity, therefore, is also an attribute of every living being, and thus of all sentient living forms we might meet.

Two more qualities can be expected when we encounter such intelligences. The first is detectability by the human senses. For, should we meet another being whom we could not detect in any way, then its existence would in no way influence us – either corporeally or spiritually – and probably *vice versa.* Recognition need not come at once.

After any actual encounter a considerable time might elapse before we could detect the other being and/or it could detect us. But, as long as we have not the slightest knowledge of such an encounter, we may as well, and we shall, live under the impression that no such encounter has occurred. Therefore our contact with other life forms would presuppose detectability.

The second quality is not so much deduced from logics but rather from natural science: Mankind lives in three-dimensional space. All within nature and the universe exists, as far as we know, in the same space. We are three-dimensional beings in a three-dimensional world. It does not follow from this that every intelligent being must be three-dimensional. But the probability is quite high, because it stands to reason that life develops on celestial, i.e., three-dimensional bodies. A three-dimensional environment can only be dealt with by a three-dimensional being or at least a being that can act in three-dimensional space. If the being is material, then we cannot envisage anything other than a three-dimensional organism, *Abbott's* "Flatland"[56] notwithstanding. If, on the other hand, the being is of pure energy – a possibility which, contrary to *Magno's* opinion,[57] cannot be ruled out in advance – then it will at least *act* in three-dimensional space. If it did not, it would not exist in our universe and would in no way be detectable by us.

One more possibility should be dealt with: the possibility of intelligence without life, i.e., a kind of intelligence that is not tied to any organism, a "ghost" of sorts or spirit. Such an intelligence, however, as long as it were neither matter nor energy, could in no way *exist* in a physical sense, especially not in three-dimensional space, and it could exert no influence in and on this space. It would not be detectable by mankind. Therefore, such an intelligence is of no interest to us. Just as we have no

[55] *Pons,* p. 98f.

[56] Dover, New York, 1952.

[57] See [text and notes 103 - 07 *infra*].

interest in any being that is corporeal but not detectable. We can, therefore, state the premise of three-dimensionality.

One more observation must be made. Wherever life develops it develops, as has been said above, by fighting harmful effects, by fighting entropy. This presupposes a certain amount of "will to live", otherwise no development would be possible. This will to live may have been lost by a very old and secure race. And as long as we do not by chance encounter a race just dying out, some last traces of this will to live will still exist.[58]

Further deduction is not possible. Only a few categories of possibility can be realized:

(a) The other sentient being or beings may consist of one organism only; it need not be a race consisting of several members.
(b) There may be some kind of "group organism" with individual members but with intelligence granted to the whole group only.
(c) The living organism may be very large or very small. Both possibilities may go far beyond our imagination. It could be either microscopic or astronomic.
(d) Three-dimensional beings need not be in a solid state of aggregation. They may be liquid or gaseous.
(e) An intelligent being is not necessarily mortal. Immortality may be an attribute which would necessitate a totally different evaluation of environment and occurrences.
(f) Although intelligence provides, as we have seen, the capacity to realize the concepts of good and evil in the very basic sense of fighting or fostering entropy, the code of values, and thus the moral concept of the other race may be far beyond our comprehension.

The will to live, as discussed above, may be confined to the whole of one race or only to individual members of another. If such members are extremely strong defensively (in the sense of defense against any invasion of entropy, even by other members of their race) and somewhat weak in their eventual offensive acts, it would not even be "moral" to abstain from harming them, because it would be practically impossible to do so. We must in no way be anthropocentric when we examine other races and their intellectual components.

Thus we have five characteristics for sentient beings whom we may encounter:

1. Life in the sense of influencing the environment by selection from more than one possibility, that is, by fighting entropy.
2. Intelligence in the sense of self-realization, realization of free will, and realization of the basic ideas of good and evil.
3. Detectability by humans.

[58] *Schopenhauer* shows very clearly how the "will to live" is the essence of life itself, the most basic trend in animate nature, how it is identical with the concept of "will" itself. See Die Welt als Wille und Vorstellung, Wiesbaden 1966, II, P. 111ff.

4. Three-dimensionality or at least existence or activity within three-dimensional space.
5. Some, if only rudimentary, will to live.

Within these characteristics virtually anything is possible, virtually everything must be expected.

Origin and Development of Protoplasmic Life

In the preceding part of this chapter we have dealt with the question of life in a purely deductive way. Having found necessary characteristics and some kind of definition, we have nevertheless said nothing about the kind of life we know to exist, i.e., the kind of life that dwells on our own Earth.

We recall the opinion of *Urey* and *Miller,* cited above. They believe that "chemical reactions similar to those we call life …" are possible only with C and H_2O (carbon and water). Life based on these elements, which we call protoplasmic life, is probably, but not definitely, a stage of development which is reached by chemical reactions and interactions on every planet and/or other celestial body which lies within the ecosphere of a star. *Shapley* is of the opinion that life could develop on dark warm bodies which move independently through space and which are in a sense midway between "hot" stars and "cold" planet bodies.[59]

Such protoplasmic life is, however, based on chemical substances which we call proteins. These are substances with high molecular weight, consisting of carbon, hydrogen, oxygen, nitrogen and sometimes sulphur, phosphorus, and halogens soluble in colloidal form only. Protein mainly exists in linked amino acids, for example

$$\underset{R}{H_2N-CH}\left[CO.NH-\underset{R}{CH}\right]_n-COOH,$$

with H_2O exuded in reactions; R symbolizes of the amino acids. The peptide chains which result from such reactions are of the type

$$\underset{R}{H_2N-CH}\,CO.NH-\underset{R}{CH_n}-COOH$$

These proteins serve, in the form of enzymes, as catalysts for the chemical reactions which symbolize life. One of the most important of these amino acids is deoxyribonucleic acid – DNA. DNA carries the "genetic code" which provides cells

[59] *Shapley,* Life on Tiny, Dark Stars, Science News Letters July 21, 1962. The nearest "Super Dwarf'", or "Under Dwarf'", a star only a little hotter and brighter than *Shapley's* dark bodies, is to be found on our star map under No. 15 ($-45^0$1841).

with the possibility of developing in a certain way and which is responsible for the inheritance of genetic characteristics.

Extensive experiments by *Miller* and others have shown how life could have originated on Earth under conditions which existed three billion years ago.[60] Scientific opinion about this occurrence have been summarized by *Haley:* "(Earth) at one time possessed an atmosphere composed largely of hydrogen. But because of its comparatively weak gravitational field and because of its exposure to strong energy sources (ultraviolet rays, lightnings, corona discharges from pointed objects), its atmosphere went through a process of reduction. It was during this reduction process that life was first formed. – As more and more hydrogen and helium escaped, the methane and the ammonia in the atmosphere were photochemically dissociated. This resulted in oxidation of a large quantity of organic compounds. These compounds accumulated in the oceans, were polymerized into more complex structures (polypeptides and polynucleotides) and finally formed enzymes and self-duplicating polynucleotides, which in turn gave birth to life as we know it."[61]

It is quite probable that life on other celestial bodies developed on the same basis of proteins and that beings we may encounter are of protoplasmic consistency. This would, of course, result in many similarities of life, necessities of life, and qualities which cannot *a priori* be assumed for extraterrestrials.

We have mentioned this possibility only in order to complete our investigations. But, since these considerations are mainly speculative, we shall have to adhere to the five characteristics of intelligent life deduced in the first section of this chapter – which will be found with all aliens – protoplasmic or not.

Intelligent Machines – The Question of Robots

We must now consider whether mechanical intelligence (i.e. artificially created mechanical intelligent beings) can reach a level at which it may be considered "living". Although we do not intend to discuss legal relationships with machines, we may point out that this question is not as ridiculous as it may seem. For we have to consider not only

(a) intelligence possibly created mechanically by men, but also
(b) intelligences mechanically created by aliens, especially by aliens with much more advanced systems of mechanical science.

When we encounter entities totally alien to us, behaving in a manner that indicates will, determination, and a tendency to preserve themselves, it is quite conceivable that we will be left absolutely uncertain as to whether these entities are living intelligences or artificially created, i.e. robots. Even here on Earth a future

[60] *Sullivan* (2), Chapter IX, *Shapley* (16), Chapter V.

[61] Op. cit. p. 402.

development of computer technology could lead to a stage where machines attain some sort of self-awareness.

It is not our task here to discuss the question of whether mankind would then be obliged to grant these machines some sort of "rights" or even to pass laws of near or absolute equality,[62] although *Clarke* envisages a day when such machines will make men obsolete.[63] We only want to point out a problem which might arise sometime in the future. The encounter with robots made by aliens, however, is no less probable than a physical encounter with the aliens themselves.

[62] *Haley,* op. cit., p. 402, referring to *Miller.*

[63] Ibid., p. 396, *Löb* during panel discussion on extraterrestrial beings, 1968.

III: The Concept, Term, and Literature of Metalaw

Selection and Definition of the Term

We have yet to prove that legal relationships with other sentient beings are indeed possible and that, even granted this assumption, it would be sensible to examine such legal problems before any actual encounter. However, before considering this question, we have to define the concept of law between two different races *per se.*

Law is the system of rules which regulates the social behavior of men and/or of their organizations. Law is a rule of conduct. It establishes the obligation to act or not to act in a certain way and it establishes the right to expect from other men, other legal subjects, that they do the same.[64]

Legal rules are by definition contradictory to the concept of freedom, since "absolute" freedom implies the right and the possibility of acting according to one's own free will without regard for whether such action harms others or infringes on their rights. No legal contact would be possible between subjects if the concept of "absolute freedom" were paid any heed.

On the other hand, the rule of "absolute law" would mean that the exercise of free will had been cancelled out, that every possible situation had been regulated in advance in a way which allows the legal subject only one course of action. The rule of absolute law would not only be identical with absolute terror, but would deprive the legal subject of one necessary constituent part of human life as we have defined it above: that of free will.

Thus, any and every legal regulation is a restriction of the possibility to exert free will. But no legal regulation may abolish this possibility. And as free will is a primary factor for every sentient being, it should be restricted only in so far as such restriction is necessary to avoid conflicts with others also possessing free will.

[64] We shall not repeat our investigation in this direction, but will refer to our book, *Fasan,* Weltraumrecbt (Mainz, 1965), p. 13ff.

"Law is, therefore, the total of conditions by means of which the discretion of the one with the discretion of the other can be reconciled under a general rule of freedom."[65]

Hence, when we encounter another intelligent race and begin relationships with it, some sort of "ground rules" will be necessary. These will have to govern our conduct and theirs in order to avoid mutually harmful activities. Such rules will be a first and basic "law" between races.

The question of what to call this new legal branch has been discussed by several authors. *Haley* calls it "Metalaw",[66] *Valladao* "Inter Gentes Law",[67] *Bueckling* "Law of Interplanetary Cooperation",[68] and *Magno* "Astral Law",[69] while *Korovin* speaks of "Interplanetary Law"[70] and *Creola* proposes "Exobiological Intersubjectnorms(!)".[71]

"lnter Gentes Law" is a quite acceptable term. However, it is a term very similar to *Vitoria's* "ius gentium"[72] and is furthermore a term consisting of three words, which is not as convenient as a single word term. *Creola's* proposition is definitely too unwieldy. "Law of Interplanetary Cooperation" is also too long. Besides, it is not significant for legal relationships with another race, as there may well be relations between planets, all of them inhabited by the same race, for instance – in the distant future – by Earthmen. This same limitation is also valid for the terms "Interplanetary Law" and "Astral Law".

The term "Metalaw", finally, is not only the oldest one that deals with this aspect of law but is also short and as clear as we can demand from so concise a term. Also several authors have already used it[73] and it is, due to its Greek component, easily translatable into other languages. Therefore, it is proposed that the term "Metalaw" be used for legal relationships with extra-terrestrial intelligences. *Thus we define Metalaw as the entire sum of legal rules regulating relationships between different races in the universe.*

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[65] *Kant.* Metaphysics of Morals, Berlin 1912, VII, 31.

[66] *Haley.* op. cit., p. 394ff. and his earlier papers, quoted there.

[67] Second Colloquium. Springer (Vienna, 1960), p. 166 in his paper 'The Law of Interplanetary Space, Second Colloquium', p. 156f.; he is supported by *Seara.Vazquez,* see below.

[68] lnterplanetarisches Kooperationsrecht, Friedenswarte, Basel, 1960, p. 306.

[69] Sixth Colloquium.

[70] As quoted by *Zukov,* at Sixth Colloquium.

[71] Raumfahrt und Völkerrecht, Polygraphischer Verlag AG (Zürich, 1967).

[72] See *Rauchhaupt,* A light from the Past, First Colloquium, p. 1.

[73] The term, introduced by *Haley,* refers to his paper, read at the VIIth IAF Congress, Space Law and Metalaw, A Synoptic View; idem Harvard Law Review, Nov. 8, 1956.

A Survey of Literature

Although legal literature regarding relationships with other intelligences is by no means sparse,[74] and while some papers dealing with this subject are more than 10 years old,[75] there has been a considerable mixing of the legal aspects of these questions with political ones, especially those having to do with power politics. This is understandable, since speculation about the hypothetical physical and mental nature of such beings brings about various reactions. As a result of these reactions, different recommendations develop as to the course of action to be taken when the actual event, the first encounter with other intelligent living forms, takes place.

A survey of such literature shows the following: *A. G. Haley* was the first to deal explicitly with the problem of legal relations between different intelligent races in the universe. It was he who coined the term "Metalaw" and suggested it as the name to be applied to this new branch of legal science. After an extensive study of related problems, he derived the following basic legal formula which he called the "Golden Rule of Metalaw":

"We must do unto others as they would have done unto them."[76]

Consequently he formulated the following clauses as derivations from the above rule:

"In establishing spatial relationships, no force of any kind may be used."[77]

"To Metalaw we can project only one principle of human law, namely the concept of absolute equity."[78]

"For the questions of Metalaw the rule should be that space outside an individual zone of sensitivity is free space, to which the traditional freedom of the seas may apply."[79]

"Where there is reason to believe that life exists on a planet, no terrestrial spaceship may land without having satisfactorily ascertained that the landing and contact

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[74] *Katz,* Who owns Space? McLeans, Canada, Magazine, Jan. 18, 1958, p. 13, *Simpson*, Into Deep Space, 32 Los Angeles, Bar Bulletin, 355–368, Oct., 1957, *Kehrberger* in his bibliography Legal and Political Implications of Space Research, Weltarchiv, Hamburg, 1965; *Fasan,* op. cit.; *Smirnoff* uses the term Metalaw as special topic in his World Bibliography of Space Law, Institute Za Mezdunarodnu Politiku i Privredu, Belgrad, 1962; *Faria* [Draft to an International Covenant for Outer Space, Third Colloquium, p. 123ff]; *Mirel* [Golden Rule invalid in space, Science News Letter, vol. 85, Feb., 1964]; *York* [Basic Problems of Metalaw, Legal Aid Brief Case, Chicago, 1958, vol. 35, p. 243ff].

[75] See *Smirnoff,* op. cit.; *Kehrberger,* op. cit.; The Law of Outer Space, Report to NASA by the American Bar Foundation, *Lipson* and *Katzenbach,* Oct., 1960, reprinted in Symposium 1961, p. 788ff., which lists several early papers under topic "E", Other Beings, with papers by *Jenks, Clarke, Haley, Mellor, Kroell, Rhyne, Garbett, Katz, Simpson.*

[76] *Haley,* Space Law and Government, p. 395.

[77] Ibid., p. 413.

[78] Ibid., p. 414.

[79] Ibid., p. 418.

will injure neither explorer nor the explored, and until the ship has been invited by the explored."[80]

"To define unlawful penetration or interference in Metalaw it will be necessary to define the proper domain that belongs to each society …"[81]

"Metalaw is an indefinite number of frameworks of natural laws."[82]

"It is better to destroy mankind than to violate Metalaw."[83]

Discussing these passages from *Haley, Jenks* points out that *Haley's* golden rule is "the keynote of a moral approach to a policy rather than a principle that lends itself to expression in legal terms".[84] Although some passages from *Haley's* Metalaw, as quoted above, are rather forceful, we cannot agree with *Jenks'* criticism. For the "golden rule" is basically the same as the prohibition of harmful interference with the legal partner, that is, in this case, the other race. And as we shall find below, this prohibition is a very basic *legal* rule.

Lasswell deals with Metalaw (without using this or any other term) in his paper for the Fourth Colloquium on the Law of Outer Space[85] and especially in his book co-authored by *McDougal* and *Vlasic* entitled *Law and Public Order in Space.*[86] However, the authors make clear that they propose a course of action rather than a legal code, and therefore this point of view should be considered first.

Similar to *Smirnoff,*[87] the book deals with interaction between beings in three sections:

(a) with cultures of inferior science and technology;
(b) of similar science and technology; and
(c) of superior science and technology.

Although *Lasswell* et al. postulate the doctrine of minimum interference, they discuss as a possible solution a kind of trusteeship[88] and a kind of international administration and repeatedly arrive at analogies regarding contact between superior and inferior civilizations on Earth. They say:

"It is compatible with the policy of minimum interference to insist upon a decisive process (with the other civilization) in which an effective voice in decision making is available to many and is not monopolized by a few."[89] And:

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[80] Ibid., p. 418f.

[81] Ibid., p. 419.

[82] Ibid., p. 419.

[83] See *Schuette,* (19), p. 14.

[84] Space Law, Stevens & Sons (London, 1965), p. 114.

[85] Anticipating remote contingencies: Encounter with living forms. Fourth Colloquium, p. 89ff.

[86] Yale University Press, New Haven, 1964, part III, chapter 9.

[87] The Legal Status of Celestial Bodies, Journal of Air Law and Commerce, Vol. 28, No. 4, 1962, p. 385ff.

[88] Fourth Colloquium, p. 83ff.

[89] Ibid., p. 987.

"There are forms of coercion (to other civilizations possible), justified as they may be by local theology and philosophy, that cannot be tolerated in a universal public order that affirms the dignity of advanced forms of life."[90]

Human dignity – and the dignity of all sentient beings in the universe – is stated as the goal,[91] although the authors realize that "with the exception of well-being – which is concerned with physical survival – none of our familiar values may be found."[92] However, all living forms "will seek to maximize preferred events."

McDougal et al. are of the opinion that there is a wide range of analogies, and state:

"Many perspectives are so well established as predispositions of effective political elites that it is but a small step to perceive that they apply to contingent encounters in space."[93]

"We do not recommend the concentrated use of our resources to save lives if the probable consequence is to multiply numbers while diminishing the level of living."[94]

"If the other race does not use its resources, we may use them."[95]

However, the prohibition of harmful action is clearly stated,[96] although restricted in the above sense.

When discussing contact with civilizations with *similar* science and technology, *McDougal* et al. rightly point out that different races need not necessarily be united when they meet in space and that there could be political interactions between several parties, especially if there are similar social structures shared by the races.[97] A preliminary agreement between two such races is proposed.[98]

Even in the case of human contact with *superior* forms some advice is given and the possibility of exercising the balance of power between two or more races is discussed.[99]

In conclusion, the question of "spheres of activity" is discussed, since there would be:

1. Spheres of activity in territory originally held by Earth or non-Earth beings; and
2. Spheres of activity in intermediate positions between the main territories of Earth and non-Earth entities.[100]

[90] Ibid., p. 984.
[91] Ibid., p. 989.
[92] Ibid., p. 990.
[93] Ibid., p. 993.
[94] Ibid., p. 976.
[95] Ibid., p. 979f.
[96] Ibid., p. 988f.
[97] Ibid., p. 994.
[98] Ibid., p. 999ff.
[99] Ibid., p. 1015.
[100] Ibid., p. 1018.

The concept of "man" refers to advanced forms of life. Regardless of morphological characteristics, the crucial mark of an advanced form of life is deemed to be the possession by individuals of complex internal systems of integration that make it possible to invent, transmit, and acquire culture.[101] A precondition of responsible conduct is taken to mean the predisposition to learn from experience.[102]

The work of *Lasswell, McDougal* et al. is among the most extensive on the subject of Metalaw. However, there is, intentionally, more "metapolitical" advice given than metalegal formulations to be found. Their work is more a discussion of *lex ferenda* than a study of eventual *lex lata.* And although "minimum interference" is proposed, we very much doubt whether any interference – coercive and therefore harmful interference – can be a basic rule of Metalaw.

Bueckling discusses legal relationships with other intelligent beings[103] under the heading of "Interplanetary Law of Cooperation". The precondition for any such relationship is, according to *Bueckling* that such beings be capable of decision based on morality and free will. Therefore *Bueckling* denies the possibility of Metalaw with beings who, like insects, are individually incapable of such decision, and thus mankind would have the status of overseer to such creatures. Material rules are, however, not stated in the paper quoted.

Magno is of the opinion that extra-terrestrial beings must be corporeal (not of liquid or gaseous form)[104] and therefore have "specific characteristics of individual solidity and corporeality".[105] They should be able to distinguish good from evil and have knowledge of themselves and of the outer world.[106] "Astral Law", as *Magno* has called it, should be based on a common moral sense whose first principle should be: "Nobody may injure others"[107] for which principle *Magno* quotes *Korovin.*[108] From this *Magno* rightly deduces that mankind may require from the aliens that they do not harm us, and believes that we must in any case be ready to defend ourselves.

Working Group Three of the International Institute of Space Law under the chairmanship of *Smirnoff* submitted in its Draft Resolution Regarding the Celestial Bodies[109] that:

"If on a celestial body any sign of present intelligent life can be found, or can reasonably be expected, the provisions of that Resolution shall be reconsidered in accordance with the peculiarities of each case, in respect to relations with those living beings."

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[101] Ibid., p. 1021.

[102] Ibid., p. 1121.

[103] See [Interplanetarisches Kooperationsrecht, Friedenswarte, Basel, 1960, p. 306].

[104] Sixth Colloquium, p. 50.

[105] Ibid., p. 53.

[106] Ibid., p. 57.

[107] Ibid., p. 60.

[108] Ibid., p. 62, *see Korovin* "Mežplanetnoe pravo?" Meždunarodnaja žisn, 1964, No. 3, p. 130, as quoted by *Zukov,* Kosmičeskoe pravo, Moscow, 1966. p. 270.

[109] Seventh Colloquium.

Valladao proposed the term "Inter Gentes Law" for relations with extra-terrestrial intelligences and considers outer space as a *res communis omnium universi,* a "thing" common to all intelligent creatures of the universe.[110] He even envisages a "Planetary Inter Gentes Association"[111] and states, obviously according to the Roman idea of *par in parem non habet imperium,* that not even Earth as a whole can assume lordship over a celestial body, inhabited by such "human beings".[112]

A very interesting study of "Law Among Planetary People" (as he calls it according to *Valladao)* is given by M. *Seara Vazquez.*[113] Apart from the possibility that a group from Earth might establish themselves as an independent nation on a celestial body – a quite reasonable possibility, the consideration of which is beyond the scope of this investigation – he considers two possibilities, namely:

1. That there might be found *human* beings on a celestial body, and
2. The possibility that such intelligent beings might be different from men.

Interesting as this division of problems may be, it is not a justifiable one. For it is not important how aliens look and how their minds are organized (these would be the two characteristics according to which we could call the aliens "men"). It is, on the contrary, only important that we meet *homines alteros,* i.e., intelligent beings who originated on another planet, who are not of Earth stock and who have a totally different (although possibly quite similar) biological evolution.

Some science fiction writers deal with the possibility that earthmen at one time in the prehistoric past emigrated or that mankind did not originate on our planet at all, but came from outer space. But even if this very improbable eventuality were true, it would make no difference. For we still would have totally alien legal partners whose line of evolution and, especially, whose cultural development might have taken them further away from us intellectually than aliens with greater biological differences.

Therefore once again we cannot agree with *Seara Vazquez* that aliens – even humanoid ones – can be colonized at all. For he writes, after stating that "no colonization is possible if they are organized and possess a certain culture", the following.

"If they are not politically organized, earthmen will have the right to colonize them". Of course, this colonization cannot be conducted on classic lines.

"A superior form of colonization will have to be conceived that could be a kind of tutelage under the vigilance of the United Nations …"[114]

To repeat, we cannot agree with this opinion. For it would mean that a kind of political organization, as we humans understand it, is a presupposition of legal maturity.

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[110] Second Colloquium, p. 166.

[111] Ibid., p. 167.

[112] Ibid., p. 164.

[113] Cosmic International Law, Wayne State University Press, Detroit. 1965, Second Part, Third book.

[114] Ibid., p. 239ff.

We shall find below that all intelligent races of the universe necessarily have equal rights. And if a race decides that any kind of an organization is absolutely unnecessary, that would be for them to decide, not for us. For what should we say if those unorganized aliens broke down all of *our* political organizations because they considered them to be unnecessary?

Thus the conclusions arrived at by *Seara Vazquez* regarding "aliens who are not men",[115] i.e.,

(a) independence
(b) legal relationships, quite different from human international law and
(c) the right of self-defense should be accepted without any discrimination as to whether the aliens are or appear to be human or not.

Clarke's opinion is summarized as follows:

"There is no danger of interplanetary warfare, since any races we encounter in space will probably be superhuman or subhuman. If there are superior beings elsewhere, their moral state will probably be as advanced as their scientific state."[116]

In a later paper he speaks of cosmic diplomats and of the possibility of shared living space in an example very similar to ours below.[117]

Kroell states that our law cannot be imposed on beings on other planets, either in their relations *inter se* or with us, and that a new law to govern "interplanetary relations" is necessary.[118]

Rhyne is of the opinion that human relationships with other (interligent) [sic] life-forms must always be based on a policy of fairness and reason.[119] *Katz* supports *Haley's* "golden rule",[120] as do *Gabett*[121] and *Simpson,*[122] while *Mirel* critizes it.[123] *Cocca* does not deal explicitly with Metalaw. However, when discussing legal problems related to the moon, he states:

"Eventual occupation of the Moon would by no means imply right of ownership but, at most, would entitle Earth – not a particular state – to *preferential domination* in the event of legal claims being put forward by political organizations from other planets."[124]

And nine years later he stated that: "Any concept of definition in the present state of cosmic exploration, must be limited to the solar system."[125] *Faria* believes that outer space is *res omnium communis* for all nations "including even rational crea-

[115] Ibid., page 241f.

[116] Symposium 1961, p. 779.

[117] *Clarke II*, op. cit., p. 118 (see [n. 16]).

[118] Symposium 1961, p. 779.

[119] Ibid., full paper of US Senate Symposium 1959, p. 269ff.

[120] Ibid., p. 779.

[121] Ibid., p. 779.

[122] Ibid., p. 779.

[123] Golden Rule invalid in space, Science News Letter, vol. 85, Feb., 1964.

[124] Legal Nature of the Moon, First Colloquium, p. 36ff.

[125] Universo y Sociedad, Buenos Aires, 1967, p. 119.

tures of other civilized worlds".[126] He furthermore properly stressed the necessity, and with this the right, of self-defense against "some possible evil intelligences".[127]

We should furthermore draw attention to the papers of *York,*[128] *Blackshield,*[129] *Keyhoe,*[130] and the review of Metalaw by *Zukov,*[131] who has written a special chapter on this aspect but feels, on the other hand, no real necessity to deal with this question.[132] *Creola* is also quite reserved in this respect, but he nevertheless introduces a new term for Metalaw, which has been quoted above.[133] *Hyman's* Magna Charta of Space,[134] one of the early documents of Space Law, contains the following passages:

"… The landing on any other planet containing life, or the occupation thereof, by earthmen shall not give to any nation on Earth any right of ownership or control of such other planet;"

"… The peoples of Earth do hereby declare that they recognize the rights of sovereignty, ownership and control of any other planet by the inhabitants thereof;"

Woetzel[135] finds that it is difficult to define metalegal rules before knowing something about the nature of the hypothetical aliens. However he finds by analogy from international (human) law "that conquest and enslavement or domination of other intelligent beings would be contrary to generally accepted precepts of law". *Smirnoff* points out that the UN Space Treaty of January 27 1967 ignores the possibility of encountering other intelligent beings except, possibly, in the provision of Art. V., which declares astronauts to be envoys of mankind. "Envoys to whom?" *Smirnoff* asks, not without reason.[136]

Fasan expressed the opinion that terms of space law as human law, with man and his organizations as the only legal subjects "could not apply to or on celestial bodies on which any sign of present intelligent life can be found or can reasonably be expected",[137] an opinion which leads to the formulation in the IISL WG III draft resolution, as quoted above.[138] In his book[139] *Fasan* proposed to start, when dealing

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[126] Draft to an International Covenant for Outer Space, Third Colloquium, p. 123ff.

[127] Ibid., p. 125, furthermore see Remarks on Metalaw (Spanish "Transdireito") Publicaoes da Comissao de Astronautics e Cybernetics da Fundacao Santos Dumont, Sao Paulo, No. 1, Feb., 1960, p. 19ff.

[128] Basic Problems of Metalaw, Legal Aid Brief Case, Chicago, 1958, vol. 35, p. 243ff.

[129] Metajurisprudential Reflections, Jaipur Law Journal, vol., 1966.

[130] Flying Saucers from Outer Space, Berlin, 1964. This paper shall represent all unscientific UFO literature which we definitely do not examine in this paper.

[131] See [Zhukov, n. 107, p. 46].

[132] Existence of rational beings on distant celestial bodies, ibid.

[133] Raumfahrt und Völkerrecht (Zürich, 1967).

[134] Frequently published, for instance, The Magna Charta of Space, Fifth Colloquium, p. 8.

[135] Sovereignty and Rational Rights in Outer Space and on Celestial Bodies.

[136] Report, Tenth Colloquium, Belgrade, 1967.

[137] Paper, Sixth Colloquium, p. 3.

[138] Seventh Colloquium.

[139] *Fasan,* Weltraumrecht, Chapter IX.

with questions of Metalaw, with the Categorical Imperative of *Kant* and to deduce the following principles:

1. The intelligent races of the universe have fundamentally equal rights.
2. Any activity damaging the other race must be avoided.
3. The preservation of the one race must have preference over the development of the other race.
4. To help the other race is an ethical, but not a legal, principle.[140]

He furthermore stated the right of self-defense as a principle of Metalaw.[141]

[140] Ibid., p. 152.

[141] Relationships with Extra-terrestrial Intelligences and *Kants* Categorical Imperative, Astronautik, vol. 2, Hannover, 1968.

IV: The Categorical Imperative and Metalaw

As we have seen above, the basic principles of reason and intelligence must necessarily be the same for every sentient being. When, therefore, we discuss legal rules, valid for every intelligent race and its members, we must start with those principles which are deducible by and from pure reason.

We may encounter opposition to this kind of project. For as long as we do not know the real nature of such aliens, of such *hominibus alteris,* we can hardly state the rules about not harming them, because we could not possibly know which of our activities would harm them and which would not. (We could thus not know the code of values of the other race).

Is it then, possible to find a basic legal term which is valid for all intelligent beings, regardless of their corporeal nature; to find a law, which is valid from pure reason alone, which is, in the strict philosophical sence, a "law *a priori*"?

The answer is, as has been deduced by *Kant,* in the affirmative. It must be, according to *Kant,* a "moral rule above all empirical, a rule above all anthropological, a valid *a priori* for *every intelligent being*" (my italics).[142] *Kant* says in so many words:

"How could it be justifiable for us to introduce something which is perhaps valid only according to the special conditions of mankind, as general rules to be respected by all intelligent beings, and how could rules for determination of *our* will be considered as rules for determination of the will of intelligent beings in general, and only as such for our own will, if such rules were empirical only and had not their origin entirely *a priori* in pure, but in practical reason?"[143]

Such a law, it is obvious, has to state a request, a duty to apply the free will inherent, as we have seen above, in every intelligent being.

[142] *Kant,* op. cit., p. 22.

[143] Ibid., p. 50.

"This duty shall be an unconditional-practical necessity of action; it must therefore apply to all intelligent beings … and *only therefore* (*Kant's* italics) be a rule for the human will".[144]

Thus *Kant* asks:

"The question therefore is: Is it a necessary rule that all *intelligent beings* (*Kant's* italics) should judge their acts always according to such maxims as to what they themselves want, that they (the maxims) could serve as general rules? If it is, then, such a rule, it must be (entirely *a priori)* connected in general with the idea of the will of an intelligent being. But to find this connection one has to go however reluctant one may be, one step further, namely in the direction of metaphysics, although to a sphere of the latter which differs from speculative philosophy in that it is the metaphysics of morals."[145]

And he continues:

"Here we talk about the objective-practical law, i.e., about the relationship of the will to itself, so far as it determines itself purely by reason, because then everything falls away which is not related to the empirical: because, if *reason for itself alone* (*Kant's* italics) determines the course of action (the possibility of which we shall now investigate), it must do so necessarily *a priori.*"

"Will has to be considered as the capacity to decide an action according to the recognition of certain laws. And such a capacity can be found only in intelligent beings."[146]

The will of every intelligent being therefore has to have the maxim of the will of the general legislator.[147] This is true for *all* intelligent beings, as *Kant* expressly states. It follows, then, that the systematic connection of "different intelligent beings" brings about a "general regime of purposes."[148]

"For intelligent beings all stand under the law, that each of them may never deal with itself and with all others merely as a means alone, but always at the same time as a purpose in itself. But from that originates a systematic connection of intelligent beings by way of objective rules, i.e., a regime which may be called a regime of purposes … because these rules have as their intention and goal the relations between these beings."[149]

The will of every intelligent being, including the human will is, as we may repeat, basically and *per definitionem* free. It is according to the above deduction a kind of causality of all intelligent beings.[150] It is therefore determined only by the necessity of acting according to the common will of all intelligent beings, which is understood to be a goal in itself (hence the above mentioned "regime of purposes").[2]

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[144] Ibid., p. 74.

[145] "Maxim" is, according to *Kant* (ibidem, p. 67), the subjective principle to act, in contraste [sic] to the objective principle, namely, the practical law.

[146] Ibid., p. 75f.

[147] Ibid., p. 76f.

[148] Ibid., p. 82.

[149] Ibid., p. 85.

[150] Ibid., p. 85f.

"And thus categorical imperatives are possible, whereby the idea of freedom makes me a member of an intelligible world, whereby my actions, were I only such a being, would be always according to this autonomy of the will. But as I am at the same time a member of the physical world, they *should* always be so …" (*Kant's* italics).[151]

"This moral obligation is thus the necessary individual will of a member of a world of reason and is considered by it as an obligation only because it (the member) considers itself at the same time as a member of the physical world."[152]

This moral obligation, which *Kant* calls the Categorical Imperative, and which is – beyond the physical world – the form of a rule only, reads as follows:

"Act in such a way, that the maxim of your will can at the same time always be valid as the principle of general legislation."[153]

The meaning of this sentence is not too difficult to grasp when we realize that it is a formula for all intelligences, *regardless of their nature.* Even the most primitive and basic legal rules for men are based upon man's nature and are therefore *natural law*.[154] But if we do not know the nature of the legal subject at all, one might, as considered above, come to the conclusion that not even then the most basic legal norm could be found. That is, according to *Kant's* Imperative, correct, as long as we look for a *material norm*. But an empty, although absolutely valid *formal term* can be deduced from the concept of reason alone. It must be the Categorical Imperative, as quoted above.

The application of this formula to all kinds of legal subjects, including mankind, is quite simple, and must be so: Being a legal subject of a certain, say human kind, and therefore knowing my own nature and that of my compatriots, I want to behave in a certain way. Then I have to ask myself whether it is desirable that all other legal subjects should act in the same way, whether it is desirable, generally, *to* permit such action as being legal.

For instance: I want to take away from another human being a certain thing without his consent, which means, that I want to steal. Then I have to ask myself whether it would be desirable to permit stealing in general. Since under such a general rule somebody might deprive me of a thing I want to keep, stealing should not be permitted in general. Therefore, the Categorical Imperative in general forbids me to steal.[155]

But under totally different circumstances, the same situation would result in a quite different solution: Should it happen that one legal subject has acquired a stockpile of all drugs of a certain kind that are necessary to prevent an epidemic, and

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[151] Ibid., p. 103.

[152] Ibid., p. 114.

[153] Ibid., p. 115.

[154] *For this see Verdross.* Abendländische Rechtsphilosophie (Springer, Vienna, 1958). Section 2, and especially, p. 226ff. We must also mention the American Declaration of Independence, which begins with the words: "We hold these truths to be self-evident, that all men are created equal, that they are endowed by the Creator with certain *unalienable rights*" (my italics).

[155] This example is requoted from *Störig,* Kleine Geschichte cler Philosophie, (Kohlhammer, Stuttgart, 1955), p. 349f.

should he refuse to provide these drugs to his sick or endangered fellow humans, i.e. to the other legal subjects, then only by taking these drugs could the race be saved. Then "stealing" should be generally permitted and stockpiling should be prohibited. And the same categorical imperative would bring about a result contrary to the one found above.

This oversimplification shows that the nature of the legal subjects and the situations common to these subjects have to be considered when we want to evolve practical rules for the application of the Categorical Imperative.

Without knowing anything about the nature of the legal subjects, we can therefore evolve no such rules. *Without knowing anything about the different intelligent races of the universe, we cannot therefore definitely establish rules of Metalaw.*

This result is however, not as negative as it seems to be. For we are not altogether unaware of the nature of our eventual legal partners of another race. We and the aliens have, as found above, some basic-characteristics in common which describe our nature, and theirs in a general but quite distinct way.

We have found that all intelligent races of the universe, with whom human contact may be possible, must have the following five characteristics in common[156]:

1. Life
2. Intelligence
3. Detectability (by the other race)
4. Three-dimensionality
5. The will to live

Applying the Categorical Imperative formula to all legal subjects with such characteristics, we can evolve material rules valid for all of them. *Considering the common values necessary for all such beings, we can evolve the basic rules of Metalaw.*

According to our deduction, however, we might assume that these rules would be valid for single beings only, because the Categorical Imperative seems to be addressed to such single beings only. This assumption, however, would not be correct. The addressees of the Imperative is every intelligent being, which means every legal subject. Legal subjects, on the other hand, are not only the individual members of the human (or any other intelligent) race, but all beings capable of free will. With humans this is not only the physical person but the legal person as well. The will of such a person is, as we have learned, detected, expressed, and carried out by its organs. With regard to the Categorical Imperative, therefore, there is no difference between physical and legal persons, right up to such "big" persons as states and international organizations (if the latter are considered legal subjects according to their statutes).

If, therefore, different races meet, and each acts according to a united will, it becomes (at least then, if not by any organization beforehand), a new, and the greatest legal person. It will then necessarily have acquired a mutual (and free) will, it will thus be subject to law; and thus the Categorical Imperative will and must be valid for it, and so must, at the same time, all rules of Metalaw, deduced and deducible from this Imperative.

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[156] See result of para 2.

V: The Rules of Metalaw

Legal History

In the first chapter we quoted several ancient thinkers who all expressed the opinion that there is intelligent life in the universe apart from the human race. These opinions are in complete accord with ancient legal theories. For we must remember that, starting with the oldest Greek philosophers, there was always the conviction that there is a *Dike,* i.e., a basic law valid for the whole cosmos.[157]

Anaximander was of the opinion that *Dike* (Law) belongs to the nature of all things, that it is a cosmic law in itself and therefore not only for humans.[158] *Heraclitus* states that there is an eternal *Logos* which exists in itself and goes beyond the human *Logoi,* i.e., human formulations in the sense of laws. *Heraclitus* proves that *Dike* operates throughout the cosmos and gives a place to everyone, not only to men. Man can find *Logos* in his own soul; to act according to human nature therefore is to act according to *Logos*.[159] This may be called the first deduction of natural law, and it is at the same time the first deduction of the fact that natural law is not a concept valid for mankind alone but is valid for the whole universe. And it can be discovered and comprehended by every being capable of reasonable thought.

It is beyond the scope of this investigation to study all the philosophical schools that developed further the concept of "general" natural law, although it would be an interesting work if we considered the fact that, for instance, *Alcibiades* deduced the validity of law not from the will of the people's majority *but from reason* – a concept which is indeed related to *Kant's* thinking as quoted above.[160] We may pass by *Plato* and *Aristotle,* although the former states that it is human intelligence which

[157] See *Verdross.* Abendländische Rechtsphilosophie (Springer, Vienna, 1958), p. 7ff.

[158] Ibid., p. 11ff.

[159] Ibid., p. 14.

[160] Ibid., p. 24.

dominates man's will and his senses[161] and who feels that our world is anchored into existence,[162] while the latter created the concept of "Entelechia", the striving after an aim, and who thus gave the concept of natural law a deeper meaning.

For our task, however, we shall confine ourselves to a short examination of one school of philosophy, which we can justly call the ancient philosophical basis of Metalaw: the school of *Stoa*.[163] According to the Stoics there is one moral-legal world law, valid for the whole unintelligent *and intelligent* (my italics) world, which is consistant with natural law. Thus *Chrysippus* says that the *Logos,* this world law, is "leader of all entities which are inclined from their nature to political organization, and that it is therefore the guideline for the legal and non-legal …".[164] And *Cicero,* Rome's greatest Stoic, said:

"Omni tempore una lex est sempiterna et immutabilis."

"(There is always one law eternal and unchangeable)"[165]

"Constans et sempiterna, lex sancta et coelestis."

"(Constant and eternal, a sacred and celestial law)"[166]

"Lex est ratio summa, insita in natura, quae jubet ea, quae facienda sunt prohibetque contraria."

"(Law is the highest reason, embedded in nature, which orders what is to be done and prohibits the contrary)"[167]

"Est quidem vera lex ratio, diffusa in omnes."

"(Reason certainly is the true law distributed among all people)"[168]

And we may conclude with his statement, most important for our examination:

"… quibus enim ratio a natura data est etiam recta ratio data est: ergo et lex."

"(To those to whom intelligence is given by their nature, true reasons is also given and, therefore, the law as well)"[169]

Thus *Cicero* has already stated what we are discussing today: That there is a natural law within every being that has intelligence. Once we find this natural law, we have the first legal norm of universal validity, we have found the first rule of Metalaw.

This conclusion is repeated by the scholastic philosopher *Thomas Aquinas*, whom we quoted earlier concerning his conviction about extraterrestrial intelligences.[170] *Aquinas* writes:

"Manifestum est quod omnia participant aliqualiter legem aeternam, inquantum scilicet ex impressione eius habent inclinationes in proprios actus et fines … Unde et ipsa (rationali creatura) participatur ratio aetema, per quam habet naturalem

[161] Ibid., p. 30.

[162] Ibid., p. 35.

[163] Ibid., p. 44, Literature there quoted.

[164] Ibid., p. 45.

[165] De re publica, III, c. 22.

[166] Ibid., c. 4., § 10.

[167] De officiis, I, c, 4, § 14.

[168] De re publica, III, c. 20.

[169] De legibus, I, c. 7. See p. 4.

[170] Summa theologia, II, 1, qu. 91, art. 2.

inclinationem ad debitum actum et finem; et talis participatio legis aeternae in rationali creatura lex naturalis dicitur."

"It is obvious that all participate in some way in the eternal law, inasmuch as they have, of course, from the natural impression made on them an inclination toward proper acts and aims … And where in it itself (the intelligent creature) eternal reason participates, from this comes the natural inclination to the due act and aim; and this participation of the eternal law in an intelligent creature is called natural law."[171]

The passionate – and convincingly scientific – plea of *Vitoria* and *Suarez* that pagans, especially Indians, are men, are legal subjects and are to be treated as such, is firmly based on the argument that they are legal subjects *because they are gifted with intelligence.* And although these two Spanish lawyers do not deal the non-human intelligences, their arguments are still valid for Metalaw.[172]

Referring to *Montesquieu's* opinion once again,[173] we come to the final conclusion: *Every creature gifted with intelligence is a legal subject for the basic natural law.* And every creature gifted with intelligence is, furthermore, a legal subject in the light of *Kant's* Categorical lmperative.[174]

Thus we have a basic legal form which is valid itself. We have, furthermore, the stated universal validity of natural law. Metalaw, therefore, is first to be found when we apply the Categorical Imperative to the nature of the imagined legal partners, the aims and values necessarily common to all partners of Metalaw, i.e., to all entities having, as we have seen, the following characteristics in common:

1. Life
2. Intelligence
3. Detectability
4. Three-dimensionality
5. A will to live

All these characteristics, then, are natural conditions. Legal rules based upon these conditions are, therefore, basic primary *natural law* for all intelligent beings. As it is true that human natural law is inseparable from every member of mankind,[175] the same is therefore true for "other" people, for all members of alien races as well. And as *Vitoria* said:

"Quod naturalis ratio inter omnes gentes constituit, vocatur jus gentium."

"What natural reason regards as applying to all nations is called international law."[176]

we [sic] may be allowed to translate the word "gens" into "race" and thus reformulate his sentence as follows: "What natural reason states among all races is called interracial law." This interracial law, however, we call Metalaw. With this we find that Metalaw is a new kind of natural law whereby the "nature" upon which this law

[171] Ibid., (author's translation).

[172] *Verdross* (165), p. 85ff.

[173] See [text and notes 10 - 2].

[174] For this see *Verdross*, op. cit., p. 74ff.

[175] Ibid., p. 231.

[176] Reflectio de lndis, tit. leg. 2.

is based is the mutual biological[177] characteristics of all intelligent races. When we start from these characteristics, we are able to evolve the rules of Metalaw.

Evolution of the Rules

We have already established that the trend of life, if not is [sic] purpose, is to preserve, to propagate, and so develop itself.[178] This development, however, leads to higher and higher and more complex organisms, to the direction of intelligent organisms as the highest level of such development.

Sinnot,[179] *Teilhard de Chardin,*[180] and *Pons,*[181] especially the latter, have evolved a biological formula valid for all life and, consequently, for all intelligent life in the universe, which reads as follows:

"The law of life is the cosmic validity of the principle of reducing entropy and increasing information."[182]

"When it recognizes the concept of good and evil as the principle of reducing or increasing entropy, and when it recognizes the freedom of the will, it has reached the level of intelligence."[183]

We must bear in mind that his "intelligent life" as the summit of creation is, as we have seen from *Kant* above, a goal in itself. To destroy, or even to arm it, therefore is necessarily illegal. This basic rule of Metalaw, the prohibition of inflicting harm on other intelligent life, which is closely related to *Haley's* "Golden Rule", is therefore a metalegal rule *a priori* in the strictest sense. It is the prohibition of increasing entropy for intelligent life. In the context of Metalaw, we might formulate this rule as follows:

1. *Any act which causes damage to another race must be avoided*

This rule naturally confers both rights and obligations on all races. If, therefore, one race does not comply with it, then the injured race has the right to protect itself. This means the right of self-defense. This right to destroy everyone and everything that inflicts entropy on itself, especially when this infliction is illegal, is therefore the second metalegal principle, which may be formulated as follows:

2. *Every race has the right to defend itself against every harmful act perpetrated by another race*

On this legal right of self-defense we might even quote *Thomas Aquinas* who, after the statements quoted above said:

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[177] As life is a mutual condition for all legal subjects, the science of all life in the universe may be biology, and the term "exobiology" may be applied to the science dealing with extraterrestrial life.

[178] See *Schopenhauer,* op. cit., p. 400ff.

[179] *Sinnot.* The biology of the spirit. Viking press (New York, 1955).

[180] Der Mensch im Kosmos (Beck, München, 1959).

[181] *Pons,* op. cit.

[182] Ibid., p. 87.

[183] *Sinnot*, op. cit., p. 122, *Pons.* op. cit., p. 102.

"Hoc sit cuilibet naturale quod se conservet in esse quantum posse."

"(It is natural for everybody to conserve his being as far as possible)"[184]

However, we must realize that this means only self-defense in the strictest sense and, therefore, never any kind of retaliation or "preventive war".

The next rule results from the fact that, as we have seen above, self-conscious life, intelligent life, is the highest level of evolution. Every intelligence must be considered as the end result of creation, both unique and essential in the entire universe.[185] There might be differences in the level of development of civilization, of scientific achievement, even of moral standards with regard to mutual values. But these are not differences *in principio* but only *in gradu,* and the problems of "emerging intelligence" have been dealt with above.[186] The principle will be self-consciousness as intelligent being, the realization of *cogito, ergo sum.*[187]

When *Aristotle* writes concerning the status of man:

"ἄνθρωπος, φαμέν, ἐλεύθερος, αὑτοῦ ἕνεκα καὶ μὴ ἄλλου ὤν"[188]

(Man, we say, is free on account of himself and because he is not anybody's property)

he gives the status of man's spirit. This same position is valid for every intelligent being. It is free, as *Thomas Aquinas* says about man: "Liber est, qui causa sui est."[189]

The basic will to live will not permit any intelligent race to consider itself inferior. The Catagorical Imperative will not permit any race to consider itself superior, because that would mean that every race might consider itself superior. Of any two subjects, however, it is clear that not both of them can be superior. Thus we arrive at the third basic rule of Metalaw:

3. *All intelligent races of the universe have, in principle, equal rights and values*

This law of equality results in one more legal concept: *Par in parem non habet imperium*[190] – no one has sovereignty over an equal partner – which is one more concept not based upon human nature but on the very concept of all intelligent life with equality of rights. Therefore we can formulate:

4. *Every partner of Metalaw has the right of self-determination*

Furthermore, every conceivable relationship with other sentient beings consists necessarily of measures which are detectable by the other race. This means mutual exertion of impressions, be it by telecommunication only. Every such contact, however, may cause collision of interests.

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[184] Requoted after *Verdross,* p. 71.

[185] Because it has intelligence.

[186] See p. 10a.

[187] This statement of *Descartes* has never been questioned since its formulation. See furthermore Art. 1 of the Universal Declaration of *Human* (my italics) Rights of Dec. 10, 1948: "All human beings … are endowed with reason and conscience …"

[188] Metaphysics, I 2 982b, 25f.

[189] He, who has his own reason, is free. Summa contra gentes IV, 55.

[190] *Leibholz* in Strupp-Schlochauer, Wörterbuch des Volkerrechts, De Gruyter (Berlin, 1960), I., p. 694ff. UN Charta. [sic] Art. 2, 1.

Let us, for instance, imagine that race A tries to contact race B, by far-reaching light effects, which are "speech" for race A but have an adverse effect, or possibly even a deadly effect, on race B. If such an occurrence takes place then race A would have to realize the damaging effect of its communication and would have to abstain from it.

But there are more serious collisions of interest possible. Let us imagine a situation where a certain substance, essential for the existence of both races, can be found in restricted quantities only; let us imagine colliding living spaces,[191] or, with *Lasswell,* conflicting ideologies: How can these problems be solved?

The solution once again is to be found by applying the "Prohibition of Damage" norm. There are, however, two possible kinds of damage:

(a) The damage of existing values, the infringement of the *status quo ante,* the *damnum emergens* of the Roman Corpus Iuris Civilis.
(b) The infringement of future possibilities of development and profit, the Roman *lucrum cessans.*[192]

Both concepts are derived not from an anthropocentric law, but stem from the very nature of the trend of life – preserving and defending itself. They are terms of pure theory – in the sense of the pure theory of law, the applicability of which will be dealt with below.

Therefore, we have to start again from the nature of life as basically opposed to entropy. The preservation of life checks and prevents entropy. But as the preservation of life is the presupposition of its further development, opposing interests will have to be solved in a way which gives priority to avoiding actual damage over any possibility of future development. Thus we can formulate the next rule of Metalaw as follows:

5. *The principle of preserving one race has priority over the development of the other race*

When considering this, however, we have to realize the two basically different kinds of possible action, namely:

(a) actual doing, i.e., activity, and
(b) not acting, i.e., inactivity

Each course of action can be damaging to the other race. We have already formulated the rule of Metalaw, quoted above, that every race must abstain from activities damaging to the other one. Can one, then go further: Can one race demand positive action by the other in order to minimize or avoid some threatening damage? For instance: we learn that electromagnetic waves of a certain frequency, which our race uses, say, for television, are harmful to the other race. Then our first rule of Metalaw forbids us to use such waves in all areas where they can damage the other race.

[191] See below [at text at note 195].

[192] Instit. IV, I.

But what should be the law when some epidemic breaks out among the members of another race, which can be *cured* by such waves? Are we then legally obliged to deliver such waves to the suffering aliens?

As long as we remain within the limits of strict legality we have to answer this question in the negative. For no race may damage another one. No race has therefore the right to demand from the other that it harm itself. But every enlargement of entropy is by definition damage to a certain degree. Were we to provide the other race with certain electromagnetic waves, we would use up energy. But using up energy increases entropy and is self-damaging. Therefore our negative answer is correct.

This solution is, as we have said, a purely legalistic one. The highest principles of human ethics would, of course, demand that we should, and very quickly, help the other race and provide the necessary energy. And thus we find that an example, given by *Kant* himself for his Categorical Imperative, is correct only from an ethical and is wrong from a legal point of view. As great a man as *Kant* was, he made mistakes, as *Schopenhauer* pointed out.[193]

With this, we come to the next conclusion:

6. *It is not a legal, but an ethical principle that one race should help the other by its own activities*

There is, however, an important exception to this rule: It becomes valid if the damaged race is harmed by a past, albeit bona fide activity of the other race, and now needs some positive action to remove the damaging consequences of this activity. The injured race has, of course, the right to demand such positive action, for life must not be damaged. Violating this principle is illegal. And once the violation has happened, the danger of entropy for the other race has been increased illegally.

Once more we have to apply the Categorical Imperative: Can and must a metalegal "rule of torts" demand the restoration of balance, the repair of damage, which results from past illegal activity? The answer must be that the damager must restore the integrity of the damaged party: the *restitutio in integrum*. Any other solution would make the Prohibition of damage rule a mere theoretical demand, a sort of *lex imperfecta.* If every race might, though illegally, inflict harm on another race without any obligation of restoration, the legal insecurity would increase, and the damaged race might feel inclined to retaliate with force.

Once more we have a legal rule which is not only universal among human legal subjects but results from a concept of life and its protection and is therefore a rule of Metalaw. Thus we find:

7. *In case of damage the injurer must restore the integrity of the injured party*

But what if restitution is impossible? Or if it is not impossible, but if it would threaten the very existence of the damager himself?

[193] *Schopenhauer,* op. cit., p. 491ff., appendix, "Critics of Kants philosophy".

The first problem is not too difficult to solve. Impossibilities cannot legally be demanded because that would be contrary to basic logic and therefore to the concept of intelligence. It is senseless to make a demand which can never be fulfilled, even if the obligated party were perfectly willing to comply. Once again Roman Law has provided a rule which results not from human nature but from reason, and what is more, from the concept of law itself: *Ultra posse nemo tenetur.* And this rule is also customary in international law on Earth.[194]

Therefore we must state:

8. *No partner of Metalaw may demand an impossibility*

But what if it would be possible to comply with a certain legal demand of one race but the performance of this duty would destroy the obligated race? For instance: We meet members of another race and cause – perhaps by mere carelessness – a very dangerous epidemic, which means a heavy ingression of entropy to the aliens. Let us furthermore imagine that help would be possible but that it would require every gram of fissionable material, every ton of coal and every stick of wood to be found in our world and furthermore, all the electromagnetic energy that could be put out by the industry of mankind. The reason being that only such huge quantities of energy could save the other race from the epidemic and even from extinction.

We can easily say that it would be, assuming the transportation problem could be solved, theoretically possible to comply with these requirements. But this would mean, of course, the total breakdown of all the cultures and civilizations created by the human race and the death of most of its members, if not all of them. Must we then comply with the demands of the other race when it declares that it was we who caused the epidemic?

In human law, private as well as international, the answer is negative.[195] No one must kill himself, no nation must destroy itself in order to fulfill any legal obligation. But is this human law a law for humans only?

Once more the answer is negative. For the very basic trend of life is, as we have established, to preserve its own existence. Suicidal tendencies are very quickly bred out of every race, or else the race dies out. Suicide is entropy's most direct influence on life because it directly and without any anti-entropical side-effects destroys the living ectropical organism. The legal equality of races results from the concept of life itself. And life, not intelligence, is the basic factor, because life without intelligence is possible, but intelligence without life is not. Thus intelligence is the secondary factor. And the concept of life itself prohibits any rule which would demand suicide.

Therefore we find:

9. *No rule of Metalaw has to be complied with when compliance would result in practical suicide for the obligated race*

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[194] *Verdross,* Völkerrecht, Springer (Wien, 1959), p. 177f., discussing Hague Court of Arbitration decision of Nov. 11, 1012 [sic], in Turkish-Russian Dispute.

[195] Ibid., In literature see *Shylocks* demand in *Shakespeares* "Merchant of Venice".

The legal term of obligation raises another question: The contact between two or more races will undoubtedly have some scientific aspects as well as some economic ones. The exchange of information will be one of the first activities. But these contacts will not remain on the level of exchange of information regarding past scientific occurrences but will inevitably include information regarding future occurrences and activities. Information regarding one's own future activities may have or may acquire the character of an obligation when information indicates that a certain action of one's own will definitely consists of certain measures within a certain space of time. Thus agreement about mutual future actions and, together with this, treaties of various kinds can be foreseen. Must such agreements be kept? Is the international – and once more ancient Roman – legal notion of *pacta sunt servanda* valid for Metalaw?

Agreements are phenomena of intelligence. They are not in inseparably bound up with human nature. They are imaginable for all sentient beings. Can then – applying the Categorical Imperative once more – any relation exist between intelligent beings if nothing is reliable, if truth is a meaningless term, if every piece of information, every promise regarding a certain future activity may be wrong? When the other partner relies on this information, on these agreements, and when he arranges his own activities to the course of action agreed upon, the breaking of such agreements or the breaking of a promise relied upon necessarily results in some damage to the deluded partner. And such damage would be, as we have found illegal. Therefore we find:

10. *Metalegal agreements and treaties must be kept*

As we have seen, every conceivable race of aliens will have to be three-dimensional or at least have to act in three-dimensional space. Every race therefore needs this "living space" as a necessary condition of its existence.

With this we can deduce:

11. *Every race has a title to its own living space*

There will be many other rules of Metalaw which will develop after the first actual detection of and/or contact with the other race. These rules *de lege ferenda* will be based upon all mutual values of the two (or more) races. There may well be the limitation or the sharing of living space areas and of spheres of influence; the exchange of scientific knowledge and legal norms as well which deem it necessary not to provide the aliens with such knowledge; there may be economic treaties, mutual permit of visitors, and so on. But nothing can be said about these rules beforehand because they will not only be based upon the concept of intelligent life but also upon the actual nature of the other race.

This ruling is particularly valid with regard to the deduction concerning living space, as mentioned above. Such living space may be exclusive, but it need not be so. Imagine humans encountering a microscopic race which lives in the highest atmosphere of, say, Mars and obtains its nourishment from a kind of atmospheric plankton which itself lives from high-flying dust particles. To go further with this example, imagine that mankind uses these layers of the atmosphere of Mars only for

space ships orbiting around the planet.[196] These, then would be living spaces mutually shared without any need for drawing up frontiers or setting limits. The same might be said for interplanetary space if any solar system were a hunting ground for beings of pure energy roaming around the central star not affecting and not being affected by a corporeal race using this space only for travelling through it.

We know, of course, that exobiologists might easily prove that these hypothetical constructions are virtually impossible. But they were only prepared to show that the question of the exclusivity of living space is not one that can be solved before we actually encounter the "other race".[197]

[196] Almost the same example is given by a man with much better and surer imagination, namely *Clarke* (see [n. 34]).

[197] Metalegal relations may evolve without the question of living space being of any importance. We need only imagine prolonged contacts over very great distances by communication, and without actual (corporeal) encounter. Such communications - by electromagnetic waves or by unmanned sondes - could be very impressive, important and, accidentally, damaging.

VI: An Order of Precedence for Metalaw, and the Pure Theory of Law

Order of the Basic Rules

Before we repeat our eleven rules of Metalaw, we must realize that they are not all of equal validity and strength, but that a kind of order of values can be established resulting from the reason for these rules. Norms based upon the concept of life itself are stronger than rules based upon the concept of intelligence. Rules that are likely to check and fight entropy will have preference over rules that are less anti-entropical. An evaluation of our eleven rules would bring about the following results:

1. *No partner of Metalaw may demand an impossibility*

This is the strongest rule of all, because an obligation to perform the impossible goes contrary to the principles of life, law, and logic. Living organisms are not capable of performing the impossible.

2. *No rule of Metalaw must be complied with when compliance would result in the practical suicide of the obligated race*

This rule is the second in strength, because it results from the most basic instinct of life, that of self-preservation.

3. *All intelligent races of the universe have in principle equal rights and values*

This rule comes next because it results from the basic will to live and because it is necessary for the development of further legal relations.

From which it follows:

4. *Every partner of Metalaw has the right of self-determination*
5. *Any act which causes harm to another race must be avoided*

This next rule, based upon the anti-entropical nature of life, is (as may well be noted) the first one which assigns a real duty to one race in regard to the other one. It results in the following terms of equal validity.

6. *Every race is entitled to its own living space*
7. *Every race has the right to defend itself against any harmful act performed by another race*
8. *The principle of preserving one race has priority over the development of another race*
9. *In case of damage, the damager must restore the integrity of the damaged party*
10. *Metalegal agreements and treaties must be kept*
11. *To help the other race by one's own activities is not a legal but a basic ethical principle*

The Pure Theory of Law and Metalaw

In addition to these positive norms, there exists a whole system of legal science which is not dependent on the nature of the subjects of law but on the precept of intelligence alone. This system is the "Pure Theory of Law" created by *Kelsen*.[198]

Once we have the basis on which to create metalegal norms, we have the methodological possibility of creating a legal system which is independent of any terms of "material law", one which is purely formalistic and therefore based on reason alone. With this it is possible to create a system independent of human or alien nature and only dependent on the basic notion of intelligent life.

Kelsen and *Merkel*[199] and the theory of pure law will not give us additional material norms, but they will provide us with enough knowledge of theoretical formal legal structure to enable us to formulate any legal notions of *positive law desired* in the necessary *structure of law.* This structure gives for instance the following picture:

1. *General norm;* for example: Do not harm the other race or its members.
2. *Special norm;* for example: if television waves injure the members of the other race, do not use such waves in areas where they can harm the *homines alteros.*
3. *Particular decision;* for example: space ship number so-and-so has in violation of special norm 2, used the prohibited waves. It is liable:
   (a) to be punished (if such a material norm exists).
   (b) to compensate the injured party, as provided for by the special norm (or the organization of its own race, when this organization is to reimburse the injured party).
4. *Execution of decision 3.,* if the liable party does not comply with it (if execution is agreed upon).

Furthermore, the pure theory of law will provide the necessary legal concepts to legally regulate certain situations. We do not know, for instance, whether the con-

[198] General Theory of Law and State, 1945; Reine Rechtslehre, 1934.

[199] Das Recht im Lichte seiner Anwendung, Deutsche Richterzeitung, 1917.

cepts of "sovereignty" and "property", or the concepts of "recognition" and "renunciation" or the notions of *lex specialis derogat generali* and *lex posterior derogat priori* will be part of a certain future metalegal system. But as they are concepts of legal theory and logic rather than terms of material law it is quite conceivable that the same intelligent reasoning by different races will bring about the same legal notions and thus these notions will become as *ius contractus* terms (i.e., formal terms) of Metalaw.

Thus the pure theory of law will provide us with a formal basis for discussion which will probably prove most useful when metalegal relations are specifically discussed between different sentient races.

We must furthermore bear in mind that an alien intelligent race need not be organized like the human one. On the contrary, there are the following possibilities:

1. There may be individual beings organized in one society – a stage of development which mankind will have reached a "World State".
2. The other race may consist of one organism only, which may be complex, and may even consist of parts which are not (or not always) in physical contact.
3. The members of the other race may be organized in groups, not representing the whole race, but with independence (like the present national states of the Earth) and with or without any kind of supreme organization.
4. There might be other possibilities. For instance, members of the other race may be at very different intellectual levels and have forms of interdependence of which we cannot be aware beforehand.

However, regarding the first three examples of possible organization, there are different levels of metalegal relations which can be envisaged.

(a) Relations with the alien race as a whole (if it is organized as a whole).
(b) Relations with organizations of that race, which are not identical with the whole race (if it is divided into sub-organizations).
(c) Relations with single members of this race.

On the other hand, we know that meta-legal relations with mankind may take place on three levels, namely

1. with mankind as a whole, which should be united or at least should unify at once when the first contact with extraterrestrial beings has been made,
2. relations with individual states, and
3. relations with individual humans or legal persons.

These are, of course, possibilities all of which are today purely speculative. But they will be useful for the *leges ferendas* which will have to be developed after the first contact.

Our representation of the necessary legal structure and the basic rules of Metalaw may seem too simplistic and too fantastic and perhaps too anthropocentric as well. It is none of these.

(i) It *is* simple, because only very basic terms can be independent of human – or non-human – nature – and simultaneously dependent on the nature of every intelligent being in the universe. Only structures which can be deduced without any experience, which are therefore almost structures *a priori*,[200] are applicable.

(ii) Although we realize that every example quoted above is fantastic and reads like science fiction, we only wish to show what might be possible regarding aliens. These examples are products of fantasy, but the logical deductions from scientific and philosophical facts are not. They are, on the contrary, somewhat conservative, because they are restricted and limited by our own reasoning capacity. An alien race, intellectually more developed than ours, might well reach further conclusions which would seem much more fantastic.

(iii) From this it follows that our conception is not anthropocentric either. Not based upon human nature, but rather upon the peculiarities necessarily inherent in every intelligent race, we should rather call it intelligentocentric, as it focuses on the concept of a living intelligence. And it applies to our human race only for the reason that this race is (or so we hope) a race of living intelligent beings.

Thus, we have formulated a set of rules which are valid for all sentient beings in the universe. All these races and beings will find them (or will already have found them), whenever they investigate the problems of legal relationships with other intelligences, the problems of what we call Metalaw.

Like the "natural constants" of *Planck,* they are "legal constants", valid for the whole universe. And only by acting according to these rules can we have enough dignity, enough self-esteem and enough humility, to appear before any other race in the spirit of true humanity, in the spirit of *humanitas universalis*.

[200] In a strict philosophical sense those are not conclusions a priori because only these, based upon reason alone, are such, are synthetical conclusions of that kind. All conclusions drawn from the nature of life, from three-dimensionality etc. are based upon certain facts a posteriori as well.

VII: Metapolitics

After discussing the possibilities of encountering intelligent aliens in outer space and after examining the metalegal rules *de lege lata,* we have to ask ourselves how human – non-human relationships might develop after the first actual contact.

We may repeat that there are four possibilities of such contact:

1. Contact by telecommunication;
2. Discovery of remnants, especially artifacts of vanished – possibly extinct – races;
3. Contact by directed artifacts, especially by unmanned sondes:
4. Actual physical contacts of the intelligences or – the difference might not be so great – possible metaphysical contact, i.e., contact from mind to mind without bodily encounter.

On the kind of encounter largely depends the course of action which seems advisable for the human race.

If contact is made by mere telecommunication, the "dialogue" which would be carried out over great distances and would therefore need a great deal of time, would be a prolonged exchange on a purely scientific basis. A mutual "language" would have to be developed before factual messages could be exchanged. But during the learning of such a language mathematical messages will be exchanged – in fact, those would be the first messages[201] – and hence mankind will learn the mathematical. i.e., scientific level of the aliens and they will in turn learn the same from us.

But will they be inclined to learn at all? Curiosity is a quality which is hardly separable from an intelligent being's will to live. In order to develop itself, an intelligent being has to gather information. And self-development is a basic characteristic

[201] *Sullivan* op. cit. Chapter XVIII. *V. Müldau* during Oberth Society discussion [n. 23]; Signals from intelligent entities may be assumed, when signals detected have got a kind of order, beyond mere statistical phenomena.

of life. Thus we may assume that every intelligent race has at least some traces of curiosity.

That means that aliens will want to learn from us. But will they let us learn from them? Here the answer is not so quickly to be found. If the other race is intellectually constructed like present-day humans, the answer might be in the affirmative. But what if they are extremely defense-oriented? What if they fear any intrusion much more than we do? What if they are more xenophobic than humans (still) are?

Thus, if aliens are not interested in the exchange of scientifically oriented messages, they must be either so degenerated that they have simply lost their curiosity and thus most of their will to live, or they must be extremely fearful.

Both obstacles might be overcome. If the alien race is degenerate, then it would need a stimulus of the greatest possible impact in order to reverse its decay – and is any greater impact conceivable than contact with another race of intelligent beings? Every outlook on life – philosophic, scientific, religious (if this is a meaningful concept for them), or questions of art (if they have any) would be called into play, and this would intensely stimulate or reawaken curiosity.

Let us imagine a race so degenerate and so plagued by boredom that it has entirely lost the will of development. That would be a race which has reached and attained all conceivable goals, found answers to all questions, done all worthwhile deeds, a race in a kind of relative "Nirvana". Suddenly, there comes a message from another race, at once there is a new goal: To know what the others know, to compare scientific results, to compare one's own solutions with alien questions and then finally, to realize the possibility of physical encounter.

In fact, if there is any will to live at all, if the other race is not just dying out, this contact will bring a kind of renaissance, at least for the best minds among them, and an answer to the first alien message will be given.

Totally different are the measures by which we may overcome fear. We may not at once realize the existence of such fear. We shall learn about it only when we realize that we are giving more information than we are receiving, and when we realize that the answers are carefully constructed in such a way as to confuse any correct picture that we may make about the aliens.

How could such fear be overcome? First we must find out what kind of fear prevails: Is it a fear of the whole race, or is it a fear of a few individuals – we might call them reactionary – who shun any new development? In the latter case we should make contact with less reactionary members of the aliens. This may prove difficult, but then, we have all the time we need; nothing and nobody is pressing us.

In the case of general racial xenophobia, however, we are confronted with an enormously rewarding task, that of extinguishing fear, of instituting trust and confidence, or better still, friendship.

To reach this goal, we must find out, of course, what could be the reason for the aliens' fear of us. They may fear for their lives, for their possibilities of expansion and development. They may fear an intrusion of entropy, or they fear damage in some way.

Thus we should have to make crystal-clear the rules of Metalaw, by which relationships between different races must be guided. We should make clear that those

metalegal rules forbid us to damage the other race, that they compel us to repair damage that has been done (also when it was done unwittingly), and that our highest (non-legal) ethical principle is to help the aliens, when necessary.

If the other race is fearful, most likely it is acquainted with the concepts of violence and war. We should therefore have to make clear to them that there will be no violence, and especially, that no war will be started by Earthmen. We should be confident enough to add that we are acquainted with war but that war is thinkable for us only as a last measure of self-defense.

If the other race fears that the means of contact may be dangerous – electromagnetic messages of certain frequencies might be felt by some beings as shocks of raw energy, for instance, then we would have to ask them what means of communication they would prefer, and we should have to do as they request.

However, once we make clear our rules of Metalaw, the aliens would realize that they need not fear us. And thus we might overcome this obstacle. On the other hand, we must realize that there may be intelligent races in our universe which have an extremely strong will to live, so strong that they may not be ready to accept equal partners or relationships. We might encounter an extremely aggressive race, a race that needs or seeks so much more living space that it is not ready to allow us a share of space or other necessary potentialities of developing our race.

The reason for such an attitude may be purely spiritual – they might consider themselves lords of creation "without gods besides them" – or they might actually be a race expanding so vigorously and so quickly that this urge is stronger than their common – and their legal – sense.

Long as the time may be before we learn that the other race fears us, the time may be longer still before we realize that we have to fear the other race. Therefore each message from the aliens will have to be very carefully studied and examined in order to find traces of any such unfriendly attitude on their part.

We will not advocate a restriction of messages to an alien race and we will not advocate ridiculous security measures. But, once again, it would be sensible to let the others learn our attitudes toward metalegal rules. They will learn that we regard them and ourselves as equals, and they will learn that we shall not attack them but are ready to defend ourselves.

Such an attitude, proud and humble at the same time, may possibly disabuse the aliens and prevent them of wrong ideas. Information about our military development is, of course, by no means the kind of information which should be exchanged at all.

The contact by unmanned sondes is one of the ways of exchanging messages; however, we must realize – and the aliens must realize too – that sondes are solid objects which travel at very high speeds and, from this fact alone, are quite dangerous. We would not advocate sending such sondes unless invited to do so, and we would not advocate extending such invitations ourselves before we know exactly how to handle them. This means that we could not, with our present technological development, invite high velocity sondes[202] because we would not know how to

[202] Such sondes could accelerate at very high rates and travel with velocities nearing "c", i.e. light velocity.

bring them to a stop. It would be up to the aliens to prepare these sondes in a way which would permit them to slow and halt them without our intervention.

Furthermore, we shall have to keep in mind the hypothesis of anti-matter. Should the other race or their artifacts consist of anti-matter, every physical contact would be disastrous. In any case, we should warn our alien partners about this danger beforehand, whether we are the senders of such unmanned sondes or whether they are.

Unmanned sondes not consisting of anti-matter, on the other hand, are of extremely great value and importance to us. They can travel over great distances, with a "board time" longer than is practicable for humans (or for short-lived aliens). They may contain "things" in the widest sense of the word, *res* in the legal sense. Exchanges of unmanned sondes would be tantamount to an exchange of goods of the highest scientific value. If the first exchange proved interesting, more would follow, and an initial sort of "trade" would develop. Exchanging scientific facts and findings as well as trade goods by unmanned sondes would start highly intensive relationships, even before any physical encounter occurred, and we shall find that many of the metalegal rules, as developed above, will already apply here.

The most interesting, the most intensive and, sad to say, the most improbable contact between humans and aliens is, of course, the actual physical contact. We can only speculate how such a contact might come about: It might be in outer space, on another planet, or during a journey. It might be a rendezvous agreed upon beforehand by message. It might be a landing of aliens on Earth – invited or not – and it might be an encounter with an alien spaceship.[203]

Lasswell, et al. consider, as shown above,[204] three categories of possible courses of action in the event of such an encounter. They discuss encounters with

– inferior
– equal, and
– superior races.

We think these categories are well founded, but are not the only ones to be foreseen, for we may encounter

– peaceful but fearless,
– peaceful and fearful,
– aggressive and fearful,
– aggressive and fearless races.

Furthermore we may encounter more than one race at the same or nearly the same time. We may meet races fighting each other and we may have to take sides, if there is no possibility of neutrality. In short, there is no limit to speculation above

[203] For evaluation of UFO-nonsense see *Westphal,* UFO UFO, D.V.A., Stuttgart, 1968. We do not fully agree with *Westphals* results, for Earth may have been and may be visited by aliens. But he correctly states, that up to now there is absolutely no proof, that UFOs really exist and that they are alien spaceships. And he is right when he claims that people who maintain to have been in contact with aliens are either erring or cheating.

[204] See [text and notes 84 - 91].

and beyond the five premises we established. We repeat these premises here, because they are the starting point for our investigations. The premises are:

1. Life
2. Intelligence
3. Detectability
4. Three-Dimensionality.
5. A will to live.

Starting from these premises we might well follow the categories of *McDougal, Lasswell,* and *Vlasic,* as quoted above, when we examine possible outcomes of a physical encounter.

What would that mean for the course of action to be taken by Earth authorities? The answer will depend primarily on the question as to whether the encounter was expected or unexpected. Expectation may not result from previous contact by telecommunication alone: it may well result from intelligence reports, from the finding of remnants of alien patrols, from discoveries of spaceships, from the finding of unmanned stations, etc.

Once we know that there are aliens within reachable distance, all Earth nations would be well advised to abandon most other tasks of world policy and concentrate on preparing for the imminent meeting. On the other hand, it would be wise to realize that an encounter may be a total surprise, that a meeting might occur – here or in space – without any warning. We agree entirely with *Lasswell,* et al. writing:

"… the course of future development will be profoundly affected by the character of the initial contact. Systematic, comprehensive consideration of precontact, contact, and post-contact events can increase the likelihood that under any contingency policies will be adopted that maximize the goals of a universal system of public order compatible with the dignity of advanced forms of life."

We should realize that the *homines alteri*, too, may or may not be prepared for the meeting: anyway, we should not rely on them, but should take the initiative with the right and proper sort of action, which is based upon the life-trend to dominate the environment. We know this trend and we may expect that the aliens know of it as well; we may also expect that the notion of violence, or even of war, is at least theoretically known to them. Because of this, they will ask themselves the same question as we will be asking ourselves:

"Do we meet a belligerent, a violent or aggressive race, or do we meet a race with which we can negotiate?"

If the aliens are aggressive, they will furthermore ask themselves:

"Are the Earthmen an easy prey, or are they ready and willing to defend themselves?"

On the other hand, they might have toyed with the idea of meeting alien beings and they might have considered some concept of relationships and, with this, the concept of regulating the latter, i.e., the concept of what we call Metalaw. – Of course, we might happen to meet a single entity which because of its isolated nature had never evolved the concept of relationships at all. But if it is intelligent at all, it will then realize that it is not alone in the universe, that there is contact with other entities, and that there will have to be relationships of some kind.

With this presupposition we should try to create a kind of basic mutual "language" and make clear to our partner (or partners) our ideas concerning the character of the encounter and about future relationships and, at the same time, ask them about their respective ideas.

Our own ideas, of course, are concerning regulations which necessarily guide *all* relationships between intelligences. Our own ideas are, therefore, those of Metalaw.

Here is what (after developing such a mutual "language") we should communicate to the aliens:

"We shall not harm you!"

"We shall not permit you to harm us."

"If harm is done unwittingly, we shall restore your integrity as fully as we can."

"We regard both you and ourselves as equals, neither you nor we are superior, neither you nor we are inferior."

"If we promise something, we shall keep our word; of [sic] you promise something, please do the same"

"We have the will to live; we realize and appreciate that you do as well."

"We need three-dimensional living space; we realize that you have the same need. Therefore we shall not impair your space; please do not impair ours."

"We intend to develop our race; but we recognize that for you the existence of your race has preference over our development. However, we expect you to take the same attitude with regard to us."

"If we can help you in any way, please tell us. It is an ethical principle for us to extend help to you."

The other life form, however far it may have developed, will recognize the sincerity of our communication. It will recognize, furthermore, that we expect the same statements of policy and the same sincerity from them.

Man is a rather aggressive race, but even this race is able to formulate rules of universal validity. If, therefore, the aliens understand our statements but do not transmit the same ideas, then we should assume that they might be more aggressive than we, and we should then be prepared for an inimical attitude from their part.

Dignified, trusting, and watchful at the same time, announcing our highest ethical principles as legal norms, we are ready to encounter any race in the universe, and to solve the problem of facing races with emerging intelligence, as discussed above. Recognizing above all the postulate of non-interference, we may find ways to guide and enlighten these races.

Certainly we shall have to make sure that no Earth nation or private interest groups have occasion to exploit any creatures thus entrusted to us. But we should very carefully consider where help and advise end and where oppressive interference begins. Our ethical principles require us to help the other race. It would be no help if, after some tutelage, we deceive ourselves in order to stay in the living space of the other race and administer it on the grounds that we had once rendered them help.

During all contacts with aliens we shall have to go back to our basic metalegal rules. They alone will provide us and any alien race with the basis for an enriching and rewarding contact between the intelligences in our universe.

Préface

Le nouveau livre du Dr. *Ernst Fasan* vient illustrer d'une manière particulièrement brillante une notion juridique chère à notre regretté collègue et ami *Andrew Haley*.

De nombreux juristes se sont déjà penchés sur la nature des relations, juridique qui pourraient résulter de rencontres entre êtres humains, c'est-à-dire des "Terriens", et d'autres êtres doués d'intelligence pouvant exister dans le reste de l'Univers. Mais, jusqu'à présent, tous ces travaux n'ont pas abouti à une systématisation cohérente de normes et de règles applicables à de telles rencontres.

Aussi on doit sayoir gré au Dr. *Fasan*, non seulement d'avoir brossé un large panorama de la littérature juridique consacrée à "Metalaw", mais aussi d'avoir défini et justifié avec beaucoup de clarté, en s'appuyant sur l'histoire du "Droit Naturel", un certain nombre de règles politico-juridiques qui devraient s'imposer à tous les êtres intelligents de l'Univers.

Ce livre est donc une utile contribution au Droit d l'Espace.

Paris, 25 novembre 1969

Dr. Eugène Pépin
Président
de l'Institute international de droit spatial

Synopsis in French [Résumé Français]

Relations juridiques avec des intelligences extra -terrestres. Un fondement doctrinaire pour le Méta-Droit

1. ***La possibilité d'une rencontre avec des êtres intelligents non-humains***
   Aussitôt que nous posons la question d'une vie intelligente extrahumaine dans l'univers, nous nous voyons confrontés avec l'absurdité des "Soucoupes Volantes" ou des "Petits Bonshommes Verts". Voilà la raison, par laquelle cette question souvent fait sourire l'interlocuteur.

   Cépendant on a posé cette question dès l'antiquité et on ne l'a pas toujours niée.

   Ici se rangent le point de vue des "Pré- Incas", du *Romain Lucrèce*, de *Giordano Bruno*, du saint *Thomas D'Aquin*, ainsi que de *Montesquieu* et d'autres.

   L'astronomie et l'exobiologie en parviennent aussi au même résultat, demontré par beaucoup de citations, qu'une vie intelligente extrahumaine est probable dans l'univers, même dans notre galaxie. Dans notre propre système solaire cependant il ne faut rien attendre de la sorte.

   Il est vrai que la supposition de l'existence de tels êtres ne comprend pas encore la possibilité d'une rencontre avec eux; mais la dilatation du temps à l' occasion des ascensions dans l'espace, décrite d'après Saenger, semble admettre cette possibilité. D' ailleurs on peut bien se figurer des actes de communication par une sorte de radiodiffusion (voir le projet d'OZMA)

   Enfin deux des œuvres principales de *Kant* paraissent supposer l'existence des êtres intelligents hors de l'humanité.
2. ***La nature physique des êtres extra-terrestres***
   Après avoir examiné les notions de "vie" et d' "intelligence", la différence entre celle-ci et la notion de "raison" peut être négligée dans notre cas. Toutes les deux expressions répondent à la définition de *Kant*, qui regarde un être comme intelligent – ou raisonnable -, dès qu'il se comprenne soi-même comme intelligent et qu'il soit capable d'agir selon quelque loi.

Ensuite les notions de l' "Entropie" et de l'"Ektropie" sont examinées suivant *Pons*.

Enfin il est constaté, rejetant l'opinion de *Magno*, que des intelligences étrangères avec lesquelles l'humanité pourrait entrer en rapport, seront distinguées par les qualités que voici:

1. Vie
2. Intelligence
3. Perceptibilité
4. Tridimensionnalité ou du moins activité dans l'espace troidimensionale
5. Volonté de vivre (voir Schopenhauer), au moins rudimentaire

3. ***Le terme technique de "Méta-Droit"; définition et littérature***
Après avoir discuté les notions du Droit et de la Liberté, l'expression de "Méta-Droit" est proposée d'après *Haley* pour désigner une notion nouvelle. Donc, les propositions de *Valladao*, *Bueckling*, *Magno*, *Korovin*, et *Creola* sont déclinées par de bonnes raisons.

   (a) D'abord le "Meta-Droit" est défini comme somme de toutes les normes, par lesquelles les relations entre des races diverses dans l'univers pourront être réglées.
   (b) Puis les travaux métajuridiques par *Haley*, *Jenks*, *McDougal*, *Vlasic* et *Lasswell* (surtout du dernier), par *Smirnoff*, *Bueckling*, *Magno*, *Valladao*, *Seara*, *Vazquez*, par *Clarke*, *Kroell*, *Rhyne*, *Katz*, *Gabett*, *Simpson*, *Mirel*, *Cocca*, *Faria*, *Blackshield*, *Keyhoe*, *Shukow*, et *Korowin*, de *Kreola*, *Hyman*, *Woetzel* et *Fasan* sont décrits et examinés minutieusement.

4. ***L'Impérative Catégorique et le Méta-Droit***
Ensuite l'impératif Catégorique de Kant est analysé. Le voici: "Agis de la sorte, que la maxime de ta volonté pourrait toujours servir de principe à une législation général."

   Cet impératif catégorique vaut ce que Kant dit *expressis verbis* pour tous les êtres intelligents, dont les hommes ne seraient qu'une espèce.

   L'impératif catégorique ne remplace aucune loi. Il n'en est qu'une moule. Mais aussitôt que nous l'employons pour nos partenaires éventuels dans l'univers, d'après leurs qualités énumérées-ci-dessus, nous gagnons les premiers principes du Méta-Droit. Ainsi il est possible de débrouiller ces principes même avant qu'on sache davantage sur nos partenaires extra-terrestres. La plupart de ces normes sont des règles *a priori*, mais il y a aussi quelque règles *a posteriori*, déduites des conditions communes de toute vie intelligente, dont nous avons déjà parlé.

5. ***Les normes du Méta-Droit***
Comme de telles normes doivent partir de la nature des différentes races intelligentes dans l'univers, l'histoire du Droit Nature est exposée à fond. Il est démontré que l'idée grecque du "Logos" comme loi universel, non seulement humain, donne un fondement capable de porter aussi le Méta-Droit. Ce fondement se

renforce et se développe par la doctrine de la Stoa, mais surtout par *Cicero*. Un arc vaste se tend *d'Anaximander* au déjà de *Cicero* jusque' à *Vitoria* et *Suarez* et voilà la base historique du Méta- Droit.

De ce fondement et des cinq qualités communes de routes les races, intelligentes se déduisent les règles méta-juridiques que voici:

1. Chaque action qui nuit à l'autre race est interdite
2. En cas de dommage l'auteur du mal doit dédommager l'autre
3. Toute race intelligente de l'univers jouit du même droit
4. Chaque race a le droit de se défendre soi-même
5. Chaque partenaire méta-juridique a le droit de disposer de soi-même
6. Chaque race peut prétendre à son espace vital
7. La conversation d'une race a la préférence sur le développement de l'autre
8. Aucune partenaire méta-juridique doit demander quelque chose d'impossible
9. Des conventions méta-jundiques sont à être tenues
10. Cependant il ne faut pas suivre une règle, si la race engagée se détruisait soi-même en la suivant
11. Enfin il n'est pas un principe de droit, mais de morale, qu'une race vienne a sécour de l'autre en cas de nécessité

6. ***Le rangement des règles méta-juridiques et la doctrine du Droit Pur***
   Il est exposé que les règles méta-juridiques trouvées au chapitre précédent sont de force différente selon qu'ils proviennent de la nature du droit lui-même ou de la notion de la vie, de l'intelligence etc. Après s'ensuit une discussion sur la "Doctrine du Droit Pur" par *Kelsen*, qui, sera d'importance pour trouver de nouvelles thèses méta-juridiques et par conséquent pour les rapports avec des intelligences extra-terrestres.
7. ***Méta-Politique***
   Le dernier chapitre sert à discuter des événements possibles, des repercussions et des mésures à être prises à l'occasion d'une rencontre avec les traces d'une autre race. Une telle rencontre pourrait arriver des manières suivantes:

   1. Pure communication de nouvelles
   2. Découverte de restes ou d'objets appartenant à une race disparue
   3. Contract par des sondes non-équipées
   4. Contact physique

   Selon Lasswel, il sera d'importance, si l'on rencontrait une race d'un développement technique inférieur au notre ou bien pareil ou supérieur: de plus, si elle est paisible ou non, si elle est de nature craintive ou non etc.

En tout cas il sera de rigueur de faire comprendre aux "hominibus alteris", que nous avons trouvé des règles méta-juridiques qui valent pour toutes les races de l'univers, que nous sommes résolus de les respecter en attendant le même d'eux. Ce n'est qu' ainsi qu'un commun travail utile pourra avoir lieu et que des évènements désagréables, peut-être même des guerres désastreuses pourront être évitées.

Geleitwort

Die Idee, daβ die Erde nicht der einzige von vernünftigen Wesen bewohnte Himmelskorper sein könnte, entstand bereits im Altertum.

Nachdem im Mittelalter und bis in das 19. Jahrhundert hinein die Frage auβerirdischer lntelligenzen nur recht skizzen- und romanhaft erörtert wurde, hat vor allem die Mitteilung *Schiaparellis* uber die Entdeckung der Marskanäle eine wissenschaftliche Diskussion der Frage extraterrestrischer vernunftbegabten Wesen in Gang gebracht, die seither nicht mehr verstummte.

Beweise dafür, daβ auβer der Erde auch andere Himmelskörper von menschenähnlichen Wesen bewohnt sind oder jemals bewohnt waren, gibt es – zum mindesten bis heute – nicht. Vor allem der Mars kommt hierfür wohl nicht in Frage.

Dagegen könnten z.B. auf den äuβeren Planeten sehr wohl organısche Stoffe entstanden sein und immer noch entstehen, und Wesen, die sich von diesen ernähren. Und eine Entwicklung zu 1ntelligenz und Kultur wäre da auch nicht ausgeschlossen. Die Versuche von *Urey* und *Stanley Miller* sprechen durchaus dafür, ebenso die Arbeiten unserer Biochemiker, besonders die von *Szentgy*örgyi und *Oparin*.

Die Vielzahl der Sonnensysteme allein in un serer eigenen Galax läβt mit einer gewissen Wahrscheinlichkeit die Annahme zu, daβ sich bereits mehrfach Leben bis zur Erreichung der Vernunft entwickelt hat.

Ob wegen der Gröβe der inrerstellaren Entfernungen dασ Zusammentreffen mit solchen Lebewesen jemals möglich sein wird, ist fraglich. Keineswegs kann man aber heute – wie dies Ieider auch während der Greenbank-Konferenz geschah – die Behauptung aufstellen, interstellare Raumfahrt sei für immer ausgeschlossen.

Das ist so, wie wenn jemand um 1850 die Atomzertrümmerung oder die Weltraumfahrt bestritten hätte, denn unsere Wissenschaft kennt ja längst noch nicht alle Naturgesetze und die sich daraus ergebenden technischen Möglichkeiten.

Selbst wenn es aber – vor allem in der näheren Zukunft – nicht zu einem tatsächlichen Zusammentreffen mit auβerirdischen Intelligenzen kommt, so ist doch die

Möglichkeit eines Kontaktes durch Nachrichtenmittel und durch unbemannte Sonden schon heute vorstellbar.

Schon ein solcher Kontakt aber würde in naturwissenschaftlicher, philosophischer, soziologischer und auch rechtlicher Hinsicht ganz gewaltige Auswirkungen haben.

Jeder Kontakt zwischen vernünftigen Wesen wird sich nach gewissen Regeln abspielen. Diese Grundrege in untersucht und formuliert *Fasan* im vorliegenden Buch, wobei er von *Kants* kategorischem Imperativ einerseits und von naturrechtlichen ldeen andererseits ausgeht. Diese Ergebnisse werden zweifellos die bereits recht umfangreiche metarechtliche Literatur als erstes Buch auf diesem Gebiete wesentlich bereichern.

Professor Dr. Hermann Oberth

Synopsis in German [Beziehungen zu außerirdischen Intelligenzen]

Eine wissenschaftliche Grundlage für das Metarecht

1. ***Die M*öglichkeit des Zusammentreffens mit nichtmenschlichen intelligenten Wesen**

   Wann immer wir die Frage nach außermenschlichen, intelligentem Leben im Universum erheben, werden wir sogleich mit dem Unsinn der "Fliegenden Untertassen" oder der "Kleinen Grünen Männer" konfrontiert. Dies ist der Grund, warum diese Frage oft belächelt wird.

   Andererseits aber ist seit den Tagen der Antike die Frage außerirdischen intelligenten Lebens im Universum diskutiert und für durchaus möglich gehalten worden.

   Hierzu gehören die Stellungsnahmen der "Vor-lnkas", des Römers *Lukrez*, von *Giordano Bruno*, dem *hl. Thomas von Aquin*, von *Montesquieu etc*.

   Astronomie und Exobiologie kommen gleichfalls zu dem an Hand vieler Zitate (darunter *Calvin, Jackson, Shapley* u.a.) nachgewiesenen Ergebnis, daß außermenschliches intelligentes Leben im Univrsum, ja selbst in unserem Milchstraßesystem, wahrscheinlich ist. In unserem eigenen Sonnensystem allerdings dürfen wir derartiges nicht erwarten.

   Bei Annahme der Existenz solcher Wesen ist zwar die Frage des Zusammentreffens noch nicht gelöst: die an Hand von *S*änger dargestellte Zeitdilation bei Raumflügen läßt jedoch auch diese Möglichkeit zu. Uberdies ist der Kontakt durch Funkverbindung- so das Projekt OZMA in den Bereich des Möglichen gerückt.

Schieβlich gehen auch zwei der wesentlichsten Werke *Kants* von der Existenz nichtmenschlicher vernünftiger Wesen aus.

2. ***Die phvsische Natur außerirdischer Wesen***
Nach einer Untersuchung der Begriffe "Leben" und "lntelligenz" werden für die Zwecke der vorliegenden Arbeit die semantischen Unterschiede zwischen dem letzteren Begriffe und jenem der "Vernunft" vernachlässigt. Für beide Termini wird die Definition Kants gewält wonach ein Wesen vernünftig – oder intelligent – ist, sobald es die Fähigkeit hat, nach dem Begriff von Gesetzen zu handeln und sich selbst als vernünftig versteht.

Anschlieβend werden die Begriffe der Entropie und der Ektropie in Anlehnung an *Pons* erörtert.

In Ablehnung der Meinung *Magnos* wird schlieβlich festgestellt, daβ fremde Intelligenzen, mit denen die Menschheit in Kontakt treten konnte, folgende Charakreristika aufweisen müssen:

1. Leben
2. lntelligenz
3. Erkennbarkeit
4. Dreidimensionalität oder doch Aktivität im dreidimensionalen Raum
5. Einen – zum mindesten in Spuren vorhandenen – Lebenswillen (siehe *Schopenhauer*)

3. ***Der Begriff die Definition und die Literatur des Metarechts***
Nach einer Erörterung der Begriffe von "Recht" und "Freiheit" wird "Metarecht" in Aniehnung an *Haley* als endgültiger Begriff vorgeschlagen. Die Lösungsvorschlage von *Valladao*, *Bueckling*, *Magno*, *Korowin* und *Creola* werden daher mit entsprechender Begründung abgelehnt.

(a) Sodann wird Metarecht definiert als die Summe aller rechtlichen Regeln, die die Beziehungen zwischen verschiedenen Rassen unseres Universums regeln.
(b) in einer eingehenden Untersuchung werden sodann die metarechtlichen Arbeiten von *Haley*, *Jenks*, *McDougal*, *Vlasic* und *Lasswell* (vor allem des letzteren), von *Smirnoff*, *Bueckling*, *Magno*, *Valladao*, *Seara Vazquez* von *Clarke*, *Kroell*, *Rhyne*, *Katz*, *Gabett*, *Simpson*, *Mirel Cocca*, *Faria*, *Blackshield*, *Keyhoe*, *Zukov* und *Korowin*, von *Creola*, *Hyman*, *Woetzel* und *Fasan* dargestellt.

4. ***Der Kategorische Imperativ und das Metarecht***
Es erfolgt eine eingehende Ableitung des Kategorischen lmperativs *Kants*. Dieser lautet:

"Handle so, daβ die Maximee in es Willens jederzeit zugleich als Prinzip einer allgemeinen Gesetzgebung dienen könnte."

Dieser Kategorische lmperativ gilt, was *Kant* expressis verbis ausführt, für alle intelligenten Wesen, von denen, wie er weiter feststellt, wir Menschen nur eine Art sind.

Der Kategorische lmperativ ersetzt kein Gesetz. Er ist lediglich die (leere) Form eines solchen. Wendet man ihn aber auf die gegebenen Charakteristika aller für uns als Partner in Frage kommenden extraterrestrischen lntelligenzen an, so finder man die ersten Grundregeln des Metarechts. Diese Grundregeln lassen sich somit klären, ehe man Näheres über unsere allfälligen künftigen Rechtspartner weiβ. Sie sind zum Teil reine Regeln *a priori*, im übrigen Regeln *a posteriori*, von den festgestellten Gesamtheiten allen intelligenten Lebens im Universum (wie oben abgeleitet) ausgehend.

5. ***Die Normen des Metarechts***
Da metarechtliche Regeln von der Natur der einzelnen intelligenten Rassen im Kosmos ausgehen müssen, erfolgt zunächst eine eingehende Darstellung der Geschichte des Naturrechts. Es wird dargelegt, daiβ die Idee des griechischen "Logos" als eines allgemein und nicht nur für die Menschen gültigen Weltgesetzes eine auch für das Metarecht gültige Basis schafft, die durch die Lehre der STOA, insbesondere aber durch Cicero eine Erweiterung und Untermauerung erfährt. Von *Anaximander* spannt sich uber *Cicero* und *Thomas von Aquino* ein weiter *Bogen* bis *Vitoria* und *Suarez*, der als historische Grundlage des Metarechts angesehen werden kann.

Hiervon und von den fünf gemeinsamen Charakteristika aller intelligenten Rassen des Universums ausgehend, werden sodann folgende metarechlichen Regeln abgeleitet :

1. Jede Handlung, welche der anderen Rasse Schaden zufügt, hat zu unerbleiben
2. lm Falle einer Schädigung hat der Schädiger Schadenersatz zu leisten
3. Jede Rasse hat das Recht auf Selbstversteidigung
4. Alle intelligenten Rassen des Universums sind gleichberechtigt
5. Jeder metarechtliche Partner hat das Recht auf Selbstbestimmung
6. Jede Rasse hat Anspruch auf eigenen Lebensraum
7. Das Prinzip der Erhaltung einer Rasse hat den Vorrang über Jedem der Entwicklung der anderen
8. Kein Partner des Metarechts kann eine Unmöglichkeit verlangen
9. Metarechtliche Vereinbarungen müssen eingehalten werden
10. Keine metarechtliche Regel muβ eingehalten werden, wenn ihre Befolgung praktisch die Selbstvernichtung der verpflichteten Rasse bedeuten würde
11. Es ist kein rechtliches, sondern ein ethisches Prinzip, der anderen Rasse durch eigene Tätigkeit zu helfen

6. ***Die Rangordnung metarechtlicher Regeln und die reine Rechtslehre***
Es wird dargetan, daβ die im vorhergehenden Kapitel gefundenen rechtlichen Regeln verschiedene Stärke aufweisen, je nachdem, ob sie sich aus der Natur des Rechts selbst, aus dem Begriff des Lebens, dem der Intelligenz oder dem der Dreidimensionalität ableiten.

Anschlieβend wird *Kelsens* Reine Rechtslehre erofert, die fur das Finden weiterer metarechtlichen Formen und den Rechtsverkehr mit auβerirdischen lntelligenzen von Bedeutung sein wird.

7. ***Metapolitik***
Das letzte Kapitel dient der Erörterung von möglichen Ereignissen. Auswirkungen und nötigen Maβnahmen aus Anlaβ des ersten Zuzammentreffens mit Spuren einer anderen Rasse.
Ein solches Zusammentreffen kann auf folgende Weise erfolgen:

1. Bloβer Nachrichtenkontakt
2. Das Auffinden von Resten oder Sachen einer verschwundenen Rasse
3. Kontakt durch unbemannte Sonden
4. Effektiver physischer Kontakt

Die zu ergreifenden Maβnahmen werden überdies davon abhängen, ob die fremde Rasse wesentlich fiedlich, oder wesentlich aggressiv, bzw ob sie wesentlich ängstlich ist oder nicht. Auch ein technisches und wissenschaftliches Niveau (s. *Lasswell*) wird von Bedeutung sein.

Prologo

El problema de las relaciones con inteligencias extraterrestres es también una cuestión jurídica. Así lo entendemos quienes consideramos que el Derecho es una ciencia de soluciones y éstas, para que tengan eficacia plena, deben anticiparse a los hechos. También consideramos al Derecho una ciencia de creación y no sólo de resultados. Lo ha demostrado el jurista espacial al establecer normas, en el Tratado del 27 de enero de 1967, para un ámbito que no conoce, ya que ha legislado para el espacio ultraterrestre, que es una inmensidad a la que apenas se asoma, y para los cuerpos celestes, que desconoce en su número y posición. Sin embargo, la ley del espacio ultraterrestre y los cuerpos celestes los cubre por entero, los alcanza a todos. Es, en una palabra, una ley técnicamente hablando, cuya característica esencial es la generalidad.

A pesar de lo dicho y de que la imaginación es un poderoso auxiliar de la ciencia, pocos son los juristas que se han enfrentado al presente con la dilucidación de un tema como el relativo a las normas que regulen las relaciones entre la persona humana y los supuestos seres inteligentes que existan dentro del amplio marco de la ley natural, en la dimensión cósmica.

Uno de los más fecundos autores de la era espacial, precursor del estudio de estos problemas a la luz de los conocimientos modernos, has ido el malogrado *Andrew H. Haley*, fallecido en 1966 cuando muchísimo se esperaba de su talento jurídico y de su ilustración científica. A partir de 1965 el jurista estadounidense *Haley* ofrece a la meditación de sus compañeros del hoy Instituto Internacional de Derecho del Espacio, antes Comité Legal Permanente de la Federación internacional de Astronáutica y por aquellos primeros tiempos del Derecho espacial, un puñado de juristas, una serie de trabajos tentativos en busca de respuesta a estos problemas, que comienzan con un sentido de protección de los derechos de aquellos seres que eventualmente habiten en otros planetas o pueblen en el cosmos. Este sentido de protección no hade interpretarse como supuesta superioridad de la criatura humana sino más bien es propia de la bondad que singularizó en vida todos los actos de

Andrew G . Haley, *Luego*, su pensamiento se agudiza, la discusión con sus colegas lo alienta a nuevos estudios, y nace así una expresión que adquiere pronto carta de ciudadanía internacional: el metaderecho (metalaw), expresión ésta que en todos sus alcances y en su esencia intima es analizada convenientemente por *Ernst Fasan*.

Justo es señalar que nuestro distinguido colega austriaco *Fasan* ha cimentado su libro en la idea de *Haley*, lo que se refleja en el subtitulado de la obra. Y hace a través de sus capítulos fundamentales la exégesis más acabada de esta doctrina, que es el mejor homenaje al precursor y guía. También es justo destacar que, del mismo modo como lo hiciera *Haley* es sus primeros escritos, *Fasan* rinde igual homenaje a los pensadores y escritores de todas las edades de nuestra cultura comenzando por la más remota antigüedad.

También refiere *Fasan* el tratamiento que ha tenido la cuestión en reuniones de científicos, como el de la Sociedad *Hermann Oberth* en la pasada primavera de 1968, sin dejar de valorar el proyecto OZMA, de 1960. En verdad el tratamiento colectivo de esta materia no ofrece mayores antecedentes. Fuera de la Mesa Redonda de *Guayaquil* (Ecuador), en 1963, se han anunciado por ahora un coloquio interamericano, a realizarse en Buenos Aires en el primer semestre de 1969 y una reun1on a celebrarse en Praga en septiembre de ese mismo año, de carácter internacional.

La tarea de *Fasan* es una prueba de su valentía y de la solidez de su formación científica. Se requiere valentía para enfrentar la discusión de un tema que está en el alcance de lo posible, sólo de lo posible, y es además testimonio que el Derecho no necesita ya, gracias a sus hombres de mente creadora, de primeras comprobaciones científicas para su elaboración autónoma. Conocimiento científico él mismo, entre los de mayor jerarquía, puede ofrecer conclusiones y reglas independientemente de la comprobación de hechos analizados. El Derecho analiza sin necesidad de pesar, medir ni palpar. La hipótesis es suficiente, como ocurre en otros altos grado, del conocimiento.

Decimos que la tarea requiere valentía, porque la prudencia es la característica de la labor de jurista. Prudencia, en el sentido clásico de la expresión, corresponde a la sabiduría de los jurisconsultos romanos. El principio se mantiene. Hay que ser prudente en las conclusiones, pero audaz en la decisión de afrontar los temas. A un espíritu conautentica vocación científica nada le está vedado en el campo de la creación. Creación que es resultado y no entrega a un libre juego imaginativo.

Prudentes fueron los participantes en la Mesa Redonda sobre Derecho Espacial, realizada en la Universidad de Guayaquil el 29 de mayo de 1963 aunque valientes con el enfrentamiento del tema; "Tiene la Humanidad facultad para dictar normas jurídicas que deban regir más allá de nuestro planeta?" Y las conclusiones fueron firmes, pero a la vez prudentes: "Se reconoce a la Humanidad la facultad de dictar normas jurídicas que deban regir más allá de nuestro planeta. Dicha facultad debe entenderse plena en lo que se refiere al denominado "espacio territorial", entendiéndose por tal el comprendido entre la superficie de la Tierra y la órbita de la Luna. Para el ejercicio de la facultad de establecer normas jurídicas en los cuerpos celestes, debe entenderse igualmente plena, en el caso de que aquellos no estén ocupados ni habitados. En cuanto a los cuerpos celestes que pudieren estar habitados u ocupados, la Mesa Redonda cree prudente hacer reserva de pronunciarse hasta tanto se

conozca suficientemente la posición de sus eventuales seres inteligentes frente al Derecho. Las facultades precedentemente enunciadas deberán ser ejercitadas por un órgano especialmente creado, con participación de todos los pueblos de la Tierra, y en el cual no prevalezcan los intereses políticos particulares de Estado alguno". Hoy, después de haber entrado en urgencia el primer Tratado cósmico, se advierte una evolución del Derecho hacia una mayor seguridad. Y esto es también índice de su jerarquía de conocimiento científico.

El primer libro orgánico sobre tan sutil cuestión es el que tenemos el honor de prologar. Es una obra que suscitará los más variados comentarios, toda clase de crítica y no pocas meditaciones. Pero en todo momento habrá respeto hacia la obra y para con el autor. Esta es la mayor recompensa para un espíritu cultivado y emprendedor, ansioso de conocer y de comunicar sus conocimientos, generoso en ideas y desbordante en sentimientos humanitarios, como lo es el de *Ernst Fasan*.

Buenos Aires, 15 de diciembre de 1968 Aldo Armando Cocca

Synopsis in Spanish [Relaciones con inteligencias extraterrestres]

Una base científica para el metaderecho

1. ***Las posibilidades de un encuentro con seres inteligentes no humanos***
   En el momento mismo de formular la cuestión relativa a la vida inteligente extrahumana en el universo no hallamos confrontados con absurdos del tipo de "discos volantes" o "pequeños hombrecillos verdes" y por esta razón la cuestión misma es recibida muy frecuentemente con una sonrisa.

   Sin embargo y desde la edad Antigua, se ha discutido siempre la cuestión de la vida inteligente extraterrestre en el universo, considerándosela de todo posible.

   Al respecto, han de recordarse las actitudes de los '"Preincas", del romano *Lucrecia*, de *Giordano Bruno*, de *Santo Tomas de Aquino*, de *Montesquieu*, e t c.

   La astrología y la exobiología también llegan al resultado comprobado por muchísimas referencias (entre ellas las de *Calvin*, *Jackson*, *Shapley* y otros) en el sentido de que es probable exista una vida inteligente extraterrestre en el universo, y aun en nuestra galaxia. Por ello podemos igualmente prever algo similar en nuestro propio sistema solar.

   Pero la suposición de que tales seres existan no basta ni nos ofrece una solución ante un eventual encuentro con ellos: también poseemos la teoría de la dilatación del tiempo en los vuelos espaciales, re presentada según *Sänger*, quien admite igualmente una contingencia tal. Además se halla ya en el alcance de lo posible un contacto por comunicación T. S. H. como la del Proyecto OZMA.

Y finalmente, dos de las obras más esenciales de *Kant*, se basen en la existencia de seres racionales no humanos.

2. ***La naturaleza física de los seres extraterrestres***
Habiendo sido examinados los dos conceptos de "vida" e "inteligencia" se superan, para los fines de la presente obra, las diferencias semánticas entre el segundo de dichos conceptos y el de "razón". Seha elegido, para ambos conceptos. La definición de *Kant*, para quien un "ser" es racional o inteligente cuando es capaz de obrar según los conceptos de la ley y cuando se entienda a sí mismo como "razonable".

   En seguida se analizan los conceptos de la entropía y de la ectropía, siguiendo a Pons. En contra de la opinión de *Magno* se establece que las inteligencias extrañas con las cuales los seres humanos podrían tomar contacto presentaran las siguientes características:

   1. Vida
   2. Inteligencia
   3. Reconocibilidad
   4. Tridimensionalidad o, por lo menos, actividad en el espacio tridimensional
   5. La existencia – por lo menos en vestigios – (ver *Schopenhauer*) de una voluntad de vivir

3. ***El concepto, la definición y bibliografía del metaderecho***
Una vez discutidos los conceptos de "derecho" y de "libertad", el nuevo concepto de mataderecho viene propuesto con referencia a *Haley*. Por eso, las proposiciones de solución de *Valladao*, *Bueckling*, *Magno*, *Korovin* y *Creola* son rebatidas con la argumentación adecuada.

   (a) Entonces, el metaderecho es definido como la suma de todas las normas legales que regulan las relaciones de las razas diferentes de nuestro universo.
   (b) Después se hace una exposición y examen detenido de las opiniones relativas al metaderecho por *Haley, Jenks, McDougal, Vlasic y Lasswell* (sobre todo los trabajos del mencionado en ultimo termino), de *Smirnoff, Bueckling, Magno, Valladao, Seara Vazquez, Clarke, Kroell, Rhyne, Karz, Gabett, Simpson, Mirel, Cocca, Faria, Black-shield, Keyhoe, Zhukov y Korovin, Creola, Hyman, Woetzel* y *Fasan*.

4. ***E1 imperativo categórico y el metaderecho***
Se ofrece una deducción derivada del imperativo categórico de Kant, que dice:

   "obra de manera que la máxima de tu voluntad pueda siempre y en cada momento servir también como principia de una legislación general".

   Como *Kant* explica *expressis verbis*, este imperativo categórico vale para todos los seres inteligentes, entre los cuales, siempre según *Kant*, nosotros – los hombres – no somos más que una especie.

El imperativo categórico no constituye ni sustituye una ley. No es otra cosa que el molde (ivacío!) de una ley. Sin embargo, si es aplicado sobre las características determinadas de rodas las inteligencias extraterrestres, que podrían ser consideradas como compañeras o "asociadas" a nosotros, se ofrecen las primeras reglas fundamentales del metaderecho. Por eso, estas normas fundamentales serán a claradas antes de buscar nociones más detalladas respecto a nuestros futuros eventuales asociadas ante la ley. Tratase, primeramente, de normas meramente a priori, en lo demás, de normas as a posteriori y basándose (como se deduce de lo ya dicho) en la comunidad ya establecida de toda la vida inteligente existente en el universo.

5. ***Las normas del metaderecho***

Ya que las normas del metaderecho se hallarán sujetas a la respectiva naturaleza de las singulares razas inteligentes en el cosmos se requiere, en primer lugar, una representación detallada de la historia de la ley natural. Se comprueba que la idea del "logos" griego como ley es válida a no solamente para los seres humanos, sino también como base aplicable al metaderecho, base que, por la doctrina de Stoa, y en particular de *Cicero*, tiene extensión y sustento adicional. Un arco amplio se extiende a partir de *Animander* por vía de *Cicero* y de *Tomás de Aquino*, a los *Vitoria* y *Suarez*, arco que puede ser considerado como el fundamento histórico del metaderecho.

De este fundamento y basándose en las cinco características comunes de todas las razas inteligentes en el universo, se deducen las normas del metaderecho, indicadas del modo siguiente:

1. Cada acción capaz de ocasionar perjuicio a otra especie es, absolutamente inadmisible.
2. En caso de perjuicio, el que provoca el daño deberá ofrecer indemnización.
3. Cada especie tiene derecho a la autodefensa.
4. Todas las especies inteligentes del universo gozan de igualdad ante los derechos.
5. Cada uno de los asociados al metaderecho tiene el derecho de la propia libre disposición.
6. Cada especie posee el derecho de reivindicar el propio espacio vital.
7. El principio de conservación de una especie en relación a la evolución de otra, aparecerá demorada.
8. Ninguno de los asociados al metaderecho podrá exigir algo imposible.
9. Las estipulaciones acordadas según el metaderecho han de ser cumplidas.
10. Ninguna de las normas del metaderecho debe ser respetada si su observancia tendría por consecuencia el autoaniquilamiento de la especie comprometida por la obligación.
11. No es este un principio legal, sino un principio ético: ayudar a la otra especie por la propia obra.

6. ***Ubicación de las normas de metaderecho y la teoría pura del derecho***
   Se pone en evidencia que las normas del metaderecho ilustradas en el capítulo precedente están en cuanto potencia afectiva diferenciadas, y esto depende de la circunstancia de hallarse o no deducidas de entre el concepto de la vida, o de entre el concepto de la inteligencia o del de la tridimensionalidad.

   En seguida se menciona la "teoría para del Derecho", de Kelsen, que ofrece importancia respecto del descubrimiento de normas ulteriores de metaderecho y de las relaciones con inteligencias extraterrestres.

7. ***Metapolítica***
   El último capítulo está destinado a la discusión de acontecimientos posibles, de consecuencias y medidas necesarias con motive de un primer encuentro con vestigios de una especie diferente.
   Un encuentro tal podría tener lugar de una u otra manera, como ser

   1. Por mero contacto de comunicaciones
   2. Por descubrimiento de residuos o de objetos de una especie desaparecida
   3. Por contacto pro sondas no tripuladas
   4. Por contacto físico efectivo

   Además, partiendo de *Laswell*, será importante si la especie encontrada es de evolución técnica inferior, comparable o superior y si la raza misma – y esto también es de esencial importancia – es pacífica o no, y si es de índole aprensiva o no.

Sera en cada caso esencial que se demuestre a los *hominibus alteris* que nosotros ya hemos descubierto las normas de metaderecho válidas para todas las especies inteligentes del universe y queestamos resueltos a observar etas normas, mientras esperamos la misma observancia de parte de nuestros asociados al metaderecho. Es solamente de esta manera que se pueden evitar hechos desagradables que podrían extenderse a la dimensión de guerras catastróficas.

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Appendix Index

P.M. Sterns, L.I. Tennen (eds.), *Private Law, Public Law, Metalaw and Public Policy in Space*, Space Regulations Library 8,
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