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OUTER SPACE: SCIENCE AND LAW

Edited by
P. Solomon Vinay Kumar



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OUTER SPACE: SCIENCE AND LAW

Editor: P. Solomon Vinay Kumar

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OVERVIEW

Outer space is the region of the universe which is outside the atmospheres of celestial bodies. Space within the solar system is defined as interplanetary space. Earth orbital space is a finite natural resource that must be managed properly. Space is a different domain which requires sophisticated technology and knowledge to work on it. Space technology is basically related to entering into outer space, maintaining and using various systems during spaceflight and returning people and things from outer space. Some technologies like remote sensing, GPS systems, long distance communication systems, satellite television depends on advanced space infrastructure and technology. Space science and technology helps us to understand and explore what is beyond earth. Space technology has introduced new opportunities and avenues in the study and understanding of environment, earth's processes and also in improving the quality of human life.

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The Space Science and Technology has helped the launch of first satellite 'Sputnik' by the Soviet Union in 1957 into outer space which induced a unique curiosity and competition among the two super powers and the international community to further explore beyond the earth's atmosphere. During the initial stages of space exploration the United States stressed the importance of peaceful and scientific uses of outer space and suggested the idea of testing of satellites and missiles to be placed under the control of international inspection. By the middle of the twentieth century countries like France and China began using space for military purposes along with US and Soviet Union. Space Science and Technology is also widely used in military activities. Modern military operations depend extensively on space technology. Collecting of data relating to important enemy installations, troop movement of the enemy state, which helps in precision attacks on military installations, without causing harm to the civilians, are carried out with the help of the 'Spatial Information Technology' (SIT) through satellite remote sensing. Several weapons of war like 'Intercontinental Ballistic Missiles' (ICBM) were developed through space science and technology which resulted in arms race in outer space between the two super powers. The US has also initiated a 'Strategic Defense Initiative' (Star Wars) program in nineteen eighties. The ever increasing human needs due to population explosion and depletion of natural resources has resulted in advancement of Spatial Information Technology. Spatial Information Technology has advanced into an important branch of subject supporting number of fields relating to land and water resources development and management, disaster mitigation and management, flood zoning, environment and ecology, and coastal engineering.

The basic international space law depends on the 'Outer Space Treaty' of 1967. The 'Rescue Agreement' of 1968, The 'Liability Convention' of 1972, The 'Registration Convention' of 1976, and The 'Moon Agreement' of 1979 are some of the important and landmark agreements

which contributed to the development of space law. Apart from these treaties, the United Nations General Assembly has adopted five resolutions which deal with the use of Nuclear Power Sources (NPS) and remote sensing. All agreements except the Moon Agreement is ratified by most of the states. The Outer Space Treaty is considered as the constitution of the outer space domain.

In 1959, the 'United Nations Office for Outer Space Affairs' (UNOOSA) recognized the need for international cooperation and established the 'Committee on the Peaceful Uses of Outer Space' (COPUOS). In 1970, COPUOS formulated the UN program on space applications to improve cooperation in space science and technology among the developing and industrialized nations. The purpose of the program is to promote the "Peaceful Use of Outer Space" for economic, social and scientific development, in particular for the benefit of developing nations. The main aim of the program is to strengthen the international legal regime governing outer space activities. At the United Nations level the program is implemented by the Office for Outer Space Affairs (UNOOSA). At the inter governmental level, the program is implemented by the Committee on the Peaceful Uses of Outer Space (COPUOS), which addresses scientific, technical, legal and policy matters related to the peaceful uses of outer space. The United Nations General Assembly through its resolution 54/68 of 6th December 1999 endorsed the resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development", which was adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-III), held in July 1999. UNISPACE-III highlighted the importance of developing space science and technology and adopted it as one of the prominent issues of global challenges for improving the standard of human life. In October 2004, the United Nations General Assembly assessed the progress made in the implementation of the recommendations of UNISPACE III and, through

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its resolution 59/2, endorsed the Committee's Plan of Action for further implementation. The Committee's Plan of Action, recommended for a strategy for improving mechanisms to develop and strengthen the use of space science and technology to support the global agendas for sustainable development. The main accomplishments of the UN Office for Outer Space Affairs (UNOOSA) are, the implementation by the international community of the legal regime introduced by the United Nations to govern outer space activities, strengthen the capacities of states to use space science and technology and its applications, and to establish and operate Regional Centers for Space Science and Technology, affiliated to the United Nations.

The First African Leadership Conference on Space Science and Technology for Sustainable Development was held in Nigeria in 2005. The Conference highlighted that Africa can affect policy-making relating to international space law-making if African countries are represented at international scientific and legal meetings. The Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space in March 2007 also adopted an agenda item on developing Space Law for consideration at its 2008 session. Till the year 2000 about eight countries enacted national space legislation in order to cope up with the fast developing space technologies and its various applications. In the recent years national legislation in the area of space law took an important turn and a good number of states have enacted space legislations to match their needs in the field of space technology.

In United States the National Aeronautics and Space Administration (NASA) which was created by the 1958 National Aeronautics and Space Act (P.L. 85-568) supervises and conducts the US civilian space and aeronautics activities. Its important programs include human and robotic spaceflight, technology development, and scientific research. NASA has its headquarters in Washington, DC. Some of its important field centers are, Johnson Space

Center, Kennedy Space Center, Langley Research Center, Marshall Space Flight Center, Stennis Space Center, Ames Research Center, Dryden Flight Research Center, Glenn Research Center, Goddard Space Flight Center. The Jet Propulsion Laboratory located at Pasadena is managed by the California Institute of Technology. The NASA's programs are divided into four directorates, such as, Aeronautics Research, Exploration Systems, Science, and Space Operations.

In UK Space Science and Technology is funded through British National Space Centre (BNSC) partner, the Science and Technology Facilities Council (STFC), and implemented with the collaboration of European Space Agency (ESA), and US space organization NASA. UK is exploring the solar system through various space science missions, and is one of the important leaders in the world to possess small satellite technology and occupies a prominent position in earth observation, satellite communications, satellite navigation and scientific instrumentation.

In Japan initially the space activity was monitored by National Space Development Agency (NASDA), the National Aerospace Laboratory of Japan, and the Institute of Space and Astronautical Science. In 2003 the three entities were merged and renamed as Japan Aerospace Exploration Agency (JAXA). Japan successfully launched the next-generation Japanese-made H-IIA rocket in 2001, and three H-IIA rockets in 2002, which started the commercial satellite-launching operations. In 2007 it successfully placed two information gathering satellites in orbit. In 2008 the Basic Space Law was enacted by the Japanese Parliament, which is its first basic law relating to space activities since 1970, when Japan launched 'Ohsumi' a satellite for testing technology, as part of its space development program. The bill is based on three important aspects of, utilization of space, promoting space-research and development, and enriching Japan's space industry.

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Russia has an advanced and an active space program, even though the budget for space activities is reduced after the collapse of Soviet Union. The Russian Space Agency has a number of low-cost launchers which are extensively used by other states and international organizations including the European Space Agency (ESA).

In Canada the 'Canadian Space Agency' (CSA) monitors and oversees its space programs. The Canadian Space Strategy framework was approved in February 2005. Canada has a prominent place in space activities and possesses a sophisticated space technology with ambitious space programs.

In China CNSA (China's National Space Administration) deals with space related activities. Since past five years China has launched 22 various types of satellites. It has also developed two other satellite series, to bring the tally to six, such as, the recoverable remote-sensing satellites, "DFH", telecommunications and broadcasting satellites, "FY", meteorological satellites, "SJ", scientific research and technological experiment satellites, "ZY", earth resource satellites, and "Beidou" (Plough) navigation and positioning satellites. China has also enhanced the implementation process to establish 'a constellation of small satellites for environment and disaster monitoring and forecasting. The World Meteorological Organization has listed the 'Fengyun-I and Fengyun-II' meteorological satellites in the international satellite series for meteorological services. For the past few decades China has constantly upgraded and improved its legal system. Its space technology requires the protection of laws, and also extensive study of aerospace legislation laws.

The Brazilian Space Agency (BSA) was established through a Law establishing the Brazilian Space Agency Law No. 8.854 of 10th February 1994. The 'Brazilian space program' is the sophisticated space program in South American Continent with advanced and well developed capabilities in launch vehicles, launch sites, and also satellite manufacturing.

In 1993 the first satellite developed by Brazil known as ‘the Data Collecting Satellite’ (SCD-1) was launched into space. Brazilian Space Agency actively coordinates with NASA of United States in implementing various space technology and space related programs.

India’s space program lays more emphasis on scientific, technological and social applications, which includes various aspects such as designing, development of launch vehicles, satellites and payloads to their applications for social development. The regional ‘Center for Space Science and Technology Education for Asia and Pacific’ (CSSTEAP) located at Dehradun in Uttaranchal state which is affiliated to the UN, was established to promote space science and technology for the benefit of future generations. The ‘Indian Institute of Space Technology’ (IIST – a Deemed University) at Trivandrum in Kerala state has come up with the state of the art technology amenities from August 2008. The Indian space program priority is based on utilization of space technology for the benefit of human needs by using remote sensing, meteorological and communications satellite systems. ISRO implements the launch vehicle program, INSAT program for telecommunications, broadcasting, meteorology, development of education, remote sensing program for application of satellite imagery for developmental purposes, and research and development in space sciences and technology for national development. In January 2007 Indian Space Research Organization (ISRO)’s Polar Satellite Launch Vehicle, PSLV-C7, successfully launched four satellites, which includes two national primary satellites and two auxiliary satellites which belong to an international customer.

In the above context, this book is aimed at studying the origin and development of space science and technology, the various benefits it offers for the global community and the legal obligations of states in conformity with the international space law. The book contains articles relating to space science and technology, its applications and legal implications on states and individuals by eminent scholars and academicians.

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The article “**A Limited International Agreement on Property Rights**”, by *Thomas Gangale*, discusses about the convention on Real Property Rights in Outer Space, the legal definition of orbits, and the problems of scarce natural resource orbits and international governance. The author opines, a space legislation of global nature among the most directly interested states and also other space faring states should be concluded for a common benefit. The article conveys that, the state parties to the ‘Outer Space Treaty’ are prohibited from conferring property rights to owners of space facilities located in the geosynchronous orbit, since real property right are not applicable to this orbit. The article highlights that specifying the six orbital elements is necessary for traffic control as space becomes more crowded, especially in certain important regions of the space. The author recommends that chaotic orbits require a more effective legal regime for traffic control, similar to the air traffic control system.

Arjen Vermeer in his article “**A Legal Exploration of Force Application in Outer Space**”, analyses, the impact of advanced space science and technology in the field of military activities related to high technology space weapons and the legal issues faced by the space faring states. The article focuses that the satellites perform number of military activities like, communications, weather information, remote sensing and navigation. The author explains, according to Article 4 of the outer space treaty, use of military personnel for scientific research and for other peaceful purposes is not prohibited. The advancement of space technology helps armed personnel during conflicts in complying with the regulations of ‘LOAC’ with regard to precision attacks with the help of satellite remote sensing data by locating and targeting only military installations without harming civilian population. The article concludes that with the rapid advancement of space technology and space weapons, the use of force in space will turn outer space into a new and fourth dimension of warfare making it necessary for the policy makers to reformulate the existing legal systems to apply them in the space medium.

In the article “**Space Applications for International Development**”, the author *Maribel John*, evaluates the rapidly developing space technology and its application for international development and analyses the legal issues, and recommends measures for its effective implementation for the benefit of mankind. The author argues that, for satellite communication technology to become a useful solution for developing countries, it is necessary for the governments of the developing nations to reform their existing regulatory procedures. International organizations can help to provide guidance and the present activities in this field, like the coordination of regulatory workshops by the Global VSAT forum, should be encouraged to develop the regulatory reforms. The author explains that the remote sensing data can also be used to identify conditions conducive to disasters, like wild fires and famines. The article focuses that efforts must be initiated to enhance awareness of the benefits of space assets especially in developing countries and promote effective national legislations, which will lead to the development of space technologies suited to the needs of those nations.

In the article “**Cooperation in Space Science and Technology in IBSA – Overcoming some Legal Challenges**”, the author Jo-Ansie van Wyk, compares the empirical evidence of the state of “space science and technology” in individual IBSA (India, Brazil and South Africa) member states and the prevailing legal challenges, and also makes an assessment of the status of major treaties on outer space in IBSA member states. The article highlights the need for a new global space regime for human security and development, and conveys that all three states space policies and science and technology programs should operate in a specific legal and political framework. The author suggests the establishment of a permanent International Space Court (ISC) as the dispute settlements in the present treaties are outdated, and a need for legal clarification relating to definitions of peaceful use of outer space and launching state will provide them with certain rights. In order to achieve global equity, the author recommends for

strengthening intra-IBSA cooperation by signing protocols, agreements and establish an IBSA working group for the development of International Space Law on matters like space debris, militarization of space and geostationary orbit.

The authors *J H Huebert* and *Walter Block* in their article “**In Defense of Advertising in Space**”, examines the prospects of advertising in space and evaluates proposals to put billboards in space, and also considers the laws affecting such billboards. Russia actively took part in space advertising activities, and launched a space mirror in 1999 to light up the night sky, but could not succeed. The article states the entrepreneurial efforts to launch space billboards compelled the US Congress to ban obtrusive space advertising. In 2005 the Federal Aviation Administration proposed new regulations to enforce the statute which adds to the Code of Federal Regulations, and the US Congress has authorized the President to enter into international agreements on space advertising. The Outer Space Treaty of 1967 is the significant document in international space law which bans private property and also restricts commercial activity in outer space but is rejected widely in view of the increasing private entrepreneurial activity in outer space. The authors refer to a case of space advertising that took place when a men’s magazine “*Maxim*” placed a 75-by-100 feet reproduction of a magazine cover featuring a popular actress in the Nevada desert, which was visible to passengers flying over in an airplane. The article explains that in US, courts have abandoned the aesthetic view and gave lawmakers ‘*carte blanche*’ in restricting uses of private property because of aesthetic concerns. The authors conclude that space advertising through private property should be considered legitimate, and all laws which are against it should be repealed, and no treaties restricting space advertising should be established.

The article “**ITAR and the US Space Industry**”, by *Micah Walter-Range*, examines the results of the space foundation’s ITAR survey, and

recommends certain legal policies, regulations and guidelines to achieve maximum efficiency and effectiveness in US space industry and space technology. The International Traffic in Arms Regulations (ITAR) which is under the jurisdiction of department of state oversees and regulates the exports of space products and services irrespective of military, civil, commercial or academic. The author opines the ITAR is considered as a government imposed restriction causing obstruction and preventing US from exploring its potentials and achieving its target as a leader in global space activity. In January 2008, The US President signed National Security Presidential Directive 56 (NSPD 56) on defense trade reform. The article highlights the legislation which is under the consideration of Congress requests the President to present a report on satellite export controls. The US government should specify the categories of goods and technical knowledge, if the aim of the export control is to prevent falling of sensitive technology into the hands of enemies and adversaries of US. The author recommends that space advocates should work and strive to bring about an understanding within the government and the space agencies to strike a balance between necessary export restrictions and the growth and health of the space industry, and also proposes for necessary policy changes and enactment of effective legislation and legal regulations for a better development of space technology.

The author *Michael C. Mineiro* in his article ***“FY-1C and USA-193 ASAT Intercepts: An Assessment of Legal Obligations under Article IX of the Outer Space Treaty”***, investigates the impact of space science and technology on outer space activities, and focuses on the obligation of state parties to the treaty to avoid harmful contamination and adverse changes in the environment of the earth and also harmful interference with the peaceful activities of other states during the processes of exploration. The article examines the legal obligations of states under Article IX of the Outer Space Treaty and in the wider context of international law, in the wake of

the “*FY-1C and USA-193 ASAT intercepts*” in outer space by China and USA respectively on the pretext of outdated, aging and decaying of those satellites. The article discusses about the Article IX of the Outer Space Treaty’s validity and mandatory obligation on states to hold international consultations if the activity or the planned experiment in the outer space can cause potential interference and harm to other states and as well as harmful environmental pollution. The author concludes that the international community should initiate efforts to strengthen Article IX of the Outer Space Treaty by proposing and appending an additional protocol to the Outer Space Treaty which provides a procedure and a monitoring body to determine whether a planned activity by a state requires international consultation and appropriate measures have been undertaken by the state to avoid harmful contamination of outer space which could have adverse impact on earth’s environment.

In the article “**International Charter on Space and Major Disasters Accession in the Layout of National Political and Legal Regimes**”, the author *Daniel Konrad T. Link*, elucidates the provisions of the charter which aims at providing a unified system of space data acquisition and delivery to governments and NGO’s of those countries which are frequently effected by natural disasters and calamities specially undeveloped and under developing countries. The author highlights that, The International Charter on Space and Major Disasters is a source for effective implementation of basic principles of space law, and at the same time its operations requires the need for a better legal regime of Earth Observation (EO). One of the important activities of the charter is to oversee the remote sensing activities which promote the protection of mankind from natural disasters. The author explains that the article 5.4 of the charter confirms that no legal action shall be taken against the state parties in the event of bodily injury, damage or financial loss arising from the execution or non-execution of charter activities. The article concludes that the SBDA (The Brazilian

Society of Air and Space Law) recommends Brazil to become a member of the International charter on space and major disasters, in order to extend its space related services to the benefit of mankind, as part of its space policy.

The author *R Wonnacott* in the article “**GNSS as a Multi-disciplinary Tool for Africa’s Development**”, explains the role and importance of GNSS (Global Navigation Satellite Systems) and describes the AFREF project, its progress and also its importance for the provision of uniform geospatial information. Examples from Africa are also analyzed in which GNSS data from a network of permanent GNSS base stations can be used for various purposes like geophysical applications, weather forecasting, climate monitoring, space weather monitoring and disaster mitigation. The article states that the GNSS systems have some common features like, all are satellite based using Medium Earth Orbiting satellites (MEO), all systems use a three-dimensional geocentric coordinate reference system, all signals are affected by variations in atmospheric conditions as the medium through which they pass. The article focuses that The African Geodetic Reference Frame (AFREF) is a unified geodetic reference frame for Africa which serves as a basis for the national three-dimensional reference networks which is consistent with the International Terrestrial Reference Frame (ITRF). The author concludes that GNSS is a very useful and universal tool and can be used for number of applications apart from positioning and navigation.

The author *Lee Ann W. Lockridge*, in her article “**Intellectual Property in Outer Space: International Law, National Jurisdiction, and Exclusive Rights in Geospatial Data and Databases**”, explores the jurisdictional issues relating to intellectual property in outer space. The author argues that, if unauthorized use of geospatial data and intellectual property occurs in outer space there is a void between the standard choice-of-law doctrine of intellectual property, which depends on territorial prescriptive jurisdiction. The article highlights, the jurisdictional issue in outer space arises relating to

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outer-space-derived data rights and activities in outer space regarding utilization, extraction, appropriation, and other unauthorized activity in outer space. The author concludes that, with outer space being extra-territorial to all nations, an effective international legal regime governing intellectual property rights in outer-space-derived information and creations would be ineffective, if it did not consider jurisdictional issues like, choice of law, and choice of forum.

In the light of the above discussion this edited book presents a compilation of research perspectives of eminent scholars on issues relating to space science and technology and the legal challenges before the states.

I

A Limited International Agreement on Property Rights

*Thomas Gangale**

Wayne N. White's 2001 proposed "Convention on Jurisdiction and Real Property Rights in Outer Space" would codify the limited property rights he construes from the Outer Space Treaty, and would add specificity. A number of changes are proposed, and issues pertaining to such a convention are discussed. Given the longstanding opposition of the United States to any definition or delimitation of outer space, and given the tangential nature of this contentious issue to property rights, the inclusion of this provision in an outer space property rights convention is counterproductive. A delimitation of outer space based on an arbitrary altitude is especially problematic. More technically precise legal definitions of orbits are required as orbits become more crowded. The orbital parameters period, inclination, apogee, and perigee, also used in earlier space treaties, are replaced by the six technical parameters used in astrodynamics: semimajor axis, eccentricity, inclination, longitude of ascending node, longitude of periapsis, and longitude at epoch. The deviation from published orbital

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parameters necessary to declare a space vehicle “derelict” and void property rights is discussed. Also discussed is the problem of “scarce natural resource” orbits and international governance. Historically, the International Telecommunications Union (ITU) has managed the Geostationary Orbit (GSO), which has been characterized as a “scarce natural resource”; however, other types of orbits might acquire that character in the future: Earth-Moon L2 halo orbits for lunar communications, the areostationary orbit for Mars communications, the semidiurnal NAVSTAR-type orbit for both Earth and Mars navigation, an analogous orbit type for lunar navigation, and other halo orbits as transportation hubs along low energy interplanetary transfer routes. The question arises as to whether the ITU should continue to manage the GSO, or whether at some point a space regime, one more broadly cognizant of the uses for “scarce natural resource” orbits other than telecommunications, should manage all such orbits.

I. Introduction

Since the collapse of the Moon Agreement, commentators have raised criticisms of the process of making new international space law.

The world community cannot, at this point, meaningfully participate on an egalitarian basis in the initial space law negotiations. It is important that the drafting of space treaties be limited to as few participants as possible in order to conclude workable conventions in a minimum amount of time.

In a situation where the majority is tempted to use its numerical strength, the influential minority may resort to a number of tactics which will eventually frustrate the multilateral law-making process.... [T]he dissatisfied minority may resort to limited international agreements negotiated within closed state groupings (Danilenko 1989).

Thus, those launching powers most likely to acquire an early capability to exploit extraterrestrial resources might conclude an agreement among themselves, excluding other states from the negotiation.

Given the universal character of space activities, limited agreements among the major space powers regarding outer space probably cannot offer a viable solution to problems calling for essentially global management. At the same time, serious thought should be given to the need to secure the support of the most directly interested states for future space legislation. A realistic assessment of the situation should proceed from the undeniable fact that all states do not have the same level of interest in outer space. While many members of the international community may remain unaffected by a particular decision concerning outer space, others are deeply concerned. Therefore it seems reasonable that the law-making process should reflect the various levels of interest of the space powers and of other states (Danilenko 1989).

However, so long as an agreement among a limited number of states does not violate existing international law, there is not necessarily a problem. It is not suggested that there be a celestial analogue to the 1939 Molotov-Ribbentrop Pact's secret protocol that divided the territories of Finland, Estonia, Latvia, Lithuania, Poland, and Romania between the Soviet Union and the German Third Reich. Several principles should be considered in exploring the prospect of a limited agreement. To begin with, the maxim *lex specialis derogat generali* must be applied. Treaties that contain specific language to regulate the behavior of states carry more weight than declarations of principles. Also, since international custom and the general principles of law develop over time, a newly adopted custom might provide the basis for a challenge to provisions in an older treaty. Finally, a custom may be accepted among relatively more important or powerful states than the parties to a more broadly-accepted treaty; this gives considerable weight to the custom, and were the custom to be codified in a treaty concluded among the relatively more important or powerful states, the weight of the new agreement against the old would be greater still.

...[I]n the framework of comprehensive settlements, states advancing far-reaching claims may easily form special pressure groups and negotiating alliances that multiply their original negotiating strength. Consequently, there is a danger that normative results of negotiations on a

comprehensive space convention may not reflect the actual balance of interests of different groups of states as regards the exploration and use of outer space. In particular, space powers may find it difficult to preserve the existing principles of space law, such as the freedom of exploration and use of outer space, which have been criticized by a number of developing countries. It is clear that comprehensive negotiations will provide states pressing for radical reforms of the existing space law an ideal opportunity to reopen negotiations on these basic principles of space law which have been codified in the Outer Space Treaty. It is highly unlikely that the relevant global conference would adopt rules of procedure reflecting the idea that the opinions of those states who are most actively involved in space activities should carry more weight than others (Danilenko 1989).

These problems might be alleviated were the consensus rule in COPUOS to be modified. For instance, consensus might be required only among launching states, effectively giving each of them veto power, while a simple majority might be required among the entire COPUOS membership. This would be analogous to the method of voting in the UN Security Council, where each of the five permanent members holds a veto. However, as Danilenko points out, the adoption of such rules "is highly unlikely".

In space law-making there is also no established tradition of requiring qualitative participation in the proposed space treaties. Consequently, from this perspective it is also reasonable to assume that the resulting compromises would tend to reflect the preferences of the numerical majority. As a result, there is a substantial risk that the negotiated convention would be resisted by the space powers. In the absence of their support, the envisioned ambitious legislative project might remain a dead letter. Far from achieving the desired coherence in space law, such a development would only destabilize the already existing legal regime for outer space (Danilenko 1989).

It would seem that the failure of the Moon Agreement is case in point, although it is certainly true that domestic American political interests played their part.

In any case, in the vein of a limited agreement, Wayne N. White (2001) proposes that the major launching states conclude a "mini-treaty" to explicitly provide for functional property rights. Arguably, this right is implicit in the Outer Space Treaty; however, a new agreement would add specificity. The idea of a "mini-treaty" is meant to circumvent the forum of COPUOS, which includes many non-launching states that have sought to limit the rights of launching states to appropriate extraterrestrial resources. Bearing in mind Danilenko's concerns regarding the development of a broad consensus including both launching and non-launching states, it might be more practical to conclude a "mini-treaty" between the major space powers, which, after all, is how the Outer Space Treaty itself began.

White's proposed Convention on Jurisdiction and Real Property Rights in Outer Space (see Appendix 1) has merit, but it also has some deficiencies. First of all, it mentions some, but not all, of the provisions in the Outer Space Treaty which establish the basis of legal principles for the proposed Property Rights Convention (PRC); obviously, the preamble of the convention should establish the strongest possible legal basis by citing all pertinent provisions of the Outer Space Treaty.

The PRC should apply only to the Solar System and not to the entire universe, so as not to prejudice the property rights of other sentient species in other star systems. Interspecies relations is a field whose development can be deferred to a later treaty as the need arises.

II. Analysis of the Convention Text

The PRC blunders into a space mine in paragraph 1(b):

The term "outer space" means all areas other than celestial bodies which are kilometers or more above the level _____ of the seas on the planet Earth. White comments:

A treaty on jurisdiction is an appropriate place to finally resolve the issue of delimitation of outer space.

While this may be a good theoretical point, it is a political poison pill. Given the longstanding opposition of the United States to any definition or delimitation

of outer space, and given the tangential nature of this contentious issue to property rights, the inclusion of this paragraph is counterproductive. A delimitation of outer space based on an arbitrary altitude is especially problematic. On the other hand, existing treaties imply a functional definition of outer space as the region where space objects are in orbit.

Paragraph 1(c) of the PRC states:

The term "space facility" means a physical structure or device located in outer space or on a celestial body which remains in one location and is used for any peaceful purpose. A structure or device which is located in outer space and orbits around a celestial body or a point in space shall be considered as "remaining in one location" so long as it remains within certain orbital parameters, as set forth below.

White comments:

The lagrangian points which are located between the Earth and the Moon are examples of equilibrium points in space around which humans may someday orbit space objects.

Paragraph 1(1) of the PRC states:

The term "Owner" means the legal owner(s) as defined and determined by any treaties, laws and regulations of the State of registry. White comments:

The term "Owner" would include natural persons, sole proprietorships, partnerships, limited liability companies, corporations, non-profit and not-for-profit organizations, and governmental entities.

Paragraph 1(o) of the PRC states:

The term "Geosynchronous Orbit" means the orbit described by the following parameters: period 1436.1 minutes, inclination 0, Apogee = Perogee [sic] = 35,786 kilometers.

White uses the term "geosynchronous orbit" where the specifications actually define the narrower case of the geostationary orbit. A more general comment should be made here. The PRC borrows language from Article IV, paragraph 1(4) of the 1975 Convention on Registration of Objects Launched into Outer Space.

This introduces several problems that require correction. To begin with, there are the terms "apogee" and "perigee," which, technically speaking, refer specifically to the highest and lowest points in an orbit around the Earth (the suffix "-gee" is a shortened form of geos; other body specific suffixes are shown in Table 1 below), rather than the generic "apoapsis" and "periapsis", which apply to orbits around

Body	Closest Approach	Farthest Approach
Galaxy	Perigalacticon	Apogalacticon
Star	Periastron	Apastron
Black hole	Perinigricon	Aponigricon
Sun	Perihelion	Aphelion
Mercury	Perihermion	Apohermion
Venus	Pericytherion	Apocytherion
Earth	Perigee	Apogee
Moon	Periselene/Pericynthion/Perilune	Aposelene/Apocynthion/Apolune
Earth	Perigee	Apogee
Mars	Periareion	Apoareion
Jupiter	Perijove	Apojove
Saturn	Perisaturnium	Aposaturnium
Uranus	Periuranion	Apuranion
Neptune	Periposeidion	Apoposeidion
Pluto	Perihadion	Aphadion

Source: en.wikipedia.org/wiki/apsis

any body. The daunting prospect of having to maintain a different suffix for every orbitable body in the Solar System (and beyond) is the main reason why the generic '-apsis' has become the norm. Presumably, the PRC is meant to apply orbits around other bodies in addition to Earth. This language problem can be solved by attacking the larger technical issue, which is that the orbital parameters White specifies (again derived from the Registration Convention) provide an incomplete characterization of an orbit, and except for inclination, they are not the part of the basic set of orbital elements used in astrodynamics to technically characterize orbits (see Table 2 below). Period, apoapsis, and periapsis can be derived from

the semimajor axis and eccentricity (together with the gravitational constant for the body being orbited). In the case of the geostationary orbit, whose value is directly tied to the synchronization of its period to the rotational period of the Earth, it does no harm, and may be legally helpful, to include the period in the specifications, although, technically speaking, it may be redundant.

Table 2: Basic Orbital Elements

Parameter	Symbol
Semimajor axis	a
Eccentricity	e
Inclination	i
Longitude of ascending node	Ω
Longitude of periapsis	ω
Longitude at epoch	L

Paragraph 2 of the PRC states:

A State Party to this Treaty shall retain jurisdiction and control over: (i) the space objects on its registry, (ii) a safety zone of 500 meters around the residential or scientific space facilities on its registry, (iii) a safety zone of 1000 meters around commercial, industrial and mining facilities on its registry, and (iv) any natural persons within said space objects and safety zones. A State Party to this Treaty shall exercise jurisdiction and control over space objects on other States' registries which are within its safety zones, and the natural persons within said objects, only to the extent necessary to protect the safety of space objects and natural persons.

White specifies numbers here, but not for the delimitation of outer space in paragraph 1(b) or for deviations from orbital parameters in paragraph 12(c), which are subject to negotiation. Likewise, the specification of safety zones is more properly the subject of negotiation. Furthermore, just as there might be zones of different extents for residential or scientific space facilities versus commercial, industrial, and mining facilities, it is foreseeable that different extents might apply on different celestial bodies, and that any of these might require adjustment from time to time as the character and density of use and occupation changes. For these reasons, there should be no hard numbers in the

body of the convention; rather it should reference annexes that contain such variable technical specifications (see Appendix 2 and Appendix 3). Subsequent protocols to the convention could amend and create these technical annexes without changing the language in the body of the convention.

Paragraph 11 of the PRC states:

Private, non-governmental Owners who or which inhabit, maintain and/or operate a space facility for a period of at least one year shall be entitled to formal recognition and registration of the following rights, which shall be designated "real property rights:"

White comments:

The terms of this Treaty in the section entitled "JURISDICTION" apply to all Owners, including governmental entities; the terms of this Treaty in the section entitled "REAL PROPERTY RIGHTS" apply only to private, non-governmental entities. Pursuant to Article VIII of the Outer Space Treaty, governmental entities will still have all of the same rights as private Owners, but in a less formal sense. States are prohibited by Article II of the Outer Space Treaty from appropriating areas of outer space and celestial bodies, and therefore, in the author's opinion, cannot confer real property rights on governmental entities.

Paragraph 11(e) of the PRC states:

The exclusive right to appropriate resources within the space facility and its related safety zone.

White comments:

Although entities may not claim ownership of mineral resources "in place", once they have been removed (i.e. mined) then they are subject to ownership.

Paragraph 12(a) of the PRC states:

If the Owner of a space facility stops using the space facility for peaceful purposes, the Owner's real property rights shall immediately terminate.

White Comments:

See Article IV of Outer Space Treaty, which says, among other things: "The moon and other celestial bodies shall be used by all States Party to the Treaty exclusively for peaceful purposes."

Paragraph 12(c) of the PRC states:

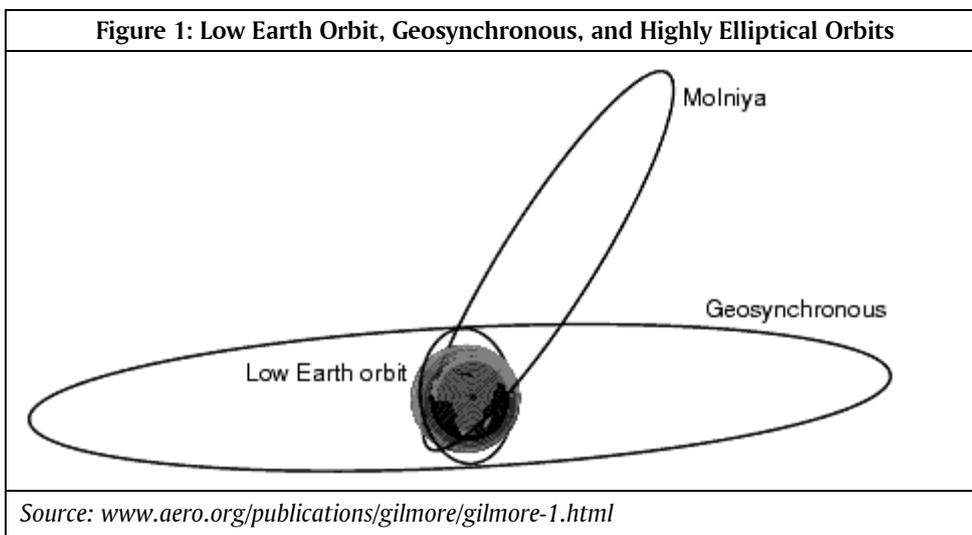
If the Owner of a space facility which is in orbit around a celestial body or point in space allows the space facility to deviate, for a period of one month or more, more than – % from any of the orbital parameters of period, inclination, apogee and perogee [sic] which are listed in the real property rights registry, the real property rights shall immediately terminate.

From a technical standpoint, there are a number of problems with this paragraph. First of all, the four parameters listed in the paragraph should be replaced by the six parameters listed in Table 2. Secondly, inclination is an angular measurement, and since the percentage of a degree is a confusing concept at best, deviation from inclination should be specified in degrees. The last three parameters listed in Table 2 are angular measurements as well, thus deviation from these also should be specified in degrees. Next, as a practical matter no single percentage can serve as a measure of deviation from several different orbital parameters; indeed, regarding any one parameter, specification by percentage is inappropriate. For example, in Low Earth Orbit (LEO), a ten percent change in apoapsis or periapsis would be on the order of 20 to 50 km; in low orbits this occurs fairly rapidly due to atmospheric drag. In contrast, at geosynchronous altitude, a ten percent deviation in apogee or perigee would represent a change of 3,500 km; such a change, as result of only natural forces acting on the space object, could only occur over an extended period of time, and the object would have become unusable (as a geostationary platform) and a hazard to other geostationary objects well before then. Finally, another issue is that different tolerances may need to be specified for different regions of space. For instance, since the geostationary orbit is a scarce natural resource, tighter than normal tolerances should apply in this increasingly crowded region. As

Mars is developed, the areostationary orbit may likewise become a scarce resource, along with lunar halo orbits as the Moon is developed. The various orbit regimes that the PRC might address include:

- Low Earth orbit: defined as an orbit around Earth whose semimajor axis is up to 8,000 kilometers. Utility: communications, science, intelligence.

See Figure 1 through Figure 6



- Medium Earth orbit, defined as an orbit around Earth whose semimajor axis is between 8,000 kilometers and 26,500 kilometers.

Utility: communications, science.

- Semidiurnal Earth orbit, defined as an orbit around Earth whose period is 11 hours, 58 minutes, 2.1 seconds (semimajor axis of 26,561 kilometers).

Utility: navigation (e.g., Navstar).

See Figure 7 and Figure 8.

- Geosynchronous orbit, defined as an orbit around Earth whose period is 23 hours, 56 minutes, 4.2 seconds (semimajor axis of 42,163 kilometers; geostationary orbit is a restricted case, where inclination and eccentricity are 0).

Utility: communications, meteorology, intelligence.

See Figure 1.

Figure 2: Orbcomm Constellation

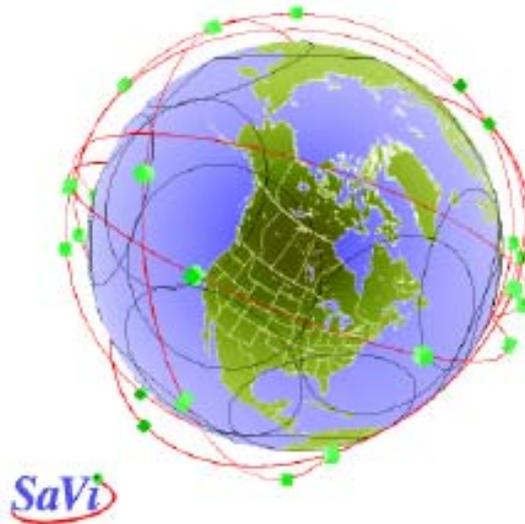
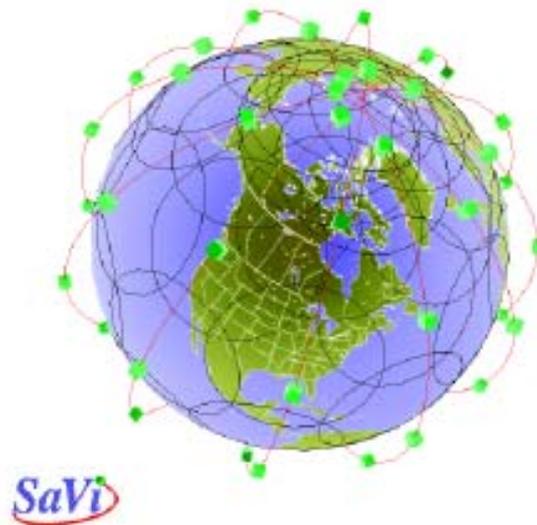


Figure 3: Iridium Constellation



Source: www.ee.surrey.ac.uk/Personal/L.Wood/constellations/overview.html

Figure 4: Teledesic Constellation

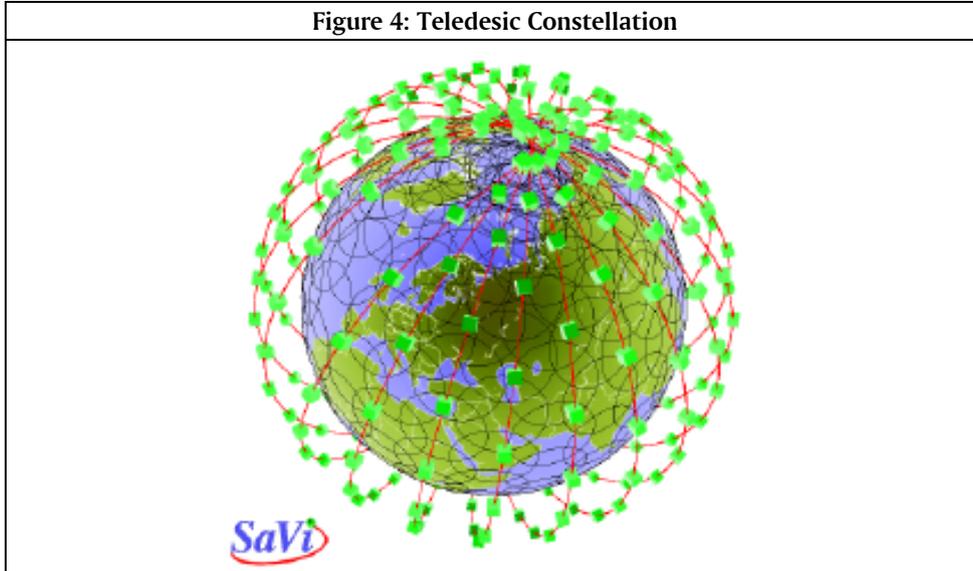
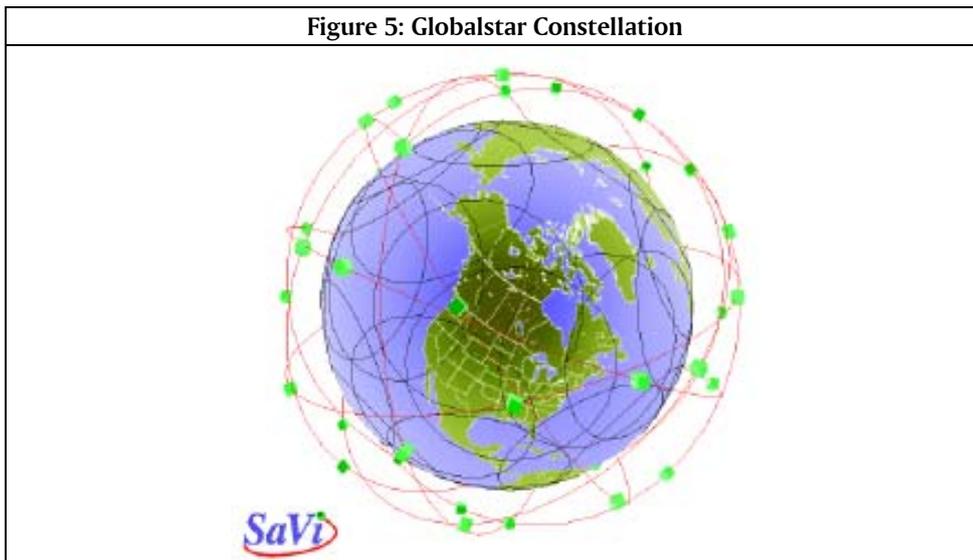


Figure 5: Globalstar Constellation



Source: www.ee.surrey.ac.uk/Personal/L.Wood/constellations/overview.html

- Highly elliptical orbit, defined as an orbit around Earth whose semimajor axis is greater than 42,200 kilometers.

Utility: communications.

See Figure 1.

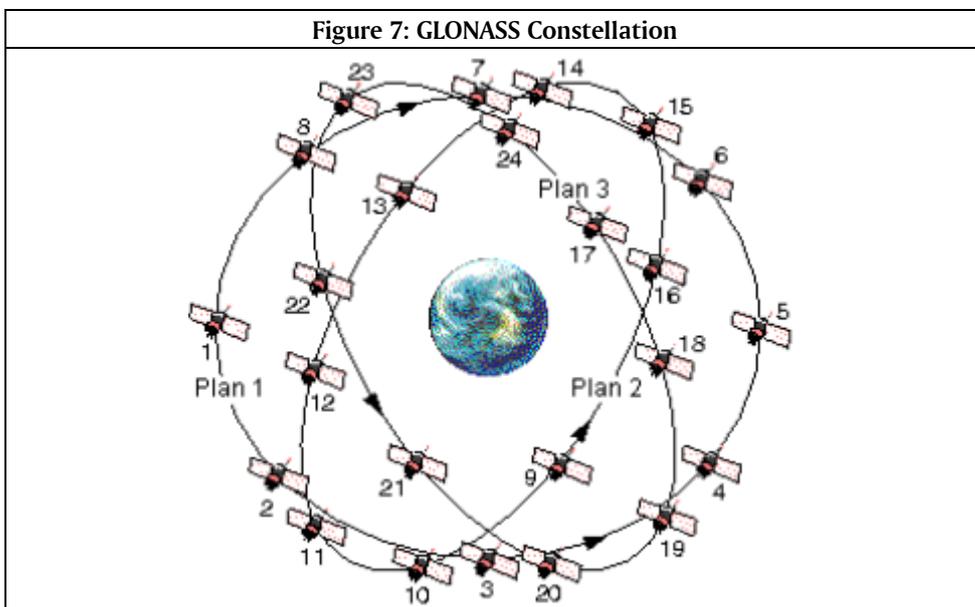
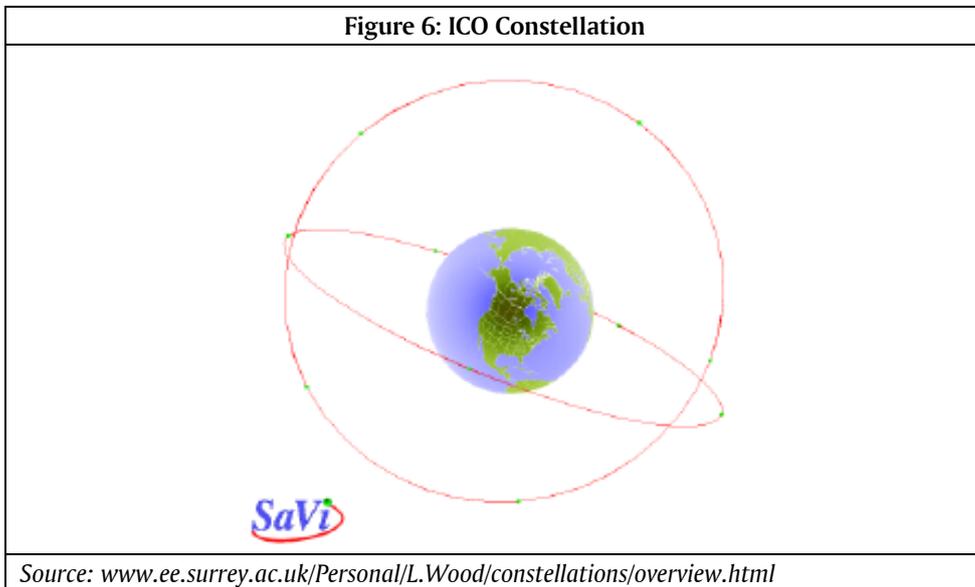
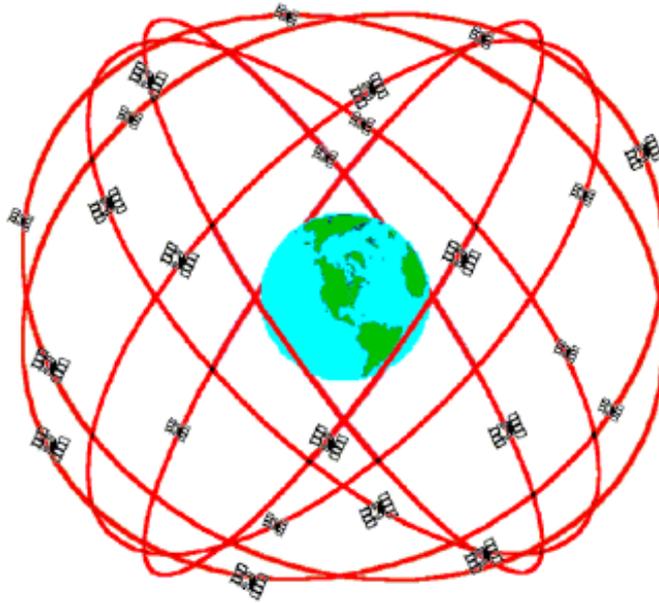


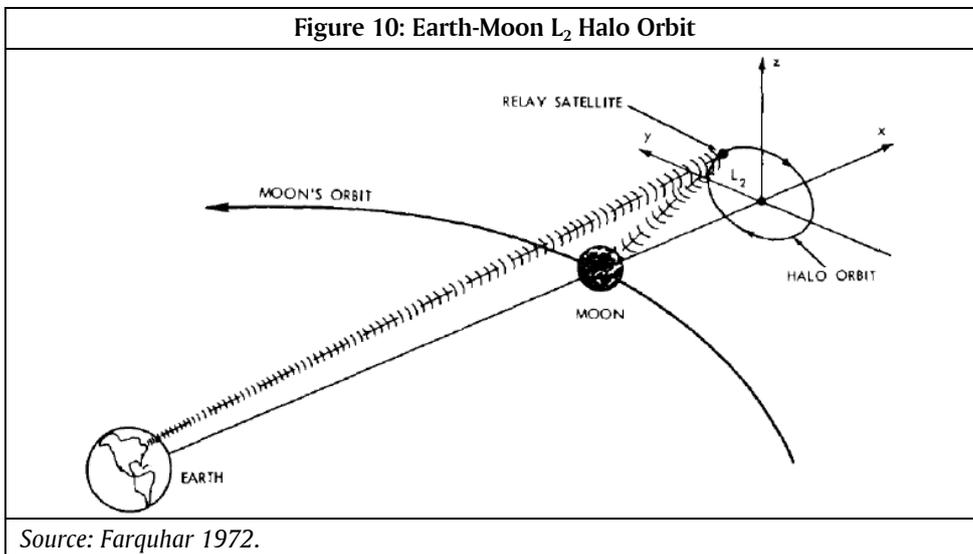
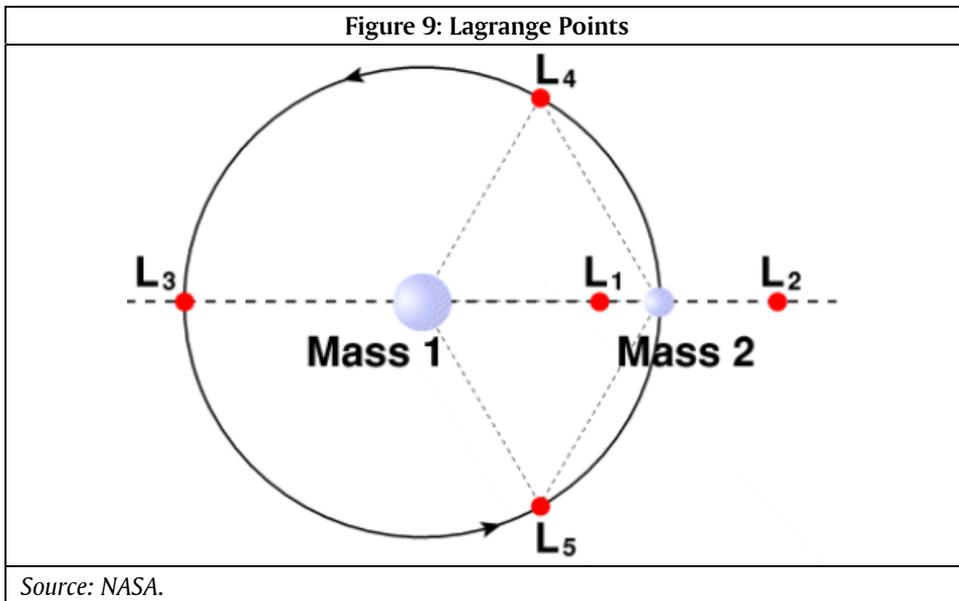
Figure 8: Navstar Constellation



Sources: www.pwsz.chelm.pl/gps/glonass.html
www.educnet.education.fr/localisation/pedago/geologie/GPS.htm

- Earth-Moon L_1 halo orbit,* defined as an orbit around the Earth-Moon L_1 Lagrange point.
 Utility: lunar near side communication, staging point for the Moon and beyond, and station to defend Earth against massive impacts (Maccone 2004).
 See Figure 9.
- Earth-Moon L_2 halo orbit, defined as an orbit around the Earth-Moon L_2 Lagrange point. Utility: communication between Earth and the far side of the Moon (Farquhar 1972).
 See Figure 9 and Figure 10.
- Earth-Moon L_3 halo orbit, defined as an orbit around the Earth-Moon L_3 Lagrange point. Utility: station to defend Earth against massive impacts (Maccone 2004).

See Figure 9

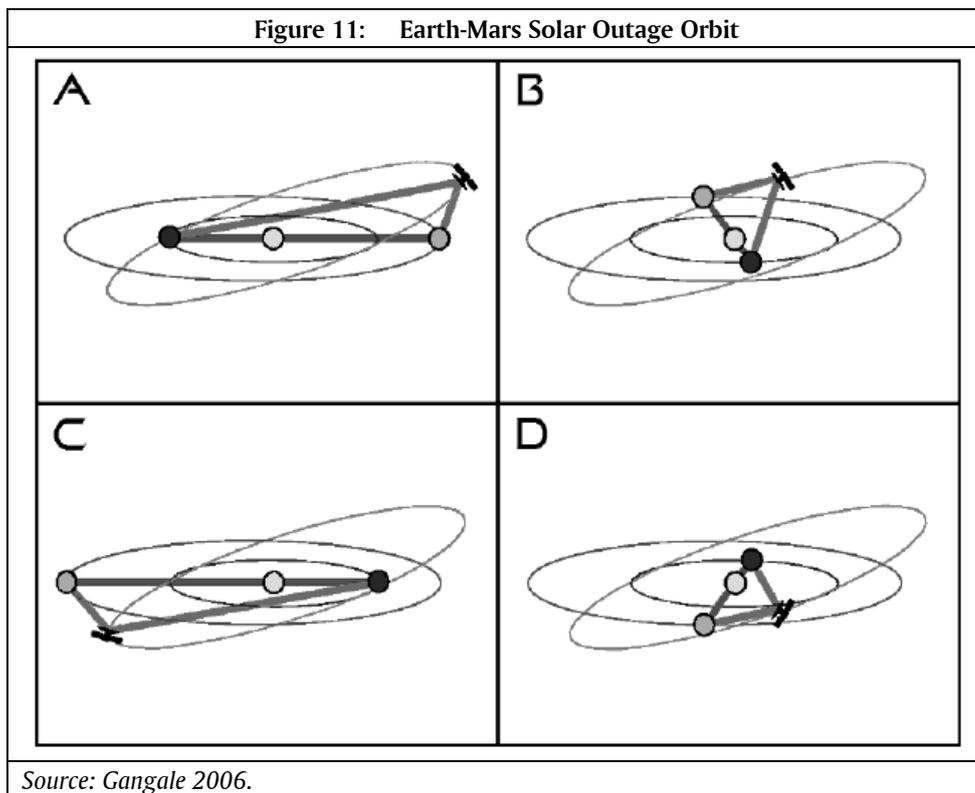


- Earth-Moon L_4 and L_5 halo orbits, defined as an orbit around the Earth-Moon L_4 or L_5 Lagrange points. Utility: possible sites for space colonies (O'Neill 1977).
See Figure 9.
- Sun-Earth L_1 halo orbit, defined as an orbit around the Sun-Earth L_1 Lagrange point. Utility: continuous view of daylight side of Earth.
See Figure 9.
- Lunar orbit, defined as an orbit around the Moon.
Utility: science and communications.
- Low Mars orbit: defined as an orbit around Mars whose semimajor axis is up to 4,500 kilometers.
Utility: science.
- Medium Mars orbit, defined as an orbit around Mars whose semimajor axis is between 4,500 kilometers and 12,800 kilometers.
Utility: science.
- Semi-sol orbit, defined as an orbit around Mars whose period is 12 hours, 18 minutes, 41.2 seconds (semimajor axis of 12,868 kilometers).
Utility: navigation.
- Areosynchronous orbit, defined as an orbit around Mars whose period is 24 hours, 37 minutes, 22.4 seconds (semimajor axis of 20,427 kilometers; areostationary orbit is a restricted case, where inclination and eccentricity are 0) (Adams 2000; Edwards *et al.* 2000).
Utility: communications.
- Highly elliptical Mars orbit, defined as an orbit around Mars whose semimajor axis is greater than 20,500 kilometers.
Utility: communications, science.

- Earth-Mars solar outage orbit, defined as an orbit around the sun whose period is 686.9797 days (semimajor axis of 227.9 million kilometers).

Utility: communication between Earth and Mars during solar conjunctions and oppositions (Gangale 2006).

See Figure 11.



Given the complexities of specifying tolerances for different orbital parameters in different regions of space, it would be better for paragraph 12(c) to refer to an annex that would address these issues in appropriate detail.

It may be that the way orbits are specified in the Registration Convention has to do with national security concerns that the US and USSR had during the Cold War. With the full set of current elements listed in Table 2, one would know the position of a space object at any time. However, White's proposed convention

establishes real property rights for "private, non-governmental Owners" of space objects, so it would be difficult to raise the issue of national security in this context.

Specifying the full set of six orbital elements may become increasingly necessary for traffic control as space becomes more crowded, especially in certain highly-valued regions of space. The four parameters specified in the Registration Convention and White's proposed Property Rights Convention are insufficient for determining the position of objects in relation to one another. It is possible for two satellites to have exactly the same orbital parameters of period, inclination, apogee, and perigee, and either be thousands of kilometers apart or right on top of each other. In fact, there is an orbit that is occupied by hundreds of space objects: the period is 23 hours 56 minutes (a sidereal day), the inclination is zero, and both the apogee and perigee are 35,785 kilometers. It is the geostationary orbit. The distinguishing characteristic between all of these satellites is the longitude at epoch, and obviously the distinction is of vital importance. The International Telecommunications Union allocates positions in the GSO by specifying longitude. Other orbits beside the GSO are inhabited by multiple objects. The Navstar Global Positioning System (GPS) consists of 24 satellites orbiting the earth in circular orbits at an altitude (both apogee and perigee) of 20,200 km, an inclination of 55 degrees, and with a period of 11 hours 58 minutes (half of a sidereal day). The Navstar constellation is organized into 6 orbital planes, 60 degrees apart in the longitude of their ascending nodes. There are four satellites in each orbital plane, 90 degrees apart in their longitude at epoch. Again, these distinctions are important, just as hundreds of airliners can fly along the same jet routes every day... as long as they are adequately separated in time. Examples of highly-populated orbits are listed in Table 3 below. With an annex specifying different orbit regimes and requiring better reporting of orbital elements over the requirements of the Registration Convention, the Property Rights Convention could provide the initial structure for a future space traffic control system.

Paragraph 12(d): of the PRC states:

Owners may not establish property rights over an area which would prevent other natural persons or legal entities from having free access to outer space and celestial bodies.

White comments:

See Article I of Outer Space Treaty, which says, among other things: "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 the basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies."

Constellation	FCC Class	Sats	Period	Apogee	Period Apogee	Inc.	Planes
Orbcomm	Little LEO	36	01:36	775	775	45.0	4
Iridium	Big LEO MSS	66	01:40	780	780	86.4	6
E-Sat	Little LEO	6	01:42	894	894	99.0	6
Leo One	Little LEO	48	01:44	950	950	80.0	8
Teledesic	Broadband	288	01:53	1,375	1,375	84.0	12
Globalstar	Big LEO MSS	48	01:54	1,414	1,414	52.0	8
SkyBridge Con. 1	Broadband	40	01:55	1,469	1,469	54.0	4
SkyBridge Con. 2	Broadband	40	01:55	1,469	1,469	54.0	4
Ellipso-Borealis	Big LEO	10	02:58	7,605	633	116.6	2
Ellipso-Concordia	Big LEO	6	04:46	8,040	8,040	0	1
ICO	MEO MSS	10	05:59	10,390	10,390	45.0	2
GLONASS	Navigation	24	11:15	19,100	19,100	64.8	3
Navstar	Navigation	24	11:58	20,200	20,200	55.0	6
Various GSO Sats	GEO	>1000	23:56	35,785	35,785	0	1

Source: Sushko 1999.

Paragraph 12(g) of the PRC States:

Any State Party to this Treaty may terminate the property rights of an Owner whose space facility is carried on said State's registry, provided said

State terminates the property rights pursuant to duly enacted laws or regulations, or duly ratified treaties, and the Owner has received due process of law including the right to be heard.

White comments:

The term "due process of law" is a term with a very well defined meaning under United States law. The author assumes that most other nations' laws have a similar concept, although the term "due process of law" may not be the language which will be clearly understood by the majority of States. The author is therefore open to suggestions regarding better terminology.

Paragraph 16 of the PRC states:

States Party to this Treaty are prohibited from conferring property rights upon Owners of space facilities which are located in the Geosynchronous Orbit. White comments:

The Geosynchronous orbit has become crowded with communications satellites in certain areas, and presents unique technical problems with respect to satellite spacing and radio frequency interference. The International Telecommunications Union addresses these issues by allocating orbital positions and frequencies. Therefore real property rights are inappropriate in this orbit.

In fact, the ITU exercises jurisdiction over the geostationary orbit only, which is a restricted case of the geosynchronous orbit. In any case, although from the viewpoint of institutional continuity, retaining ITU jurisdiction over the geostationary orbit might make for more ready acceptance of the PRC, look to a future in which other types of orbits – possibly nowhere near Earth – may become scarce resources and require a comparable level of regulation, one must ask whether these too should come under the purview of the ITU, or whether a new agency dedicated specifically to managing the scarce resources of outer space should be formed, and if so, whether the geostationary orbit should continue to fall under the jurisdiction of the ITU or be transferred to the new agency. Therefore, it is an open question as to whether "real property rights are inappropriate in this orbit". Were the geostationary orbit to be subsumed under the new agency, it should be able to exercise jurisdiction over property right

cases in this orbit, as with any other type of orbit. For that matter, the paragraph rescinds ownership rights provided under Article VIII of the Outer Space Treaty:

Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth.

There is no mention of the geostationary orbit in that treaty, therefore ownership of objects in that orbit has never been prohibited. Why should such rights be excluded now? It is only necessary to provide for the regulation of the scarce resource represented by the geostationary orbit. Historically, such regulation has been provided by the ITU; in the future, this may or may not be handed off to an international space authority.

III. Conclusion

Specifying the full set of six orbital elements may become increasingly necessary for traffic control as space becomes more crowded, especially in certain highly-valued regions of space. With an annex specifying different orbit regimes and requiring better reporting of orbital elements over the requirements of the Registration Convention, the Property Rights Convention could provide the initial structure for a future space traffic control system. Chaotic orbits will require a more active traffic control regime, more like the air traffic control system, where controllers would be responsible for ensuring separation between spacecraft and would issue maneuvering instructions to spacecraft operators as needed. In the future types of orbits other than the geostationary orbit – possibly nowhere near Earth – may become scarce resources and require a comparable level of regulation; thus, the purview of the ITU may expand to include these other orbits, or a new agency dedicated specifically to managing the scarce resources of outer space should be formed, which may or may not include the geostationary orbit in its jurisdiction.

Appendix 1

Convention on Jurisdiction and Real Property Rights in Outer Space

Wayne N. White, Jr. and Thomas Gangale***

Preamble

Recognizing the common interest of all mankind in furthering the exploration, settlement and economic development of outer space for peaceful purposes,

Noting the great importance of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, which is commonly known as the Outer Space Treaty, and which Provides in Article I that outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States, and which

Provides in Article I 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, and which

Provides in Article VIII that a State Party to the Treaty on whose registry an object launched into Outer Space is carried shall retain jurisdiction and control over such Object, and over any personnel thereof, while in outer space or on a celestial body, and which

Provides in Article IX that States Parties to the Treaty undertake to not cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies,

Recognizing that the Outer Space Treaty permits exploitation and private appropriation of *extracted* resources,

Desiring to further define the extent of States' jurisdiction with respect to outer space and celestial bodies, and

Desiring to protect the interests of those who risk their lives and their investments in the settlement and economic development of outer space, including the Moon and other celestial bodies,

Have agreed on the following:

Definitions

1. For the purposes of this Convention:
 - a. The term "celestial bodies" means all natural bodies in the ~~Universe~~ Solar System other than the planet Earth;
 - b. The term "outer space" means all ~~areas~~ regions other than celestial bodies ~~in which are kilometers or more above the level of the seas on the planet Earth~~ *it is possible for a space object to complete at least one revolution of a celestial body without propulsion and by virtue of the inertia of its mass;*
 - c. The term "space facility" means a physical structure or device located in outer space or on a celestial body which remains in one location and is used for any peaceful purpose. A structure or device which is located in outer space and orbits around a celestial body or a point in space shall be considered as "remaining in one location" so long as it remains within certain orbital parameters, as set forth below;
 - d. The term "residential space facility" means a structure located in outer space or on a celestial body whose primary purpose is to provide shelter, life support and living space for natural persons;
 - e. The term "scientific space facility" means a structure located in outer space or on a celestial body whose primary purpose is to further the purposes of scientific investigation and/or exploration of the Universe;
 - f. The term "commercial space facility" means a structure located in outer space or on a celestial body whose primary purpose is the sale of goods or services to other entities;

- g. The term "industrial space facility" means a structure located in outer space or on a celestial body whose primary purpose is the production of products for use or consumption by other entities;
- h. The term "mining space facility" means a structure located in outer space or on a celestial body whose primary purpose is to facilitate the removal and processing of material resources;
- i. The term "space vehicle" means a device which is designed to transport people and material: (i) from celestial bodies to outer space, (ii) through outer space, (iii) from one point to another on the surface of a celestial body, (iv) from outer space to the surface of a celestial body; or any combination thereof;
- j. The term "space object" means any device or structure which does not remain in one location, or a space facility or a space vehicle, as defined above;
- k. The term "State of registry" means a State on whose registry a space object is carried;
- l. The term "Owner" means the legal owner(s) as defined and determined by any treaties, laws and regulations of the State of registry;
- m. The term "foreign national" means a citizen of a State other than the State of registry;
- n. The term "abandonment" means:
 - i. Cessation of regular or periodical use of a structure, or
 - ii. Cessation of operation and/or loss of control of a device without taking prompt, overt action to re-establish operation and/or control over said device, or
 - iii. An Owner's express public declaration that the Owner has abandoned a structure or device;

- o. The term "~~Geosynchronous~~ Geostationary Orbit" means the orbit described by the following parameters: ~~period 1436.1 minutes, inclination 0, Apogee = Perogee = 35,786 kilometers.~~
- i. *Period: 23 hours, 56 minutes, 4.2 seconds;*
 - ii. *Semimajor axis: 42,163 kilometers;*
 - iii. *Eccentricity: 0;*
 - iv. *Inclination: 0 degrees.*

Jurisdiction

2. A State Party to this ~~Treaty~~ *Convention* shall retain jurisdiction and control over:
 - a. The space objects on its registry,
 - b. A safety zone ~~of 500 meters~~ around the residential or scientific space facilities on its registry, *as specified in the appropriate annex to this convention that references this paragraph,*
 - c. A safety zone ~~of 1000 meters~~ around commercial, industrial and mining facilities on its registry, *as specified in the appropriate annex to this convention that references this paragraph,* and
 - d. Any natural persons within said space objects and safety zones. A State Party to this ~~Treaty~~ *Convention* shall exercise jurisdiction and control over space objects on other States' registries which are within its safety zones, and the natural persons within said objects, only to the extent necessary to protect the safety of space objects and natural persons.
3. States may enact and enforce laws and regulations which govern their citizens while they are in outer space, and space objects on their registry, so long as said laws and regulations do not violate any treaties or other agreements to which the State is a party, or any principles of customary or general international law.

4. Entities may occupy and use locations in outer space on a first-come, first-served basis, so long as said occupation and use will not interfere with other entities activities.
5. The Owner of a newly constructed space object shall promptly register said space object with an appropriate State in accordance with any treaties, laws and regulations which govern the Owner.
6. Owners of space objects may transfer ownership of their space objects at any time, so long as they comply with any applicable treaties, laws and regulations of the State of registry. Any Owner who or which transfers ownership of a space object shall promptly notify the State of registry that ownership of the space object has been transferred, and shall provide said State with the information necessary to identify and contact the purchaser.
7. The purchaser of a space object shall promptly register said object with an appropriate State in accordance with any treaties, laws and regulations which govern the purchaser. In the event that the purchaser registers the space object with a State which is different from the State of registry of the seller of the space object, the purchaser shall promptly notify the seller's State of registry that registration of the object has been transferred, and the identity of the State on whose registry the space object will be carried in the future.
8. The State of registry shall retain jurisdiction and control over a space object after the Owner of a space object abandons said space object, and until such time as an entity either purchases or otherwise legally assumes control and/or occupation of the space object and registers said object with another State, or advises the State of registry that the space object has been dismantled.
9. Abandonment of a space object by its Owner shall not negate or affect any international liability to which the State of registry may be subject, pursuant to the terms of the Outer Space Treaty, the Convention on International Liability for Damage Caused by Space Objects, general principles of international law, or any other applicable treaties, laws or regulations.

10. In the event that a natural person allegedly commits an act in a space object or in a safety zone which constitutes a crime under the laws of the State of registry, and said natural person is a foreign national, the State of registry shall consult with the foreign national's government. If the foreign national's government does not provide assurances that it will prosecute the natural person on charges commensurate to those which are justified under the laws and regulations of the State of registry, then the State of registry may prosecute the natural person in its court(s) pursuant to its own laws and procedures.

Real Property Rights

11. Private, non-governmental Owners who or which inhabit, maintain and/or operate a space facility for a period of at least one year shall be entitled to formal recognition and registration of the following rights, which shall be designated "real property rights:"
 - a. The right to exclude natural persons and legal entities from the space facility and its related safety zone;
 - b. The right to be free of interference from others;
 - c. The right to control the activities of all natural persons and legal entities within the space facility and its related safety zone;
 - d. The right to direct the activities of space vehicles and the natural persons inside such vehicles within the space facility and its related safety zone;
 - e. The exclusive right to appropriate resources within the space facility and its related safety zone;
 - f. The right to sell real property rights to other natural persons or legal entities.
12. The real property rights which States confer upon Owners shall be subject to the following limitations:
 - a. If the Owner of a space facility stops using the space facility for peaceful purposes, the Owner's real property rights shall immediately terminate;

- b. If the Owner of a space facility abandons the space facility for a period of 2 years or more, the Owner's real property rights shall immediately terminate;
 - c. If the Owner of a space facility ~~which~~ *that* is in orbit around a celestial body or point in space allows the space facility to deviate, for a period of one month or more, ~~more than _____%~~ *beyond the tolerances specified in the appropriate annex to this Convention that references this paragraph,* from any of the orbital parameters of ~~period~~ *semimajor axis, eccentricity, inclination, apogee longitude of ascending node, longitude of periapsis, and perogee longitude at epoch* ~~which~~ *that* are listed in the real property rights registry, the real property rights shall immediately terminate;
 - d. Owners may not establish property rights over an area which would prevent other natural persons or legal entities from having free access to outer space and celestial bodies;
 - e. The Owner of a space facility shall only have the right to direct the activities of space vehicles which are carried on the registry of a State other than the State of registry of the space facility, and the natural persons inside such vehicles, to the extent necessary to protect the safety of other space objects and natural persons within the space facility and its related safety zone;
 - f. Owners shall not have the right to exclude from the space facility and its related safety zone natural persons who come to inspect the space facility, on the basis of reciprocity, pursuant to Article XIII of the Outer Space Treaty;
 - g. Any State Party to this ~~Treaty~~ *Convention* may terminate the property rights of an Owner whose space facility is carried on said State's registry, provided said State terminates the property rights pursuant to duly enacted laws or regulations, or duly ratified treaties, and the Owner has received due process of law including the right to be heard.
13. Each State Party to this ~~Treaty~~ *Convention* shall establish a registry of real property rights, and shall enact laws and, if deemed necessary, regulations which set forth the procedures which Owners of space facilities

must follow in order to establish, register, and obtain documentation of real property rights. States shall require Owners of a space facilities which orbit around celestial bodies or points in space to provide the registry with the orbital parameters of the space facility, including ~~period~~ *semimajor axis*, *eccentricity*, *inclination*, ~~apogee~~ *longitude of ascending node*, *longitude of periapsis*, and ~~perogee~~ *longitude at epoch*. States' registries of real property rights shall be openly and easily available to other States and to the general public, free of charge.

14. States ~~Party~~ *Parties* to this ~~Treaty~~ *Convention* shall not confer real property rights upon an Owner which would prevent other natural persons or legal entities from having free access to outer space or celestial bodies.
15. Real property rights which States confer pursuant to this ~~Treaty~~ *Convention* shall not provide the basis for any claims of territorial sovereignty. States are prohibited from exercising territorial sovereignty in outer space and on celestial bodies.
16. ~~States Party to this Treaty are prohibited from conferring property rights upon Owners of space facilities which are located in the Geosynchronous Orbit.~~

Resolution of Legal Issues

17. In order to provide Owners with greater certainty and less risk when legal issues arise, and to permit Owners to avoid legal disputes whenever possible, States ~~Party~~ *Parties* to this ~~Treaty~~ *Convention* are encouraged to resolve legal issues which arise in outer space or on celestial bodies by first considering analogous terrestrial treaties, laws, regulations and case law precedents before enacting new national laws. For example:
 - a. Resolve legal issues regarding real property rights by first looking to terrestrial real property law;
 - b. Resolve legal issues regarding space vehicles which travel in outer space by first looking to terrestrial maritime law;

- c. Resolve legal issues regarding space vehicles which travel only on the surface of celestial bodies by first looking to the law governing terrestrial ground transportation;
- d. Resolve legal issues regarding overflight of space facilities by first looking to terrestrial air law;
- e. Resolve legal issues regarding safety zones by first looking to terrestrial law which governs safety zones around facilities on continental shelves;
- f. Resolve legal issues regarding criminal jurisdiction by first looking to terrestrial laws which govern international criminal jurisdiction, extradition, and conflict of laws;
- g. Resolve legal issues regarding personal injury and damage to space objects by first looking to terrestrial laws which govern those issues.

Consultation

18. States ~~Party~~ *Parties* to the ~~Treaty~~ *Convention* shall confer 5 years from the date this Convention enters into force, and every 5 years thereafter, to determine whether the following quantitative provisions of this ~~Treaty~~ *Convention* need to be revised pursuant to ~~Treaty~~ *Convention* amendment:
 - a. The physical extent of safety zones for residential and scientific, and commercial, industrial and mining space facilities;
 - b. The period of habitation, operation or maintenance of a space facility which is necessary to establish and register real property rights;
 - c. The period of abandonment of a space facility necessary to terminate real property rights;
 - d. The percentage of deviation from orbital parameters necessary to terminate real property rights.
19. The Parties may consult via a secure form of electronic communication.
20. In the event that a simple majority agree that one or more of the quantitative provisions need to be revised, the Parties shall convene a

meeting to determine the revised quantitative figures. Each State Party to the ~~Treaty~~ *Convention* shall be permitted to send one voting representative to such a meeting. After full and complete discussion of relevant facts and issues, the States' voting representatives shall determine the revised quantitative figures by simple majority vote. Each State shall bear the cost of sending their representative(s) to such a meeting. The States participating in the meeting shall equally share the cost of the meeting, regardless of which State hosts the meeting, unless the host State voluntarily agrees to bear such costs.

21. In the event that States' representatives vote to change one or more quantitative provisions of this ~~Treaty~~ *Convention*, such changes shall take effect one year from the date of the vote, or at such later time as the parties may agree. Any changes in the quantitative provisions may serve to increase the rights of entities that already have property rights which have been conferred in accordance with this ~~Treaty~~ *Convention*, but such changes shall not under any circumstances diminish or abrogate the rights of entities that own property rights on the date when States' representatives vote to change the quantitative provisions.

Dispute Resolution

22. In the event of a dispute between two or more Owners of space facilities who have registered real property rights with different States pursuant to this ~~Treaty~~ *Convention*, the Owners are first encouraged to seek resolution of their disputes through alternative dispute resolution methods such as international conciliation, mediation or arbitration. If such Owners are unwilling to or cannot resolve their disputes through private dispute resolution, the Owners may ask their respective States of registry to convene an arbitration panel to resolve the dispute. Each State of registry shall select one arbitrator. Those arbitrators shall then select one or two additional arbitrators by simple majority vote, such that the total number of arbitrators constitutes an uneven number. The arbitration panel shall then hear the facts and issues presented by the Owners and their legal counsel and shall decide the outcome of the dispute within a reasonable time.

General Provisions

23. This ~~Treaty~~ *Convention* shall not provide the basis for the formation of any organization, either temporary or permanent, which would administer the terms of the ~~Treaty~~ *Convention* and/or determine the quantitative figures set forth in the ~~Treaty~~ *Convention*. It is the intention of States ~~Party~~ *Parties* to this ~~Treaty~~-*Convention* that the costs of administering the real property regime shall always remain minimal, so that no State will be prevented from becoming a party to the ~~Treaty~~ *Convention* because of prohibitive costs.
24. This ~~Treaty~~ *Convention* shall be open to all States for signature. Any State which does not sign this ~~Treaty~~-*Convention* before its entry into force in accordance with article 23 of this *Convention* may accede to it at any time.
25. This ~~Treaty~~ *Convention* shall be subject to ratification by signatory States.
26. This ~~Treaty~~ *Convention* shall enter into force upon the deposit of instruments of ratification by three States.

Appendix 2

Convention on Jurisdiction and Real Property Rights in Outer Space

Annex 1

Safety Zones

Thomas Gangale

1. Pursuant to Paragraph 2(b) of the Convention, a State Party shall retain jurisdiction and control over a safety zone of ____ meters around the residential or scientific space facilities on its registry.
2. Pursuant to Paragraph 2(c) of the Convention, a State Party shall retain jurisdiction and control over a safety zone of ____ meters around the around commercial, industrial and mining facilities on its registry.

Appendix 3

Convention on Jurisdiction and Real Property Rights in Outer Space

Annex 2

Deviation from Published Orbital Parameters

Thomas Gangale

Pursuant to Paragraph 12(c) of the Convention, if the Owner of a space facility that is in orbit around a celestial body or point in space allows the space facility to deviate, for a period of one month or more, beyond the tolerances for a specific type of orbit as defined in this annex, from any of the orbital parameters that are listed in the real property rights registry, the real property rights shall immediately terminate:

Section 1: Earth Orbits

1. Low Earth orbit, defined as an orbit around Earth whose semimajor axis is up to 8,000 kilometers:
 - a. Semimajor axis: ____kilometers;
 - b. Eccentricity: ____;
 - c. Inclination: ____degrees;
 - d. Longitude of ascending node: ____degrees;
 - e. Longitude of periapsis: ____degrees;
 - f. Longitude at epoch [year]: ____degrees.
2. Medium Earth orbit, defined as an orbit around Earth whose semimajor axis is between 8,000 kilometers and 26,500 kilometers:
 - a. Semimajor axis: ____kilometers;
 - b. Eccentricity: ____ ;

- c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.
3. Semidiurnal Earth orbit, defined as an orbit around Earth whose period is 11 hours, 58 minutes, 2.1 seconds (semimajor axis of 26,561 kilometers):
- a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.
4. Geosynchronous orbit, defined as an orbit around Earth whose period is 23 hours, 56 minutes, 4.2 seconds (semimajor axis of 42,163 kilometers; geostationary orbit is a restricted case, where inclination and eccentricity are 0):
- a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.
5. Highly elliptical orbit, defined as an orbit around Earth whose semimajor axis is greater than 42,200 kilometers:
- a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: _____;

- c. Inclination: ____degrees;
- d. Longitude of ascending node: ____degrees;
- e. Longitude of periapsis: ____degrees;
- f. Longitude at epoch (year): ____degrees.

Section 2: Earth-Moon Lagrange Point Halo Orbits

- 1. Earth-Moon halo orbits, defined as an orbit around Earth-Moon Lagrange points, shall be subject to active traffic control as such an authority is established.

Section 3: Sun-Earth Lagrange Point Halo Orbits

- 1. Sun-Earth L₁ halo orbit, defined as an orbit around the Sun-Earth L₁ Lagrange point, shall be subject to active traffic control as such an authority is established.

Section 4: Lunar Orbits

- 1. Lunar orbit, defined as an orbit around the Moon:
 - a. Semimajor axis: ____kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: ____degrees;
 - d. Longitude of ascending node: ____degrees;
 - e. Longitude of periapsis: ____degrees;
 - f. Longitude at epoch (year): ____degrees.

Section 5: Mars Orbits

1. Semi-sol orbit, defined as an orbit around Mars whose period is 12 hours, 18 minutes, 41.2 seconds (semimajor axis of 12,868 kilometers):
 - a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: ____;
 - c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.
2. Low Mars orbit: defined as an orbit around Mars whose semimajor axis is up to 4,500 kilometers:
 - a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: ____;
 - c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.
3. Medium Mars orbit, defined as an orbit around Mars whose semimajor axis is between 4,500 kilometers and 12,800 kilometers:
 - a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: ____;
 - c. Inclination: ____ degrees;

- d. Longitude of ascending node: _____ degrees;
 - e. Longitude of periapsis: _____ degrees;
 - f. Longitude at epoch (year): _____ degrees.
4. Areosynchronous orbit, defined as an orbit around Mars whose period is 24 hours, 37 minutes, 22.4 seconds (semimajor axis of 20,427 kilometers; areostationary orbit is a restricted case, where inclination and eccentricity are 0):
- a. Semimajor axis: _____ kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: _____ degrees;
 - d. Longitude of ascending node: _____ degrees;
 - e. Longitude of periapsis: _____ degrees;
 - f. Longitude at epoch (year): _____ degrees.
5. Highly elliptical Mars orbit, defined as an orbit around Mars whose semimajor axis is greater than 20,500 kilometers:
- a. Semimajor axis: _____ kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: _____ degrees;
 - d. Longitude of ascending node: _____ degrees;
 - e. Longitude of periapsis: _____ degrees;
 - f. Longitude at epoch (year): _____ degrees.

Section 6: Solar Orbits

1. Earth-Mars solar outage orbit, defined as an orbit around the sun whose period is 686.9797 days (semimajor axis of 227.9 million kilometers):
 - a. Semimajor axis: ____ kilometers;
 - b. Eccentricity: _____;
 - c. Inclination: ____ degrees;
 - d. Longitude of ascending node: ____ degrees;
 - e. Longitude of periapsis: ____ degrees;
 - f. Longitude at epoch (year): ____ degrees.

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2

A Legal Exploration of Force Application in Outer Space[†]

*Arjen Vermeer**

Military use of outer space has been part and parcel of national security strategies ever since the space age began, 50 years ago. Recent developments in technology and military doctrine have shown an increased interest by States in the deployment of force application devices in space. Undoubtedly, military activity in space will only increase in wars to come. Thus, an assessment thereof under international law seems pertinent. Contrary to common belief, the arms control provisions of the 1967 Outer Space Treaty reserve only celestial bodies to be used for 'peaceful purposes', thereby demilitarising them completely. Conversely, the Treaty does not limit military activities in the space between celestial bodies, the outer void space, except for the prohibition of weapons of mass destruction and the application of general international law, including the UN Charter. Yet, force application by space weaponry challenges the regime governing the use of force in international relations, the jus ad bellum, as spelled out in the Charter on a conceptual

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and substantive level. Firstly, the concept of 'force' needs to be revisited. Secondly, the differentiated regimes of outer void space and celestial bodies have significant impact on the lawful exercise of the right of self-defence, including the deployment of spatial missile defence shields. Lastly, a possible jus in bello spatiale, a law of armed conflict in outer space, is examined. The analysis focuses on the application of the general principles and the environmental protection regime existing under the current regulation of means and methods of warfare. Additionally, targeting issues under the law of armed conflict are evaluated in view of the characteristics of space assets. It is concluded that existing rules are profoundly tested, but should, nevertheless, be applied in the space medium in accordance with the fundamental principles underlying them.

I. Introduction

The ascent into space of man-made objects has made it possible to use space as a medium for military purposes. Space militarisation can be described as any activity in space which is executed by a man-made object that is incorporated *de jure* or *de facto* in the military organization of a State.¹ Satellites, for instance, may perform a number of tasks for military purposes, including communications, weather information, remote sensing and navigation (e.g., GPS and missile guidance). Along the continuum of space militarisation, one also finds space weaponisation. Space weaponisation denotes the introduction of operational weapons systems in outer space.² Examples of dedicated space weapons include Kinetic Energy Weapons (KEWs) and Directed energy Weapons (DEWs). The concept of Kinetic energy Weapons is a quite simple one: a 'kill' is being executed through high velocity impact (hit-to-kill). Directed energy Weapons include a broad variety of technologies, such as lasers, particle beams and signal interference technologies like high-powered microwaves or high power radio frequencies. Electromagnetic and Radiation Weapons (ERWs), another subcategory of DEWs, operate through the emission and/or creation of electromagnetic pulse or radiation. The device that brings about both

consequences at once is a nuclear weapon. Lastly, Explosive Proximity Weapons (EPWs), also referred to as space mines, explode upon contact or in proximity.

Despite the technological development, political realities have prevailed to the extent that space faring States, the US being an exception, are cautious to include the use of (defensive) space capabilities as viable means to secure their national interest in their national (military) space doctrines and policies.³ Nevertheless, the weaponisation of space by those and other nations looms just as large.⁴ This article will focus on whether and to what extent force application by space weapon systems in space is regulated under existing international law, in particular the outer Space treaty, the Charter of the United Nations and the law of armed conflict. It will start, however, with an inquiry into the legal-historical context of the militarisation and weaponisation of outer space.

II. The Ascent into Space and the International Community

The military significance of space had been acknowledged right from the start of space activity. In fact, it provided the incentive to go into space in the first place. The technological advances of the 1950s, in particular the development of the Intercontinental Ballistic Missile (ICBM), started off a space race between the US and the Soviet Union with the launch of the first man-made satellite, the Sputnik 1, by the latter on 4 October 1957. It was only three months later in January 1958 that the US sent their first satellite into space, the explorer 1. Though the 1960s are generally seen as a softening of the cold War, space exploration marked another chapter of the continuous search for military dominance by the world's leading powers at the time.

The international community, however, has been quick to respond to even the earliest rhetoric in the direction of space militarisation. The United Nations General Assembly (GA) adopted a series of resolutions relevant to the disarmament or rather the non-armament of outer space. The first resolution in this context, GA resolution 1148 of 14 November 1957 on 'regulation, limitation and balanced reduction of all armed forces and armaments' called for a common study of a system of inspection to ensure that objects sent through outer space were used "*exclusively for peaceful and scientific purposes*".⁵ The second resolution of major importance towards the regulation of space activities

recommended States to be guided by the principles that international law applies to outer space and celestial bodies and that those are not subject to national appropriation.⁶ However, the landmark resolution was resolution 1962 (XVIII), adopted unanimously by the general Assembly on 13 December 1963.⁷ This so-called 'principles Declaration' aimed at providing guidance on how to use space for peaceful purposes in the interest of all mankind.⁸ The imperative drive to negotiate this principles Declaration was to embed space activities within an arms control regime.⁹ It spurred the superpowers to cooperate and to lay down legally binding norms with regard to military activities in outer space. The increasing activity in space by the US and the Soviet union and the concern thereof on the part of the international community led to the negotiation and adoption of the 1967 treaty on the principles governing the Activities of States in the exploration and use of outer Space, including the moon and other celestial Bodies (Outer Space Treaty or OST).¹⁰

This document constitutes the first legally binding instrument in the regulation of space activities and is considered to be the *Magna Charta* of space law.¹¹

III. Space Warfare in Sight?

By the time the 1967 OST was signed, space-based military assets were already an integrated part of both superpowers' defence systems. Satellite systems of reconnaissance and surveillance would serve the threefold purpose of technical intelligence gathering, arms control monitoring and verification.¹² These space-based systems were, by way of tacit agreement between the US and the Soviet union, accepted as legitimate means of confidence-building and information-exchange.¹³ It is undeniable that, ever since the first satellite was put into orbit, space has seen an ever increasing development in quantity and quality of militarisation. The 1991 first gulf War demonstrated for the first time the practical advantages of force enhancement space capabilities in war; a phenomenon that is known as passive military use of outer space.¹⁴ Satellites provided indispensable services, such as communications, weather information, remote sensing and navigation (e.g., GPS and missile guidance). This even led some experts to say it was "the first 'space war', since it was the first occasion on which

the full range of modern military space assets were applied to a terrestrial conflict".¹⁵ the dependence on satellite systems has been demonstrated once more in the 1999 Kosovo campaign and even more so during the 2003 Iraq War.¹⁶ it is, therefore, to be expected that the inclusion of satellite systems in military planning as force enhancers will undoubtedly further develop in support of future warfare.¹⁷

Space warfare capabilities, *i.e.*, force application capabilities, have been researched, developed and tested almost exclusively by the US and the Soviet union since the late 1950s, of which most importantly air-launched Anti-Satellite weapons (ASATs) were explored to counter ICBM attacks. This active development of ASATs continued until the political climate shifted to a period of *détente* in the early 1970s in which the Anti-Ballistic Missile treaty (ABM) and the Strategic Arms reduction treaties (Start I & II) were signed. However, this was quite quickly taken over again by increasing rivalry in the late 1970s and would come to a new height during ronald reagan's presidency.¹⁸ Reagan was the first US president who overtly advocated the weaponisation of outer space. In his third year of presidency, he handed down his famous ' Star Wars Speech' and announced his ' Strategic Defense Initiative' (SDI).¹⁹ The SDI was a program to ensure national security by raising a defensive non-nuclear missile shield with space-based components to counter a (nuclear) Soviet missile attack. Confronted with some initial successful tests with ASAT capabilities, the international community tried to counter what it saw as space arms race initiatives. One of these counter-initiatives came from the sole multilateral disarmament forum, the geneva-based Conference on Disarmament (CD). From 1982 onwards, this intergovernmental body has included in its agenda to work towards negotiations of a treaty on the Prevention of an Arms Race in Outer Space (PAROS).²⁰ No such agreement has been reached yet, in spite of the repetitious and explicit affirmation of the un general Assembly that outer space "must not become an arena for a new arms race".²¹

IV. A Call for Legal Appraisal: Recent Developments in US Space Policy

As international concerns remained, the US continued its search for space protection. In 1998, president Bill Clinton and his administration released a

National Security Strategy (US NSS), which strongly aimed at further development of military programs to protect US national security interests in outer space.²² When George W. Bush took office in 2001 it did not take long before the new administration adopted its own version of Reagan's SDI for a national or Ballistic Missile Defence (BMD). Following the catastrophic events of '9/11', 2001, the Bush administration made it a priority to defend itself against missiles from rogue States. Subsequently, it announced its withdrawal from the ABM treaty in order to be freed of legal restraints and to work on a BMD. Moreover, in 2001 a congressional commission chaired by later to be Secretary of Defense Donald Rumsfeld evaluated that the 600 US satellites on which the US military relied were easy targets for hostile adversaries and had to be able-bodied. The Rumsfeld report stated:

[W]e know from history that every medium-air, land and sea-has seen conflict. Reality indicates that space will be no different. Given this virtual certainty, the US must develop the means both to deter and to defend against hostile acts in and from space. This will require superior space capabilities.²³

This recommendation was given a follow up five years later. In 2006, the Bush administration, including then Secretary of Defense Rumsfeld, released its National Space Policy (US NSP).²⁴ The 2006 US NSP is noticeable for a number of things. In particular, it ventilates a unilateral approach toward arms control matters. It explicitly opposes the development of new legal regimes limiting US access to space.²⁵ Strikingly, it places the importance of freedom of action in space on an equal footing with that of air and sea power. Moreover, given the wording of the US NSP, weaponisation of outer space looms large:

In order to [...] enhance the national security, the United States must have robust, effective, and efficient space capabilities.

Enable unhindered US operations in and through space to defend our interests there.

Develop and deploy space capabilities that sustain US advantage and support defense and intelligence transformation.²⁶

Bearing in mind that the controversial Bush doctrine of preemption promulgated by the 2002 US national Security Strategy also extends to outer space,²⁷ the 2002 US NSS in combination with the 2006 US NSP warrants close scrutiny. Even more so as it is expected that space-based assets will increasingly form part of military structures all over the world. This necessitates an assessment of the legality of military uses of space, particularly space weapons and force application in space.

V. Obligations Arising from Article IV of the 1967 Outer Space Treaty

In 2007 the 50th anniversary of the space age which began with the launching of the Sputnik I on 4 October 1957 and the 40th anniversary of the first treaty to regulate space activities comprehensively, the 1967 Outer Space treaty, were commemorated. Article IV of the OST has significant bearing on military activities in outer space. It reads as follows:

1. States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
2. The Moon and other celestial bodies shall be used by all States parties to the treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

1. Article IV(1): Weapons of Mass Destruction

The first paragraph prohibits putting nuclear and any other weapons of mass destruction in orbit or in outer space. However, the treaty leaves crucial terms undefined, such as 'outer space', 'orbit' and, not surprisingly, 'Weapons of Mass

Destruction' (WMD). it is generally understood that 'outer space' comprises celestial bodies, including the moon,²⁸ and all space in between, the so-called outer void space.²⁹ 'orbit' is generally understood to comprise at least one full orbit around the earth in order to exclude from the scope of the provision (nuclear laden) ICBMS passing *through* space.³⁰

Furthermore, the object of the prohibition is *objects* carrying weapons of mass destruction, not the weapons per se. This strict interpretation can be explained by reference to the technological state of art at the time of conclusion.³¹ It would, however, be a misreading and against the spirit of the OST, to cling to such a strict reading. Be that as it may, the question still stands: what are weapon of mass destruction? Although weapons of mass destruction are not denned in any agreement, the UN General Assembly in its very first Resolution has employed the definition that they are "atomic weapons and [...] all major weapons *adaptable* to mass destruction".³² Two years later, the un Commission for Conventional Armaments denned WMD as: "[...] atomic explosive weapons, radio active material, lethal chemical and biological weapons, and *any* weapons developed in the future which have characteristics comparable in destructive effect [...]".³³ Thus, according to Gorove, the question may be a relative one in relation to new weapons, in particular, those developed to be deployed in space: "their capabilities of mass destruction must be evaluated with each technological advancement".³⁴

Moreover, some have argued that any weapon which uses atomic energy for whichever purpose should be regarded as a nuclear weapon and thus a WMD; this would particularly be true for DEWs.³⁵ However, it is submitted that, at least for the purposes of the OST, nuclear weapons that do not have the characteristics of a WMD and *a fortiori* nuclear material not intended to be used as a weapon are excluded from the prohibition.³⁶ Thus, space weapons that use nuclear energy, but do not possess the characteristics in effect or design as WMD, like some DEWs, fall outside the scope of Article IV(1).

2. Article IV(2): The 'Peaceful Purposes' Debate

Article IV(2) is concerned only with the demilitarisation of 'the moon and other celestial bodies'.³⁷ It is important to keep in mind that in 1967 neither the US nor the Soviet union attempted to bring about a complete demilitarisation of the

whole of outer space comparable to the regime established by the 1959 Antarctic treaty.³⁸ The omission of any reference to outer space *sensu lato* is therefore a deliberate one.³⁹ Nevertheless, Article IV(2) bears significant resemblance with the Antarctic Treaty and, arguably, has the same effect of establishing a regime of complete demilitarisation, albeit spatially limited to celestial bodies.⁴⁰

The main debate focuses on the interpretation of the term 'peaceful' in the context of the use of outer space for 'peaceful purposes'. Though this notion appears to have its own functional meaning, if at all, discussion generally runs through two other terms, namely 'non-aggressive' and 'non-military'. Initially, following the events of the Sputnik and Explorer, both the US and the Soviet Union aimed at a complete demilitarisation of outer space.⁴¹ However, the availability, use and potential of satellite systems prompted the US already in 1958 to change its interpretation of 'peaceful' from 'non-military' to 'non-aggressive'. It is argued that the interpretation of 'peaceful' meaning 'non-aggressive', as supported by the US, is erroneous. Replacing 'peaceful' by 'non-aggressive' in Article IV(2) would *contrario* mean – if one accepts the limited spatial application of Article IV(2) – that outer void space may be used for aggressive purposes.⁴² This conclusion cannot be warranted, particularly as Article III OST makes the UN Charter and its provisions on the prohibition of the use of force applicable to outer space.⁴³ In other words, it would make Article IV(2) redundant.

On the other hand, the interpretation of 'peaceful' meaning 'non-military' is a more likely one. 'Peaceful' should be seen distinct from terms like 'offensive' or 'aggressive' and 'defensive' or 'non-aggressive'. Cheng aptly summarizes the parallel with Article I of the 1959 Antarctic Treaty as follows:

- i. 'peaceful' means non-military;
- ii. references to military installations, military manoeuvres and so forth in the provision are exemplificative and not exhaustive;
- iii. the possibility of using military personnel and equipment or scientific research or other peaceful purposes in no way invalidates point (i) above.⁴⁴

According to the customary rules of treaty interpretation, treaty terms shall be interpreted according to their ordinary meaning in their context and in the light of the object and purpose of the treaty.⁴⁵ First of all, the ordinary (sociological) meaning of 'peaceful' implies more than the mere absence of violence at a given moment. It entails a state devoid of force. Secondly, in the context of the OST, there are several references to 'peaceful purposes' hinting at a non-military meaning.⁴⁶ Thirdly, other treaties with a similar nature can be referred to for interpretative purposes, as the practice of the ICJ has shown.⁴⁷ There are a number of treaties that, according to their object and purpose, point to 'peaceful' as 'non-military'.⁴⁸ Admittedly, none of these treaties provide a definition of 'peaceful'. Yet, there is no indication that the parties to the outer Space treaty intended to attach a special meaning to it in the sense of Article 31(4) of the VCLT. Hence, the meaning of 'peaceful', *i.e.*, 'non-military', should then also be applied to Article IV(2) OST.

3. Military Space Activities in Outer Void Space

The US and the USSR only accepted Article IV of the outer Space treaty as it stands to gain maximum freedom to protect their national interests. The 1967 outer Space treaty regulates specific military activities in differentiated regimes: one addresses the moon and other celestial bodies (Article IV(2)) and the other the outer void space (Article III).⁴⁹ This differentiation begs the question whether the legal consequences for the use of force remain nevertheless equal for both regimes. It is argued that this is not the case.

VI. The Use of Force in Outer Space

Any interference, including the use of force, against a space object is prohibited. This stems from the exclusive jurisdiction over space objects, which as a matter of principle, is spelled out in Article VIII of the outer Space treaty.⁵⁰ However, it does not tell us whether such interference amounts to a prohibited use of force for the purposes of the *jus ad bellum* or rather *jus contra bellum*, as reflected in particular in the Charter of the United Nations. The cornerstone provision on the regulation of the use of force between States is the well-known Article 2(4) of the UN Charter prohibiting the use of force in international relations.⁵¹ Article 2(4) is declaratory of customary international law⁵² and even considered to be *jus cogens*,⁵³ thus binding upon all States in all their international relations,

including those in outer space. Article ii of the OST excludes appropriation in outer space *sensu lato* and, thus, negates the possibility of the use of force against the territorial integrity.⁵⁴ Without an associated terrestrial attack, the political independence of a State cannot be threatened either.⁵⁵ As Article 2(4) contains an absolute prohibition, all uses of force in outer space are necessarily subject to the prohibition to act in 'any other manner inconsistent' with the UN Charter.

Furthermore, it is generally accepted that 'force' denotes *armed* force.⁵⁶ However, signal interference weapons, for instance, are not considered to apply force in the 'classical' sense, *i.e.*, using kinetic energy.⁵⁷ To make Article 2(4) applicable, Brownlie argues that new types of force application devices would be covered if "The agencies concerned are commonly referred to as 'weapons' and forms of warfare" and if "these weapons are employed for the destruction of life and property".⁵⁸ Thus, a re-interpretation of the notion 'force' along these lines seems justified to incorporate space weaponry within the prohibition.⁵⁹

VII. Chapter VII of the UN Charter

The generally accepted exceptions to the prohibition on the use of force are a Security Council (SC) authorisation and forcible measures taken in the lawful exercise of the right of self-defence. Though the drafters of the charter may not have been concerned with the inclusion of space limitations in the charter, its application to outer space should not be disregarded. As concerns the first exception, the united nations system provides the Security council with coercive tools under Chapter VII of the Charter.

Prior to applying these means, however, the Security council has to determine that a situation falls within the scope of Article 39 UN Charter. The qualification that has been given the most to situations in recent decades is that of a threat to international peace and security. Applied to situations in space, this could involve either a threat to mankind (*e.g.*, WMD, space debris, or theoretically even space weaponisation as such) or a threat to another State's national security (*e.g.*, the threat or use of force against a State's space assets). Interestingly, Article 41 UN charter, dealing with non-military measures, provides for the possibility to interrupt "telegraphic, radio and other means of communication" with the State(s) involved.⁶⁰ This could encompass space-based assets, like communication and

GPS satellites. Lacking any reference to space or space forces, Article 42 UN charter would not automatically bar military measures to be taken from or in outer space. Even if such an approach were adopted, that is the exclusion of military space measures by Article 42, there is nothing to assume that the UNSC could not change this interpretation by subsequent practice.⁶¹ In support of this argument with regard to military space activities, one may claim that this has already been achieved.⁶² Moreover, the technological advances in space are undeniably a great asset to UN peacekeeping missions.⁶³ Space assets may, thus, not only be called upon to support earth-based measures, but force application in or from outer space may come within the purview of the actions envisaged by the charter as well.

VIII. Self-Defence

Article 51 UN Charter does not conclusively define the right of self-defence, it mainly sets out the conditions under which measures in Self-defence are lawful.⁶⁴ Basically, it requires an armed attack and prescribes a temporary response, i.e., "until the Security council has taken measures necessary to maintain international peace and security". Article 51 calls on States to report immediately to the Sc once measures in self-defence are taken. Furthermore, customary international law places two additional constraints upon the lawful exercise of the right of self-defence, namely necessity and proportionality.⁶⁵ Consequently, the statutory and customary requirements do not deter the application of this right in outer space. This conclusion is widely accepted today.⁶⁶

1. Self-defence in Outer Void Space

Undoubtedly, the right of self-defence is activated once an attack takes place against a military space asset wherever it may be located in outer void space.⁶⁷ there is, however, considerable controversy as to whether the right of self-defence extends to the protection of nationals and property owned by either own nationals or a third State's nationals outside the territory of their nationality or the territory where they are registered. The 1974 *Definition of Aggression* states that force amounts to aggression when marine or air fleets are attacked.⁶⁸ Though the meaning of aggression does not necessarily coincide with the meaning of armed attack, the traditional view is that what amounts to aggression amounts to armed attack as well. Thus, in light of the spirit of Article 3 *sub d* of the *Definition*

of *Aggression*, the interpretation that space fleets or space systems could be taken as the object of attack is plausible. Attacks on individual assets being part of such fleet or system may thus fall within the right of self-defence as well.

There are other long held lines of reasoning that go a step further and dangerously push the limits of international law. The first argument is that due to the obliged registration of military and civilian space assets in a particular State, these assets may profit from diplomatic protection by that State of registry.⁶⁹ This would result in an affirmative approach to include the nationals and property in question within the right of self-defence. However, to jump from diplomatic protection to self-defence is a circular argument. States are foremost under the obligation to settle their disputes peacefully as established in Article 2(3) of the UN Charter.⁷⁰ The circularity inserted here is that while forcible protection may be effectuated, it may only be done so according to the conditions set out under the right of self-defence. The question whether these nationals or assets fall within that right is exactly the point in case.⁷¹

In addition, two arguments have been raised that relate to matters of forcible self-help. firstly, it is argued that States may use force to protect their space assets, notwithstanding their nature, on the basis of their jurisdiction and control as expressed in Article VIII OST and secondly, that through the operation of registration, States may forcibly protect the sovereign rights and interests of these assets.⁷² If this forcible protection in the former case is invoked to enforce the international obligation not to use force, this act is forbidden as a measure of forcible self help.⁷³ Regarding the second ground of forcible protection, just because nationals or assets carry the nationality of a State, it simply does not mean they are permeated with sovereignty, with the exception of the acts of a State's nationals that are attributable to it.⁷⁴ Both arguments fall back into the same circular reasoning as the previous argument. Accordingly, these arguments cannot be accepted.

It suffices to note here that, although the concept of self-defence has been accepted to apply to outer void space, the 'terrestrial' discussions about the parameters of the exercise of self-defence in space are just as vigorous. Any such discussions should, however, be held with the particular context of space operations in mind.

2. Self-defence on Celestial Bodies

The issues related to the interpretation of 'peaceful purposes' can be put in the context of the place of self-defence in the regulation of a demilitarised zone in general, and of celestial bodies in particular. A 'non-aggressive' approach argues in favour of military installations on celestial bodies for the purpose of self-defence.⁷⁵ In addition to the objections mentioned in Section V.2, this argument cannot be accepted from a *jus contra bellum* perspective. The demilitarisation of celestial bodies can be seen as a collective act precisely tailored to prevent threats to the peace. Celestial bodies are *res communis* denoted for exactly that purpose as demilitarised zones. It is this situation that makes the analogy with the Antarctic regime even more pertinent. The preamble of the Antarctic treaty clearly iterates:

Recognizing that it is in the interest of all mankind that Antarctica shall continue *forever* to be used exclusively for peaceful purposes and shall not become the scene or object of international discord;

Convinced also that a treaty ensuring the use of Antarctica for peaceful purposes only and the continuance of international harmony in Antarctica will further the purposes and principles embodied in the charter of the united nations.⁷⁶

The reference to the UN Charter is only made in light of *furthering* the purposes and principles. As a consequence, in furthering a *jus contra bellum* and the maintenance of international peace and security, States have gone a step beyond the charter and declared Antarctica off-limits to any military activity other than that for peaceful purposes. Moreover, Antarctica must not be made 'the scene or object of international discord'. These words may be interpreted as not to make Antarctica the scene or object of hostilities. While these preambular paragraphs do not have binding effect, their aspirations are captured by Article I of the Antarctic Treaty. State practice confirms that this regime cannot be derogated from, not even in wartime.⁷⁷ States have implicitly acknowledged such an approach in 1967, employing similar terminology in the OST, emphasizing its comprehension with the words "exclusively for peaceful purposes".⁷⁸ Hence, it can be concluded that Article IV OST precludes any (offensive and defensive) military activity *on* and *against* celestial bodies.

3. Ballistic Missile Defence

A ballistic missile defence system is seeking defence of the State possibly through military deployment in outer space aiming at tracking and intercepting incoming missiles. The issue involved in this context does not so much concern the orbiting of those components – this is a legal activity when they comply with the OST and Article IV OST in particular –, but some of these components would undoubtedly claim some sort of protection, identification or exclusion zone around them. Any space asset that comes within such a zone risks being targeted. Then the question is, would the assumingly permanent nature of the associated 'keep out zones' of these assets run counter to international law? On the high seas, States have arguably acquiesced in the establishment of such zones, at least for the duration of a conflict.⁷⁹ A strong argument can be presented that any interference arising from such a zone, be it in peace – or wartime, would be contrary to the freedom of navigation in space.⁸⁰ Interestingly, there seems to be increasing acceptance of the fact that such missile defence may be accepted in a multilateral setting only, if at all.⁸¹ Yet, this clearly contradicts the principle that outer space cannot be subject to sovereign claims and, consequently, cannot be occupied. State practice in space on this point is, however, at present non-existent. Nevertheless, it may be claimed that that the practice of permanent 'keep out zones' falls outside the legal paradigm and limits current initiatives for unilateral deployment of a BMD when assets used for a BMD make use of 'keep out' zones in peacetime.

IX. The Law of Armed Conflict in Outer Space

The use of force is not only judged by the regime governing the legality of the resort to armed force, *the jus ad bellum*, but also by the law applicable in armed conflict, *the jus in bello*.⁸² Leaving aside the question of qualification of a certain conflict, a few but significant principles have been accepted as being applicable to any type of armed conflict: military necessity, humanity, proportionality and discrimination.⁸³ Yet, it cannot be held beforehand that the *corpus* of the LOAC applies *in toto* to armed conflict in outer space because of the unique environment it presents and the specifics of space operations. Fortunately, hostilities in space have not arisen at this point in time. It can, however, not be excluded that one day outer space will be the fourth dimension of warfare and,

consequently, may attain its own *corpus of jus in bello spatiale*, a law of armed conflict in space.

Yet, any development of a specific framework of the LOAC in outer space is likely to be premised on two levels of analogy.⁸⁴

First, the law of armed conflict is characterized by numerous customary and conventional law norms for land, sea and, to a lesser extent, air warfare that would similarly limit the conduct of hostilities in the space environment as well (macro-level of analogy). Second, one should take into account that the OST assists significantly in shaping a minimum order and may therefore not be suspended or terminated.⁸⁵ Thus, a number of norms could be specifically tailored to conform to the existing norms of the *corpus juris spatialis* regulating military activities in outer space (micro-level of analogy). Taken as a whole, the overriding objective in the development of a *jus in bello spatiale* should be not to:

contravene in principle or in any important respect the rules already governing other forms of warfare [...], but should extend the accepted principles [...] so that the laws of war might be a unity in applying to all kinds of agencies of war.⁸⁶

The current *corpus* of the LOAC is therefore a logical starting point, in as far as the prescriptions or norms behind it could be transposable to the military use of space. This may certainly be the case for the rules relating to the conduct of hostilities, laid down in the 1977 first protocol additional (AP I) to the 1949 Geneva conventions. Interestingly, mention should be made of Article 49(3) AP I, which stipulates that 1977 Additional protocol I applies to all existing types of warfare "which may affect the civilian population, civilian individuals or civilian objects on land". Article 49(3) makes apparent that land, naval and air warfare should have due regard to the rules laid down in part IV of AP I concerning the protection of the civilian population against the effects of hostilities. It might be argued that the given dimensions are not meant to be exhaustive and thus that this provision applies to hostilities in any dimension of warfare, space included, that affect the civilian population, individual civilians or civilian objects on land.

It remains to be seen whether the existing rules related to the conduct of hostilities are appropriate to apply to space warfare, if only by analogy. This is, of course, without prejudice to the emergence of other principles and rules through any future State practice in space. To exemplify, this paper will reflect on two important applications of the principles of the LOAC: the protection of the space environment and the law of targeting in space.

X. Protecting the Space Environment During Armed Conflict

The concern of the law of armed conflict for the protection of the environment can be appreciated in two ways: firstly, the LOAC deals with the effect of warfare on the environment; secondly, the LOAC deals with the use of the environment as a means of warfare.⁸⁷ Article 35(3) and Article 55 form the direct protection regime of the environment afforded by Additional protocol I of 1977 and cover the first aspect of the LOAC's interference with the environment.

It is safe to assume that both provisions belong to the body of customary law.⁸⁸ The place of Article 55(1) in the section on the protection of the civilian population on land may suggest its application is confined to land warfare. However, Article 35(3) is not so limited and, hence, as one commentator correctly notes, the protection of this provision extends to all types of warfare.⁸⁹ That this includes space warfare as well, can be made apparent through the interpretation of 'natural environment', a term which is mentioned in both articles but has been left undefined. As both articles seem to take an ecological approach, the 'natural environment' is commonly referred to as a "system of inextricable interrelations between living organisms and their inanimate environment".⁹⁰ The ICRC commentary explains that "[t]he concept of the natural environment should be understood in the widest sense to cover the biological environment in which a population is living"⁹¹ Another authority asserts that the environment "represents the living space, the quality of life and the very health of human beings, including generations unborn".⁹² Bourbonnière comes to the conclusion that if the term is to be understood in the widest sense, "the concept of 'environment' can be interpreted to include the orbits within which there is human presence".⁹³ To make similar provisions applicable to all orbits around celestial bodies, it should be argued that in the event that future generations may inhabit, or at least be present on or in orbit around celestial bodies, those bodies and

orbits should also be covered by the regime protecting the space environment. Though such an interpretation may arguably be justified, it problematically demonstrates the exclusion of the remainder of outer space, in which (unmanned) assets may still be active such as space mines. Ultimately, one should not be surprised if a proposal finds its way to the negotiation table to declare the protection of the environment applicable to the whole of outer space as an area that affects the development of mankind.⁹⁴

The 1977 convention on the prohibition of military or any Other Hostile Use of Environmental Modification Techniques (generally known as the ENMOD Convention) is concerned with the deliberate manipulation of the natural process.⁹⁵ Importantly, the convention is limited only to "military or any other hostile use of environmental modification techniques" (Article I). The treaty is made explicitly applicable to outer space.⁹⁶ Nevertheless, the treaty's "utility in the context of space weapons is doubtful", as current space weapon technology is not focusing on deliberately manipulating the natural process.⁹⁷ Assuming such technology will be available at a given moment and will be used, the treaty's value cannot be underestimated.

Be that as it may, force application in space will leave its traces during and (long) after armed conflict in the form of space debris. The production of debris in space is not only an environmental issue but, moreover, space debris can have the same effect as a weapon.⁹⁸ It would take an enormous, but necessary effort of belligerents to limit the production of space debris to minimize environmental damage and to prevent damage to non-belligerent space assets. A future LOAC in space should reflect this appropriately.

XI. Targeting Issues

For the most widely accepted definition of a military objective today, one has to consider Article 52(2) AP I.⁹⁹ This article intends to give effect to the principle of distinction between civilian objects and military objectives contained in Article 48 AP I. Article 52(2) sets out a two-pronged test in order to qualify an object as a military objective. First, a military objective must by its nature, location, purpose or use make an effective contribution to military action. Concerning the 'nature' of a military object, this is established when the object is integrated in the military structure. Objects by 'location' often refer to either a construction located at a

strategic point or a designated area as a whole. Interestingly, the latter option could include an orbit.¹⁰⁰ Regarding 'purpose and use', these criteria commonly indicate a dual-use object. Secondly, the objective's total or partial destruction, capture or neutralization, in the circumstances ruling at the time, must offer a definite military advantage.¹⁰¹

Then the question arises whether a civilian asset that performs military functions for one or both belligerent parties can be considered a military objective?¹⁰² The question relates to dual-use objects, *i.e.*, objects being used both – either simultaneously or alternatively – for military as for civilian purposes. The law of armed conflict does not, however, use such a terminology but only speaks of military objectives and civilian objects. These notions are used to the exclusion of the other, although a civilian object may be turned into a military objective. Interestingly, certain means of communication were proposed to fall under Article 52(3), where it is stated that in case of doubt a civil object is presumed to be so used.¹⁰³ Satellites, though not explicitly mentioned, play a crucial role in today's communications infrastructure. However, those means failed to be included precisely because of their more likely military use in wartime. This also corresponds to the 'purpose' criterion. The intended future use of an object in space may even, as suggested by Schmitt, be inferred from the execution of a contract dealing with the future acquisition of data from satellite use by the military.¹⁰⁴ Hence, the general rule of Article 52(2) AP I applies. In case an object has a military purpose or use it constitutes a legitimate target, notwithstanding its registration as a civilian space asset.

In addition, there are a number of proportionality issues making targeting a legal labyrinth. The law requires (Articles 51(5)(b) and 57(a)(ii) AP I) weighing the *concrete and direct anticipated* military advantage against the *anticipated* loss of civilian lives; the latter must not be excessive in relation to the former.¹⁰⁵ This applies to civilian assets used for military purposes as well as to military assets providing civilian services.¹⁰⁶ Judging the excessiveness may be further complicated by multi-ownership of assets and neutrality issues.¹⁰⁷ Moreover, the obligation to minimize collateral damage includes an assessment of possible damage done to other assets through space debris resulting from an attack. The foreseeable long-term or reverberating effects – except environmental concerns – are, even if identifiable, not considered part of the current legal restraints on

targeting, but seem to worry States nonetheless.¹⁰⁸ This can be explained by today's technologically advanced societies, which rely more and more on sophisticated and (civil-military) integrated systems, networks and infrastructures.¹⁰⁹ Yet, these systems often use satellites which, in turn, are likely to be the objectives of belligerents. Attacking these satellites may disrupt and damage large segments of modern day societies (including medical and other emergency response capacities) depending on satellite data and communications.

A further matter that may complicate observance of the LOAC in space warfare relates to the taking of precautionary measures. In land and air warfare, belligerent parties have the obligation to take the required precautionary measures *in attack* (Article 57 AP I) and *against the effects* of attacks (Article 58 AP I). Article 57 obliges *inter alia* to do everything feasible to verify that the objects to be attacked are not civilian objects. Article 58 includes the obligation to separate civilian objects under the control of a party from military objectives.¹¹⁰ While the former task may be facilitated by the registration convention,¹¹¹ the latter is complicated by the fact that a rather large portion of space assets are of a dual-use nature, or may be used so. This category of assets makes it virtually impossible to separate the military functions from the civilian ones. Moreover, the possibility cannot be discarded that, one day, space warfare may develop the way naval warfare has developed. That is, merchant shipping and civil spacecraft may support the military effort in space extensively. The San Remo manual, therefore, opted not to include the obligation to take precautionary measures against the effects of attacks in naval warfare.¹¹² This arguably demonstrates that more weight is put on the attacking party in taking precautionary measures and is likely to develop into a similar rule for space warfare as well, considering the great number of dual-use assets.

On top of that, if a space asset kills, injures or captures an adversarial asset through the invitation of the confidence leading the enemy to believe that the asset is entitled to, or is obliged to be accorded, protection under the rules of international law applicable in armed conflict, with intent to betray that confidence, it is culpable of perfidy.¹¹³ Let's take, for instance, the feigning of civilian status as explicitly mentioned in Article 37(c) AP I. The example used in this respect by Schmitt concerns that of military asset that is registered as civilian, which provides data to facilitate targeting the enemy.¹¹⁴ It is thus not its status as

civilian *per se* that is perfidious, but an additional act is necessary to constitute perfidy. Schmitt uses the criterion of 'facilitation to attack' to substantiate this point. One should, however, be careful not to stretch the causality issue too much.¹¹⁵ There still has to be a definite result of either killing, injuring or capturing an adversary as a (direct) result of the perfidious act to fall within the prohibition of Article 37 AP I. An example can be the sending of an illegitimate distress signal by a civil registered but in fact military space asset, upon which an enemy manned military spacecraft comes to the rescue and is caught in an attack from the 'civilian' asset, as a consequence of which the crew of the spacecraft gets killed.

XII. Is There an Obligation to Use Space Weapons?

Despite the prohibitions or restrictions of the means and targets in warfare, it should be explored whether certain space weapons would ensure greater compliance with the LOAC than the deployment of other weapon systems and, therefore, whether their use may be not only permissive but even obligatory.¹¹⁶ As satellites used for military purposes are instrumental to the functioning of a great number of combatants, their neutralization would severely weaken enemy potential. It thus contributes to one of the main purposes of warfare, namely to disable "the greatest possible number of men".¹¹⁷ Technological advancement in space weaponry may display increasing compliance with the LOAC through, for instance, precision attacks. Despite the capabilities of certain space weaponry, under the LOAC, there is simply no obligation to use weapons that can carry out precision attacks in every instance. Space weapons cannot and should not be seen as panacea to minimize collateral damage and less so to guarantee zero-casualty warfare. The attacking party has to take the necessary precautionary measures and in doing so it has to match the best means and methods with the military objective. Only if the outcome of the 'matching' would require the deployment of space weapons would there be a specific obligation to use them. Thus, if space were to be weaponised, there would not be a general obligation to use space weapons.

XIII. Conclusion

Technological developments and States' interest in the weaponisation of space call for a legal appraisal of legally permissible activities in space, in particular

the use of force. The Outer Space Treaty regulates only partly the non-weaponisation of space through its prohibition of WMD and the non-militarisation norm only applies to celestial bodies. The OST leaves it to other norms to fill the gaps but determines through its differentiated regimes the framework in which other legal sources regulate the use of force. Moreover, space weaponry itself poses a challenge to existing norms. The prohibition on the use of force requires an acknowledgment of this challenge. Such an approach is necessary if the absolute character of the prohibition is to be retained. Another implication of force application in space will be a lawful extension of the powers of the Security Council under Chapter VII of the UN Charter.

Furthermore, the right of self-defence is of major importance to the proper functioning of the UN Charter. The contents of this right have always been contested but seem to face new difficulties when applied to outer space. Additionally, the right of self-defence is affected by the division of regimes in the OST. It clearly does not override just any other legal regime. Demilitarised zones, like those for celestial bodies, are established precisely to further international peace and security. It has thus been argued that this may limit the exercise of the right of self-defence.

Moreover, the precise rules of a law of armed conflict in space or *jus in bello spatiale* are unlikely to emerge in the near future; the law of armed conflict is inherently shaped after a conflict rather than before. Yet, the issues identified take a central place in shaping such a regime, notwithstanding the problems inherent to the use of analogies. The crucial test for such analogies will be their appropriateness in the context of space warfare, though parties to a conflict remain bound by the general principles of international law and the law of armed conflict which are undeniably applicable to the use of force in space as well.

This limited study has highlighted a number of issues likely to be encountered by law-makers and policymakers involved in military space activities. There is an obvious need for these activities to be drawn into the legal sphere. Overall, this work has attempted to demonstrate that, when force application will take place in space and space will be turned into a fourth dimension of warfare, lawyers

and policymakers need to rethink existing rules and apply them in the space medium in accordance with the fundamental principles underlying them.

Endnotes

- † This article originated from a thesis in fulfilment of a Master of Advanced Studies in International Humanitarian Law at UCIHL (currently: Geneva Academy of International Humanitarian Law and Human Rights), Geneva, Switzerland, in 2006. All opinions and errors are the responsibility of the author alone.
- 1 J.F. von Bentzien, 'Die militärische Nutzung des Weltraums in Friedens – und Kriegszeiten aus rechtlicher Sicht', Vol. 35 *Zeitung für Luft- und Weltraumrecht* 1986, p. 324.
 - 2 Cf. I.A. Vlastic, 'Space Law and the Military Applications of Space Technology', in N. Jasentuliyana (ed.), *Perspectives on International Law* (London, Kluwer Law International, 1995), p. 386, note 6.
 - 3 National Science and Technology Council, 'National Space Policy', 31 August 2006, <http://www.ostp.gov/galleries/default-file/Unclassified%20National%20Space%20Policy%20--%20FINAL.pdf> (last accessed on 24 February 2008). See also Commission to Access US National Security Space Management and Organization, 'Report of the Commission to Access United States National Security Space Management and Organization', Washington DC, 11 January 2001, <http://www.defenselink.mil/pubs/space20010111.html>, p. 100 (last accessed on 6 April 2006) ('Rumsfeld Report', named after the Chairman of the Commission, Donald Rumsfeld).
 - 4 T. Hitchens, 'Developments in Military Space: Movement toward Space Weapons?', October 2003, <http://www.cdi.org/pdfs/space-weapons.pdf> (last accessed on 29 October 2007). See also J.W. Heath, 'the Vanishing Horizon: Will the Asymmetric Battlefield Make Space-Based Weapons a Reality?', Vol. 45 *Proceedings of the Forty-fifth Colloquium on the Law of Outer Space* 2003, pp. 206-215.
 - 5 UNGA Res. 1148 (xii), 14 November 1957 (emphasis added).
 - 6 *Id.* 1721A (xvi), 20 December 1961.
 - 7 *Id.* 1962 (xviii), 13 December 1963, entitled 'Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space'.
 - 8 *Id.*, Preambular Paragraph 1.

- 9 W. von Kries, 'Die militärische Nutzung des Weltraums', in Karl-Heiz Böckstiegel and Marietta Benkö (eds.), *Handbuch des Weltraumrechts* (Köln, Carl Heymanns Verlag, 1991), p. 329.
- 10 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 610 U.N.T.S. 205, entered into force 10 October 1967. The Outer Space Treaty echoes almost all and *ad verbatim* the principles adopted by the GA in its 1963 Principles Declaration. In addition to the 'Principles Declaration', the Drafters relied on UNGA Res. 1884 (XVIII), 17 October 1963, operative paragraph 2. For further reading on the background of the Outer Space Treaty, see B. Cheng, 'Le Traité de 1967 sur l'Espace', Vol. 95 *Journal du Droit International* 1968, pp. 532-645.
- 11 The OST has partly been elaborated and complemented by subsequent treaties which form the so-called *corpus juris spatialis*: 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 672 U.N.T.S. 119, entered into force on 3 December 1968; 1972 Convention on International Liability for Damage Caused by Space Objects, 961 U.N.T.S. 187, entered into force on 1 September 1972; 1975 Convention on Registration of Objects Launched into Outer Space, 1023 U.N.T.S. 15, entered into force on 15 September 1976; and, 1979 Agreement on the Activities of States on the Moon and other Celestial Bodies, 1363 U.N.T.S. 21, entered into force on 11 July 1984.
- 12 W.E. Burrows, 'Imaging Space Reconnaissance Operations during the Cold War: Cause, Effect and Legacy', 1997, http://webster.hibo.no/asf/Cold_War/report1/williams.html (last accessed on 24 February 2008).
- 13 I.A. Vlastic, *supra* note 2.
- 14 W. von Kries, *supra* note 9, pp. 316-317. See also D. Wolter, *Common Security in Outer Space and International Law* (Geneva: Unidir, 2006), pp. 25-29.
- 15 US Air force Chief of Staff, Merrill McPeak, cited in I.A. Vlastic, *supra* note 2, p. 388.
- 16 See Space Today Online, 'Yugoslavia, Afghanistan, Iraq: The Satellite Wars', <http://www.spacetoday.org/Satellites/YugoWarSats.html> (last accessed on 24 February 2008).
- 17 P. Jankowitsch, 'Legal Aspects of Military Space Activities', in N. Jasentuliyana (ed.), *Space Law: Development and Scope* (Westport, Praeger Publishers, 1992), p. 154 asserts that: "The Gulf War [...] also demonstrated the disadvantages for a combatant that does not have access to such technology. That demonstration will certainly promote more widespread use of military satellites".

- 18 In the same year Ronald Reagan was elected president of the US, 1981, the Soviet union proposed a Treaty on the Prohibition of the Stationing of Weapons of Any Kind in outer Space. Although a seemingly welcome initiative, the proposal was, nevertheless, soon off the table. See UNGA Res. 36/192, 20 August 1981.
- 19 Speech of president R. Reagan, *New York Times*, p. A20, 24 March 1983.
- 20 The UNGA had requested the treatment of this topic in the CD. See UNGA Res. 36/97C, 9 December 1981, and UNGA Res. 36/99, 9 December 1981.
- 21 UNGA Res. 43/70, 7 December 1988, operative paragraph 1. The resolution was adopted with 154 States in favour, 1 against (US).
- 22 "Our policy is to promote development of the full range of Space-based capabilities in a manner that protects our national security interests", in The White House, Office of the President, *A National Security Strategy for a New Century*, October 1998, p. 25 <http://www.globalsecurity.org/military/library/policy/national/nss-9810.htm> (last accessed on 24 February 2008).
- 23 2001 'Rumsfeld report', *supra* note 3, p. 100.
- 24 2006 'National Space policy', *supra* note 3.
- 25 *Id.*, pp. 1-2.
- 26 *Id.*, pp. 1, 2 and 4 respectively. The recent successful destruction of a dead US spy satellite may put current military activities into perspective however. See Andrew Gray, 'US Has High Confidence It Hit Satellite fuel tank', *reuters*, 20 February 2008, <http://www.reuters.com/article/newsOne/idUSN1930844420080221?pageNumber=2&virtualBrandChannel=0&sp=true> (last accessed on 24 February 2008).
- 27 The White House, *The National Security Strategy of the United States of America*, September 2002, <http://www.whitehouse.gov/nsc/nss.html> (last accessed on 24 February 2008), p. 30 states: "[...] military capabilities must also include the ability to defend the homeland, conduct information operations, ensure US access to distant theatres, and protect critical US infrastructure and assets in outer space". The 2006 US NSS reiterates this doctrine, but it may be too soon to tell whether it has nevertheless lost any of its legal significance. See C. Henderson, 'The 2006 National Security Strategy of the united States: The pre-emptive use of Force and the Persistent Advocate', unpublished manuscript, (on file with the author).
- 28 The Moon has always been treated as a celestial body in the framework of the UN in resolutions and agreements subsequent to UNGA Res. 1884(XVIII) of 17 October 1963, explicit reference was made to 'the Moon *and other* celestial bodies' (emphasis added). Cf. OST, Article IV(2). See C.Q. Christol, *The Modern International Law of Outer Space* (New York, Pergamon Press, 1982), p. 22. In the case of Article IV(1) of the OST this exclusion should be attributed to poor drafting.

- 29 The term 'outer void space' was introduced by Cheng, see B. Cheng, 'Introducing a New Term to Space Law: 'Outer Void Space'', Vol. 11 *Korean Journal of Air and Space Law* 1999, pp. 321-327. Outer Space in the sense of Article IV(1) of the OST is, thus, outer space *sensu lato*.
- 30 L. Condorelli & Z. Mériboute, 'Some Remarks on the State of International Law Concerning Military Activities in Outer Space', Vol. 6 *Italian Y.I.L.* 1985, pp. 20-25.
- 31 S. Gorove, 'Arms control provisions in the outer Space treaty: A Scrutinizing reappraisal', Vol. 3 *Georgia Journal of International and Comparative Law* 1973, p. 117.
- 32 UNGA Res. 1(i), 24 January 1946, operative paragraph 5(c) (emphasis added). See also the statement made by US Ambassador Goldberg expressly limiting the categories of WMD, quoted in R. L. Bridge, 'International Law and Military Activities in Outer Space', Vol. 13 *Akron Law Review* 1979, p. 656.
- 33 Resolution of the UN commission for conventional Armaments, 12 August 1948, <http://www.yale.edu/lawweb/avalon/decade/decad253.htm> (last accessed at 25 February 2008; emphasis added). See also UNGA Res. 34/87A, 11 December 1979, where this definition is recalled in an arms control context, only 6 days after the adoption of UNGA Res. 34/68, 5 December 1979, which formed the basis of the moon Agreement. Note that this definition does not define 'mass'. Regrettably, the recent WMD Commission, consisting of renowned experts, did not attempt to define WMD either, see Weapons of Mass Destruction Commission, 'Weapons of Terror – Freeing the World from Nuclear, Biological and Chemical Arms', 2006, <http://www.wmdcommission.org> (last accessed on 24 February 2008).
- 34 S. Gorove, 'International Space Law in Perspective – Some Major Issues, Trends and Alternatives', Vol. 181 *Receuil de Cours A.D.I.* 1983-iii, p. 378.
- 35 S. Gorove, *supra* note 31, p. 115 and R.J Zedalis and C.L Wade, 'Anti- Satellite Weapons and the Outer Space Treaty of 1967', vol. 8 *California Western I.L.J.* 1978, pp. 465-467.
- 36 Cf. Article 5 of the 1967 Treaty for the Prohibition of nuclear Weapons in Latin America and the Caribbean (Treaty of Tlatelolco), 634 *U.N.T.S.* 326, entered into force on 22 April 1968. These characteristics do not only include the destructive impact, but also the indiscriminate nature and long-lasting effects. See Weapons of Mass Destruction Commission, *supra* note 32, pp. 17, 32 and 42.
- 37 Even though in the second sentence of Article IV(2) there is only a reference to 'celestial bodies', it has been submitted that the Moon is a celestial body. No claim can thus be made that the moon is excluded from the application of the second sentence. *Contra*, see R.J. Zedalis and C.L. Wade, *supra* note 35, p. 461.

- 38 This became apparent when both superpowers rejected a proposal to that effect, see UN Doc. A/C.1/PV.1493 of 1 August 1966 and UN Doc. AC.105/C.2.SR.66 of 1 August 1966.
- 39 C.Q. Christol, *supra* note 28, pp. 21-22 and R. Lakshanan, 'Prohibition of Weaponisation of Outer Space', Vol. 28 *Proceedings of the Twenty-eighth Colloquium on the Law of Outer Space* 1985, p. 73.
- 40 1959 Antarctic Treaty, 402 U.N.T.S. 71, entered into force 23 June 1961, Article I reads: "(1). Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military manoeuvres, as well as the testing of any type of weapon. (2) The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose".
- 41 D. Goedhuis, 'An Evaluation of the Leading principles of the Treaty of Outer Space of 27th January 1967', Vol. 15 *Netherlands I. L. Rev.* 1968, p. 23. US president Eisenhower wrote to Soviet Premier Bulganin on 13 January 1958: "I propose that we agree that outer space should be used only for peaceful purposes. We face a decisive moment in history in relation to this matter. Both the Soviet Union and the United States are now using outer space for the testing of missiles designed for military purposes. The time to stop is now" (quoted in D. Wolter, *supra* note 14, pp. 10-11).
- 42 I.A. Vlastic, 'The Legal Aspects of Peaceful and Non-Peaceful uses of Outer Space', in B. Jasani (ed.), *Peaceful and Non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (Geneva, UNIDIR, Geneva, New York: Taylor & Francis, 1991), pp. 44-45 even concludes that "[i]f 'peaceful' means 'non-aggressive', then it follows logically – and absurdly – that all nuclear and chemical weapons are also 'peaceful', as long as they are not used for aggressive purposes".
- 43 Article III of the 1967 OST reads: "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding".
- 44 B. Cheng, *Studies in International Space Law* (Oxford, Clarendon Press, 1997), p. 519.
- 45 1969 VCLT, 1155 U.N.T.S. 331; entered into force on 27 January 1980, Article 31(1). Article 31 VCLT reflects customary law: ICJ, *Case concerning Kasikili/Sedudu Island (Botswana v. Namibia)*, ICJ Rep. 1999, § 18.
- 46 Following Article 31(2) VCLT, see OST, preambular paragraphs 2 and 4, Articles ix and XL

- 47 See ICJ, *Advisory Opinion on the Interpretation of the Agreement of 25 March 1951 Between WHO and Egypt*, ICJ Rep. 1980, p. 73, §§ 45-47.
- 48 1956 Statute of the International Atomic Energy Agency, 276 U.N.T.S. 3, entered into force on 26 October 1956; 1959 Antarctic Treaty (*supra* note 40); 1967 Tlatelolco Treaty (*supra* note 36); 1968 Treaty on the Non-Proliferation of Nuclear Weapons, 729 U.N.T.S. 161, entered into force on 5 March 1970; 1972 Biological and Toxic Weapons Convention, 1015 U.N.T.S. 163, entered into force on 26 March 1975; and 1993 chemical Weapons Convention 1974 U.N.T.S. 45, entered into force on 29 April 1997. The object and purpose of those treaty provisions referring to 'peaceful purposes' are similar to that of Article IV OST, namely of an arms control or disarmament nature. The notable exception is the 1982 United Nations Convention on the Law of the Sea, 1833 U.N.T.S. 3, entered into force on 16 November 1994, which refers to 'peaceful purposes' in its Article 88. This reference to 'peaceful' is generally considered to denote 'non-aggressive'.
- 49 B. Cheng, 'Properly Speaking, Only Celestial Bodies Have Been reserved for Use Exclusively for Peaceful (Non-Military) Purposes, but Not Outer Void Space', in M.N. Schmitt (ed.), *International Law Across the Spectrum of Conflict: Essays in Honour of Professor L. C. Green on the Occasion of his Eightieth Birthday*, Vol. 75 *International Law Studies* (Newport, Naval War College, 2000), pp. 81-117 and G. Zhukov & Y. Kolosov, *International Space Law* (New York, Praeger Publishers, 1984), p. 224. For the purpose of this work, an analysis of the prohibition of any interference, including forceful interference, with a space object due to a State's exclusive jurisdiction is excluded. See Articles VIII and IX of the Outer Space Treaty.
- 50 Article VIII reads in part: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. [...]".
- 51 Article 2(4) UN charter reads: "All members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the purposes of the united nations".
- 52 See generally, B. Simma (ed.), *The Charter of the United Nations: A Commentary* (Oxford, Oxford University Press 2002, 2nd ed.), pp. 112-136.
- 53 See for example ICJ, *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, ICJ Rep. 1986, 27 June 1986, p. 14, § 83 (*Nicaragua case*). Note that the court itself did not acknowledge this status but underlined the support for this status.
- 54 It has, however, been argued that territorial integrity may, in addition to land mass, be interpreted to include human and natural resources in space. See R.L. Bridge, *supra* note 32, p. 660.

- 55 I. Brownlie, 'the maintenance of international peace and Security in outer Space', Vol. 40 *B. Y.I.L.* 1964, p. 8. in the same sense, see R. Higgins, 'the Legal Limits to the use of force by Sovereign States: united nations practice', Vol. 37 *B.Y.I.L.* 1961, p. 283.
- 56 Support for this interpretation can be found *i. a.* in preambular paragraph 7 of the un charter and UNGA Res. 2625 (XXV) of 24 October 1970, entitled 'Declaration on principles of international Law concerning friendly relations And cooperation Among States in Accordance With the Charter Of The United Nations'.
- 57 W. Von Kries, *supra* note 9, pp. 337-338.
- 58 I. Brownlie, *International Law and the Use of Force by States* (Oxford, Clarendon Press, 1963), p. 362. Furthermore, he argues that "it would be in accordance with general principles of law to include intended and direct consequences in the prohibition of the use of force in international relations". See I. Brownlie, *supra* note 50, p. 25. Consider, for example, the manoeuvring of a satellite so as to block a solar panel of another satellite thereby cutting off the electricity and thus causing (fatal) damage. Example mentioned in M. Benkö, 'The Problem of Space Debris: A Valid Case against the Use of Aggressive Military Systems in Outer Space?' in M. Benkö & K.-U. Schrogl (eds.), *Space Law: Current Problems and Perspectives for Future Regulation* (Utrecht, Eleven International Publishing, 2005), p. 167.
- 59 This line of reasoning is also applied in the field of "cyber warfare" or "computer network attacks", and has generated a general acceptance of specific means and methods denoted as force application.
- 60 Article 41 UN charter reads: "The Security Council may decide what measures not involving the use of armed force are to be employed to give effect to its decisions, and it may call upon the members of the united nations to apply such measures. These may include complete or partial interruption of economic relations and of rail, sea, air, postal, telegraphic, radio and other means of communication, and the severance of diplomatic relations".
- 61 R. J. Lee, 'The *Jus ad Bellum in Spatialis*: The Exact Content and Practical Implications of the Law on the Use of Force in Outer Space', Vol. 29 *Journal of Space Law* 2003, p. 110, in particular footnote 32.
- 62 Practice has Established that the Phrase 'all necessary means' utilized in certain UN Security Council Resolutions encompasses the use of force, and, naturally, includes auxiliary or force enhancement activities. Given the significant use of space-based assets, the first Gulf War may serve here as an example. See *supra* note 15 and accompanying text. See also *infra* Section III.
- 63 R. A. Morgan, 'Military Use of Commercial Communication Satellites: A New Look at the Outer Space Treaty and "Peaceful Purposes"', Vol. 60 *J. Air L. & Com.* 1994-1995, p. 309. This may not only be restricted to UNSC authorized missions, but may also

include those pursuant to UNGA Res. 377(V) of 3 November 1950, *Uniting for Peace* type of action and regional arrangements under Articles 51-53 of the UN charter.

- 64 Article 51 UN charter reads: "Nothing in the present Charter shall impair the inherent right of individual or collective self defense if an armed attack occurs against a member of the United Nations, until the Security Council has taken the measures necessary to maintain international peace and security. Measures taken by Members in the exercise of this right of self-defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain international peace and security".
- 65 *Nicaragua case*, *supra* note 53, § 176; ICJ, *Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons*, ICJ Rep. 1996, p. 226, § 226 (*Nuclear Weapons case*) and ICJ, *Oil Platforms case* (*Islamic Republic of Iran v. United States of America*), ICJ Rep. 2003, § 76.
- 66 See R.A. Morgan, *supra* note 63, pp. 307-308; N. Ronzitti, 'Problemi Giuridici Sollevati dalle Iniziative in Materia di Disarmo Spaziale', in F. Francioni & F. Pocar (eds.), *Il Regime Internazionale dello Spazio* (Milano, Dott. A. Giuffrè Editore, 1993), pp. 79-87; E.S. Waldrop, 'Weaponization of Outer Space: US National Policy', Vol. xxix A.A.S.L. 2004, pp. 18- 21; L. Haack, 'Aspects Juridiques de Certaines Utilisations Militaires de L'espace', Vol. XXI A.A.S.L. 1996, pp. 92-97. For early Recognition of this right in outer space, see J. Cobb Cooper, 'Self-Defense in Outer Space and the United Nations', in I.A. Vlasic (ed.), *Explorations in Aerospace Law: Selected Essays by John Cobb Cooper 1946-1966* (Montreal, McGill University Press, 1968), pp. 412-422 and I. Brownlie, *supra* note 55. Nevertheless, there seemed to be some confusion at the beginning of the space age, see M. Chandrasekharan, 'The Space Treaty', Vol. 7 *Indian JIL* 1967, who denies the application of the right of self-defence to outer space.
- 67 See *Definition of Aggression*, Article 3 *sub d*, annexed to UNGA res. 3314 (xxix) of 14 December 1974. A.V. Lowe, 'Self-Defence at Sea', in W.E. Butler (ed.), *The Non-Use of Force in International Law* (Dordrecht, Martinus Nijhoff Publishers, 1989), p.188 asserts that "the extension of the right of self defense to cover warships is arguably necessary for the practical survival of the right to defend the State itself". This reasoning applies undoubtedly to military space assets too.
- 68 *Definition of Aggression*, *supra* previous note, Article 3 *sub d*.
- 69 See Article VIII OST. The 1975 Registration Convention, *supra* note 11, Article II requires every man-made space object to be registered by a launching State. On diplomatic protection, see e.g., ICJ, *Nottebohm case* (*Liechtenstein v. Guatemala*), ICJ Rep. 1955, p. 24 in which the court held that a State "assumes the defense of its citizens by means of protection as against other States". See also A. Hurwitz, *The Legality of Space Militarization* (Amsterdam/New York, North-Holland, 1986), p. 74,

note 84. *Nota bene*, this issue may be complicated by the fact that space assets can be registered in one State but are owned by a non-State entity in another State.

- 70 In commenting on the prepared forcible rescue operation by the US to rescue its nationals taken hostage in the US embassy in Teheran, the ICJ made clear that the obligation to settle matters peacefully takes precedence. See ICJ, *Hostages case (United States v. Iran)*, ICJ Rep. 1980, p. 3, § 93.
- 71 for a discussion of this argument in the exercise of self-defence at sea, see generally V.A. Lowe, *supra* note 67.
- 72 In favour, L. Haeck, *supra* note 66, p. 92 and H.H. Almond, 'Military Activities in Outer Space – The emerging Law', Vol. 23 *Proceedings of the Twenty-third Colloquium on the Law of Outer Space* 1981, p. 150.
- 73 See Article 2(4) of the UN Charter; ICJ, *Corfu Channel case (United Kingdom v. Albania)*, ICJ Rep. 1949, p. 4 and Article 22 of the Draft Articles on Responsibility of States for Internationally Wrongful Acts, *Report of the ILC on the Work of its Fifty-third Session*, UN GAOR, 56th Sess, Supp No. 10, p 43, UN Doc A/56/10 (2001).
- 74 A.V. Lowe, *supra* note 67.
- 75 H.H. Almond, 'Demilitarization and Arms Control: Antarctica', Vol. 17 *Case Western J.I.L.* 1985, p. 250.
- 76 Antarctic Treaty, *supra* note 40, Preamble (emphasis added).
- 77 To illustrate this point with State practice, one can refer to the care taken by the UK during the Falklands War to avoid military operations in the Antarctic region. See D. R. Rothwell, *The Polar Regions and the Development of International Law* (Cambridge, Cambridge University Press, 1996), p. 72. See also the references *supra* note 74.
- 78 Cf. Antarctic Treaty, *supra* note 40, Article 1.
- 79 See generally C. Michaelsen, 'Maritime Exclusion Zones in Times of Armed Conflict At Sea: Legal Controversies Still Unresolved', Vol. 8 *J.C.S.L.* 2003, pp. 363-390 and W.J. Fenrick, 'The Exclusion Zone: Device in the Law of Naval Warfare', 24 *Canadian Y.I.L.* 1986, pp. 91-126.
- 80 Article I OST. See J.F. von Bentzien, *supra* note 1, pp. 322-323.
- 81 It has been argued that if such a defence must be built, it should be done cooperatively. See D. Wolter, *supra* note 14, pp. 126-127 and T. Graham Jr., 'Space Weapons and the Risk of Incidental Nuclear War', Vol. 35 *Arms Control Today* 2005, pp. 12-16.

- 82 M. Walzer, *Just and Unjust Wars* (New York, Basic Books, 3rd ed., 2000), p. 129. The *Jus in bello* is also called international humanitarian law, the law of war or the Law of Armed Conflict (LOAC). The latter term will be used throughout this article.
- 83 See for instance the *Nicaragua* case, *supra* note 53, § 218 and the *Nuclear Weapons* case, *supra* note 65, §§ 75-84.
- 84 R.A. Ramey, 'Armed Conflict on the Final Frontier: The Law of War in Space', Vol. 48 *A.F.L.Rev.* 2000, pp. 124-125.
- 85 It is submitted that the OST as the *Magna Charta* of space law continues to apply in armed conflict between two or more belligerents. Firstly, States are under the obligation to allow non-belligerent States access in space. See J.I. Gabrynowicz, 'The Outer Space Treaty and Enhancing Space Security', in UNIDIR, *Building the Architecture for Sustainable Space Security-Conference Report, 30-31 March 2006* (Geneva, UNIDIR publications, 2006), pp. 113-123. Secondly, the OST provisions, especially Article IV, are overriding norms in the sense that by their nature they are specifically designed to apply during armed conflict as they serve to minimize the risk of and damage in armed conflict. See R.J. Mathews & T.L.H. McCormack, 'The Influence of Humanitarian Principles in the Negotiation of Arms Control Treaties', Vol. 81 *I.R.R.C.* 1999, pp. 334- 335. Besides, the OST embodies, arguably, peremptory norms, which indicates its continuous application. See R.J. Lee, *supra* note 61.
- 86 W.L. Rodgers, 'Laws of War Concerning Aviation and Radio', Vol. 17 *A.J.I.L.* 1923, p. 635 restating the view of the "Commission of Jurists", established during the 1921 Washington Conference on the Limitation of Armament to consider amendment of the laws of war. The commission's work contributed to the formation of the 1923 Hague Rules of Air Warfare.
- 87 ICRC commentary, <http://www.icrc.org/ihl.nsf/intro?OpenView> (last accessed on 24 February 2008), Article 35, § 1450. See also P.J. Richards & M.N. Schmitt, 'Mars Meets Mother Nature: Protecting the Environment during Armed Conflict', Vol. 28 *Stetson L. Rev.* 1999, p. 1049.
- 88 In favour, see M. Bourbonnière, 'Law of Armed Conflict (LOAC) and the Neutralisation of Satellites or *Jus in Bello Satellitis*', Vol. 9 *J.C.S.L.* 2004, pp. 43-69 and J.M. Henkaerts & L. Doswald-Beck, *ICRC Study on Customary Rules of International Humanitarian Law* (Cambridge, Cambridge University Press, 2005) (CIHLS), Rules 44-45. Against: Y. Dinstein, *The Conduct of Hostilities Under The Law of International Armed Conflict* (Cambridge, Cambridge University Press, 2004), p. 185, who cites the authority of the ICJ in the *Nuclear Weapons* case to argue that these provisions "have not yet crystallized as customary international law".
- 89 See Y. Dinstein, *supra* previous note, p. 184.
- 90 ICRC Commentary, *supra* note 87, Article 35 AP I, § 1451.

- 91 *Id.*, Article 55 AP I, § 2126.
- 92 *Nuclear Weapons case*, *supra* note 65, § 29.
- 93 M. Bourbonnière, *supra* note 88, p. 65.
- 94 "Ecological warfare refers to the serious disruption of the natural equilibrium permitting life and the development of man and all living organisms, a disruption of which the effects may be felt for one or more decades." ICRC Commentary, *supra* note 87, Article 35 AP I, § 1462.
- 95 1977 Convention on The Prohibition of Military or Any Hostile Use of Environmental Modification Techniques, 1108 *U.N.T.S.* 151, entered into force Oct. 5, 1978 1108 *U.N.T.S.* 151, entered into force Oct. 5, 1978 1108 *U.N.T.S.* 151, entered into force on 5 October 1978, Article I.
- 96 *Id.*, Article II.
- 97 N. Jasentuliyana, *International Space Law and the United Nations* (The Hague/London/Boston, Kluwer Law International 1999), p. 114. R.A. Ramey, *supra* note 84, p. 58 asserts: "So long as space weapons do not change the outer space environment 'through the deliberate manipulation of natural processes,' the treaty is not likely to serve as a bar to the deployment or use of space weapons".
- 98 M. Benkö, *supra* note 58, p. 167.
- 99 Article 52(2) AP I reads: "Attacks shall be limited strictly to military objectives. In so far as objects are concerned, military objectives are limited to those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage". It reflects customary law, see CIHLS, *supra* note 88, Rules 40-45. See also Rule 40 of the San Remo Manual on international Law Applicable to Armed Conflicts at Sea of 12 June 1994, <http://www.icrc.org/ihl.nsf/FULL/560?OpenDocument> (last accessed 24 February 2008).
- 100 M. Bourbonnière, 'National Security Law in Outer Space: The Interface of Exploration and Security', Vol. 70 *J. Air L. & Com.* 2005, pp. 59-60.
- 101 "Although the psychological impact of a certain attack may be a legitimate consideration in choosing between targets which are for other reasons of a military character, that impact alone is not sufficient to establish the qualification of a certain target as a military objective": M. Bothe, 'Legal Restraints on Targeting: Protecting of Civilian Population And The Changing Face Of Modern Conflicts', Vol. 31 *Israel Yearbook of Human Rights* 2002, p. 43.

- 102 Generally on lawful military use of satellites, see R. A. Morgan, *supra* note 63. On the international Space Station, see C. Petras, "Space Force Alpha", *Military Use of the International Space Station and the Concept of "Peaceful Purposes"*, Vol. 53 *A.F.L. Rev.* 2002, pp. 135-181. The answer to this Question Pertains Equally to Multi-owner space assets, see R.A. Ramey, *supra* note 84, pp. 144-150.
- 103 These communication means included the installations of broadcasting and television stations, telephone and telegraph exchanges of fundamental military importance.
- 104 M.N. Schmitt, 'International Law and Military Operations in Space', Vol.10, *M.P.Y.U.N.L.* 2006, pp. 116-117.
- 105 CIHLS, *supra* note 88, Rule 14.
- 106 M.N. Schmitt, *supra* note 104, pp. 118-120.
- 107 For an excellent work on neutrality issues in the context of targeting, see M. Bourbonnière, 'The Ambit of the Law of Neutrality and Space Security', Vol. 36 *Israel Yearbook on Human Rights* 2006, pp. 205-229.
- 108 See Article 57 Ap I. For examples of State practice, see H. Shuet & D. Wippman, 'Limiting Attacks on Dual-Use Facilities Performing Indispensable Civilian Functions', Vol. 35 *Cornell I.L.J.* 2002, pp. 565-566.
- 109 M. Sassòli, 'Legitimate Targets of Attacks under international Humanitarian Law, Background Paper Prepared for the Informal High-Level Expert Meeting on the Reaffirmation and Development of International Humanitarian Law, Cambridge, June 27-29, 2003', June 2004, p. 7, <http://www.hpcr.org/publications/papers.php> (last accessed on 24 February 2008).
- 110 See also CIHLS, *supra* note 88, Rules 22-24.
- 111 See 1975 Registration Convention, *supra* note 11, Articles II and IV.
- 112 See part III, Section II of the San Remo manual and the explanation given in L. Doswald-Beck (ed.), *San Remo Manual on International Law Applicable to Armed Conflicts at Sea, Prepared by International Lawyers and Naval Experts convened by the International Institute of Humanitarian Law* (Cambridge, Cambridge University Press, 2nd ed., 1991), pp. 122-124. The drafters of the San Remo Manual rather sought the solution in "the restrictive approach adopted with regard to exemption from attack and the loss of protection [...], as well as the development of criteria for the use of zones [...].", *idem*, p. 124.
- 113 Article 37 AP I and CIHLS, *supra* note 88, Rule 65. Note that this article uses the term 'adversary' and refers to a human enemy combatant. In space, it will rather be unmanned assets that perform hostile activities by proxy, at least in the foreseeable

future. Despite the fact that persons, who can be misled, are behind the controls of the object, the protection of human dignity is not in direct jeopardy. Therefore, one may agree that "if [perfidy] is used solely for combat against military objects, (...), without affecting any enemy combatant, it is permissible". See D. Fleck (ed.), *The Handbook of Humanitarian Law in Armed Conflicts* (Oxford, Oxford University Press, 1995), pp. 201-202.

114 M.N. Schmitt, *supra* note 104, p. 122.

115 The example mentioned by M.N. Schmitt, *id.*, (providing data on the target's location to facilitate attacking it) seems to operate in a grey area. The collection of data can, perhaps, better be described as a 'spy like' activity. Reconnaissance in and from space is considered a legal (military) activity, notwithstanding the asset being registered as civilian or military, see I.A. Vlasic, *supra* note 13 and accompanying text. 'Facilitation' may not be the obvious act that is considered as betraying the confidence of the adversary. On the other hand, adversaries may get killed, injured or captured because of it. In such cases, due to the 'remote' involvement of such assets resulting in the actual killing, injuring or capture of enemy assets, "[i]t will be no easy matter to establish a causal relation between the perfidious act that has taken place and the consequences of combat". See ICRC Commentary, *supra* note 87, Article 37 AP I, § 1492.

116 Note that Article 36 AP I obliges State Parties to review every new weapon, means or method to assure its conformity with AP and any other rule of international law applicable to them.

117 1868 St. Petersburg Declaration, Preamble.

3

Space Applications for International Development

*Mariel John**

Science and technology, and particularly space technology, increasingly help address many of the challenges faced by developing countries. Space systems, particularly communications satellites and remote sensing satellites, have the potential to play a large role in these efforts. Communications satellites can connect remote areas, allowing the spread of information, whether for medical purposes, education, or disaster relief. Remote sensing satellites allow rapid collection of data about large areas of land – information that is essential to creating models for predicting and preventing famine or disease. Remote sensing can also be used to monitor conflicts or natural disasters and help identify where aid is needed most. In addition to the practical solutions communication and remote sensing satellites can provide for addressing

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national challenges, indigenous space activities have the potential to enable wide-reaching economic growth, allowing countries to break the cycle of poverty and international aid.

Executive Summary

Space-related activities generate \$257 billion each year and are often thought of as the domain of wealthy and technologically advanced nations. This perspective is misleading, however, as science and technology increasingly help address many of the challenges faced by developing countries. Space systems, particularly communications satellites and remote sensing satellites, have the potential to play a large role in these efforts.

Communications Satellites and Applications

Communications satellites play an important role in increasing the information and communication technology infrastructure of developing nations. A high percentage of the population in many developing nations is located in remote, rural areas that are least likely to have access to terrestrial communication infrastructure. Satellites can provide voice and data broadband service, and the market for satellite communications is high due to the lack of traditional alternatives in rural areas. Communication technology can be used to provide farmers with information that aids productivity. It can enable telemedicine or tele-education in remote areas. After a disaster has occurred, satellite communication may provide the only reliable communication method during the response and rebuilding efforts. The following recommendations would enable the realization of these benefits in a more efficient and effective way:

1. Commercial satellite companies operating in developing nations should work closely with experts in international development and with local government and/or NonGovernmental Organizations (NGOs) to ensure that space solutions are culturally appropriate. This will allow

solutions to be more readily adapted and accepted by these communities.

2. Studies should be initiated to continue to define the market for communications satellite services in developing nations. This will provide an understanding of the complexities and differences in various areas and suggest the best ways to proceed in introducing new technology. This may be done by governments interested in understanding the most efficient method for investing in communications infrastructure, or by companies interested in identifying potential new markets.
3. Governments in developing nations and commercial communications satellite operators should work together to develop a logical regulatory scheme in developing nations. In addition, clear guidance should be provided by governments on how to work within existing regulations
4. Governments in developing nations should consider investing in affordable ground technology to provide satellite communication access in rural areas, particularly for clinics, schools, and other community centers. The technology would be used to directly address the UN Millennium Development Goals as well as national goals in health, education, and other areas.

Remote Sensing Satellites and Applications

Remote sensing satellites are well-suited to addressing some of the challenges faced in developing nations. These satellites provide the ability to observe large areas without the need for data collection on the ground. This may be the only cost-effective way to collect data about large, sparsely populated areas. Satellite remote sensing data can be used to create models that predict outbreaks of many diseases, including malaria, cholera, dengue fever, and others. It can be used to identify conditions conducive to disasters, such as wild fires or famines. This advanced warning allows nations to target relief efforts and provide aid more efficiently, thus reducing costs while saving more lives. Governments can use satellite imagery to make coherent land use policies and support sustainable development and use of natural resources. Remote sensing from space

immediately following a disaster can allow a rapid assessment of areas most affected, and aid can then be targeted to these areas. The United Nations High Commission on Refugees (UNHCR) has found that imagery from space can be essential for locating displaced populations and coordinating the provision of aid. Satellite imagery can also be used to identify locations with adequate resources to support refugee populations and act as the basis of UN-supported refugee camps. The following recommendations are intended to make these opportunities more widely available:

1. Remote sensing providers, developed nations that own remote sensing satellites, and developing nations should work together to define the means by which reliable and useful remote sensing data can be provided to developing nations, particularly for disease and disaster prevention. This would allow developing nations to begin making use of this data immediately for these essential efforts.
2. Further research should be done to assist developing countries in employing space products to create useful operational models for disease and disaster prevention.
3. Governments in developing nations should support efforts to integrate remote sensing data with other data sources through funding and policy initiatives. Governments should also seek to work with satellite operators in data integration efforts. Systems with integrated data will provide more robust outcomes and reduce uncertainty, which help target action where it is needed.

Capacity Building and Space Applications

The ability of a nation to drive innovation and economic progress depends on its science and technology capacity. According to a report by the RAND Corporation, this includes "the infrastructure, investment, institutional and regulatory framework, and personnel available to conduct scientific research and technological development." Investing in the space sector is a productive method for nations to begin growing their capacity and addressing these issues. At a minimum, nations may cultivate space experts to help understand how space assets can be applied to national priorities. This knowledge would allow the

country to have a voice in international efforts related to space and to take full advantage of international space application programs that already exist. A space program can be one part of the science and technology infrastructure of a nation, but its development should be coordinated with the development of supporting institutions, whether public or private. By starting a space program, developing nations can grow and maintain a technologically advanced workforce. They can also encourage increased study of science and technology, including space science and engineering, in schools and universities. Initially, engaging in space activities may be challenging for developing nations, and these recommendations offer methods to help facilitate their entry into this field:

1. Space programs in developing nations should begin by focusing on programs with a direct benefit to society. They should keep costs as low as possible and ensure that the benefits are clearly communicated to the public. It is advisable for governments to track the return on their investment so the public understands that the funds are being used wisely.
2. Developing nations should consider international collaboration as a method for incremental development of a space program. Working with developed nations, already experienced in creating space technology, can help to reduce risk and reduce costs.
3. When creating their own national policies, developing nations should take note of other nations' existing national legislation on space activities. This effort should be coordinated with the United Nations' efforts to identify common principles, norms, and procedures among nations with existing space legislation.

Efforts must be undertaken to increase awareness of the benefits of space assets to developing nations and the specific challenges that they face. This will lead to the development of space technologies tailored to the needs of these nations. Research should be done to develop applications for small scale entrepreneurial and agricultural uses. Research should address simpler, more automated applications for tele-education, telemedicine, and telebusiness. The developed world should provide support in building indigenous science and

technology capacity in developing nations through increased cooperation in the space sector. By taking steps such as these, the benefit of space applications can be realized by developing nations.

Background

The World Bank classifies 144 nations, more than two thirds of the world's total, as middle or low income – often referred to as developing nations.¹ These nations are located throughout the world but are concentrated in Africa, Latin America, and Southeast Asia. Developing nations are often home to low-density populations in rural areas, with little transportation or communication infrastructure connecting these regions. They frequently struggle to meet the basic needs of their citizens. Food is often scarce and malnutrition is common. Millions of people die each year of preventable diseases, many of them young children. Housing is often inadequate and does not provide protection against natural disasters. In response to this situation, the United States and other developed nations spend billions of dollars each year on aid for developing nations.² These programs provide food, clothing, medicine, and other essentials. Yet, despite these efforts, the problems of developing nations continue to grow.

Space-related activities generate \$257 billion each year and are often thought of as the domain of wealthy and technologically advanced nations.³ This perspective is misleading, however, as science and technology increasingly help address many of the challenges faced by developing countries. Space systems, particularly communications satellites and remote sensing satellites, have the potential to play a large role in these efforts. Communications satellites can connect remote areas, allowing the spread of information, whether for medical purposes, education, or disaster relief. Remote sensing satellites allow rapid collection of data about large areas of land – information that is essential to creating models for predicting and preventing famine or disease. Remote sensing can also be used to monitor conflicts or natural disasters and help identify where aid is needed most. Developed nations should work with developing nations to create these capabilities.

International Activity
<p>There has already been a noticeable trend of growth in the number of developing nations beginning or expanding their space activities, including India, Brazil, Nigeria, and many others. Developed nations are also recognizing the value of applying space applications to the needs of developing nations. NASA provides satellite data and expertise to the Famine Early Warning System (FEWS) for developing nations.⁴ Africa and the European Union have developed a partnership with the African Union for "Science, Information Society and Space."⁵ The United Nations Program on Space Applications carries out projects to promote the practical uses of space technology in sustainable development, particularly in developing countries.⁶ These efforts indicate that governments and international organizations are beginning to recognize the potential for space assets to be used to help address the challenges faced by developing nations.</p>
Commercial Involvement
<p>Commercial companies are involved as well. Intelsat, the world's largest satellite communications company, has supported projects using satellite-based models for improving education and health in Africa.⁷ A number of satellite communications companies, such as SES World Skies, offer communication services in developing areas. These activities are having an impact, and their specific application and future development are important for all nations and their leaders to understand and support.</p>

In addition to the practical solutions communication and remote sensing satellites can provide for addressing national challenges, indigenous space activities have the potential to enable wide-reaching economic growth, allowing countries to break the cycle of poverty and international aid. These space programs may consist of trained professionals and facilities capable of analyzing data collected by the satellites of other nations, rather than indigenously developed satellites, rockets, or other hardware. Indigenous space programs enable developing nations to focus the use of space assets on objectives that are critical for survival and growth. By investing in space capabilities, developing nations spur progress in science and technology in the broader sense. Building the human and technical infrastructure for space activities helps develop educated citizens and technology-smart government. It also encourages high-tech industry to grow. Investing in space activities can play a part in allowing developing nations to take control of their futures.

Space infrastructure and assets certainly cannot solve all of the problems these nations face, but they can provide a valuable means to help them improve physical conditions for their people and economies and reduce their reliance on foreign aid. These practical uses make space an important, if not essential, investment for sustainable development in Third World countries.

Investment in Space Activities
<p>It is important to understand that significant investment is not necessary in order for developing nations to reap the benefits of space technologies. Applications of space assets - such as famine or disease prediction maps - may be created by countries with well developed space programs, or by international groups like the United Nations, and provided to developing nations for little or no cost. However, a developing nation may gain additional benefit by creating its own space program. At a minimum, a space program may simply include a group of space experts, enabling the country's leadership to understand how space assets can be used to address its national goals. This understanding can guide future national space policy and can be expressed in global forums, giving the nation a voice in international efforts. It can also provide the country a starting point for identifying and cultivating strategic partnerships with nations that already have advanced space technology. With more investment in cultivating trained experts as well as some investment in research and analysis facilities, developing countries can carry out their own analysis on remote sensing data provided by developed nations or international organizations at a low cost or even for free. This level of investment and capability would allow many, if not all, of the benefits discussed in this paper to be realized. Nations interested in further investment in space may choose to develop their own hardware, such as communications or remote sensing satellites. This can be done with limited funds by including training programs as part of a satellite-building contract. This was the approach Nigeria took in its partnerships with Surrey Satellite Technology, Ltd., (SSTL) in the United Kingdom.</p>

Figure 1: Levels of Investment and Corresponding Benefits	
	<p>No National Investment in Space</p> <ul style="list-style-type: none"> ● May Benefit from Space Applications Created by Developed Nations <p>Cultivate Space Expertise</p> <ul style="list-style-type: none"> ● Informed Voice in International Space Application Efforts ● Able to Form Strategic Partnerships Regarding Space Applications <p>Trained Space Professionals and Research Facilities</p> <ul style="list-style-type: none"> ● Able to Apply Other Nations' Satellite Data to National Priorities ● Promote Science and Technology Capacity Building <p>Indigenous Space Hardware (Satellites)</p> <ul style="list-style-type: none"> ● Able to Focus Space Asset Entirely on National Priorities ● Further Develop Science and Technology Capacity

Communications Satellites and Applications

Information and Communication Technology (ICT) has been recognized as a key enabler of development. This technology provides remote locations with a link to information and to the rest of the world. Only 9.7 percent of the population in developing nations has access to Internet services; this is one sixth as many as in developed countries. Internet access in developing nations is also unevenly distributed. According to United Nations Conference on Trade and Development, four out of 54 countries in Africa (Nigeria, Morocco, Egypt, and South Africa) account for almost 60 percent of Internet users in the region. The number of users is considerably lower for broadband Internet connections, which enable applications such as the high quality video needed for telemedicine. No country in Africa has more than 2 percent broadband penetration.⁸ With such a small portion of the population having access to information and the ability to communicate, technological progress and development are difficult.

Communications satellites play an important role in increasing the ICT infrastructure of developing nations. A high percentage of the population in many developing nations is located in remote, rural areas that are least likely to have access to terrestrial communication infrastructure. This is often due to the cost or difficulty of installing fiber cables or cell phone towers in remote areas with rough terrain. However, satellite backbones for rural connectivity provide an alternative. Satellites can provide voice and data broadband service, and the market for satellite communications is high due to the lack of traditional alternatives in rural areas. A number of satellite operators, such as SES World Skies, Eutelsat, Intelsat, Hispasat, Thuraya, and others already offer services in developing areas. Indonesia, a lower middle-income nation made up of more than 6,000 inhabited islands, developed a communications satellite constellation in the 1970s. Since then, this constellation has provided regional communications for the country as well as coverage in the Philippines, Malaysia, and Singapore.⁹

The United Nations Millennium Development Goals highlight some of the challenges faced by developing nations, including poverty and hunger, a lack of access to education, and health issues. Space systems that supply Internet and

voice connectivity can help developing nations and provide numerous opportunities for addressing these issues and improving the situation of rural populations.

Agriculture and Business

The availability of information in remote areas provides previously isolated people with an opportunity to increase the security and productivity of their business or possibly expand their trade to new markets. Agriculture is the primary industry in many rural areas, and communications connectivity allows farmers to receive critical weather forecasts, market price information, and expert advice on how to increase productivity for existing crops or grow additional crops. A program in South Africa in which farmers received text messages regarding correct irrigation timing was estimated to have saved these farmers approximately \$300 per hectare (2.47 acres).¹⁰ This money could then be reinvested in other farm improvements. The Indian Space Research Organisation (ISRO) has already begun a program to provide satellite communication services to 600,000 villages throughout India. These Village Resource Centres (VRCs) would provide access to a variety of space-based services and deliverables, including information on natural resources and interactive advisories on agriculture, fisheries, and resource management for both land and water.¹¹

Medicine

Providing adequate medical care in remote areas poses a number of difficulties. Rural clinics are often not well staffed and lack professionals trained in specialty fields. Telemedicine has the capability to provide assistance and expertise to personnel working in remote areas. This technology has been used in the United States for more than 40 years, providing improved access to rural communities at lower costs.¹² The International Institution for Communication and Development (IICD) recently conducted a project focused on teleradiology in Mali. There are approximately a dozen radiologists in the country, all located in the city of Bamako, Mali's capital. IICD set up the necessary technology infrastructure, such as scanners, software, and Internet connections, and provided training to allow rural clinics to send x-rays to a central hospital in Bamako. The radiologists in Bamako were then able to provide diagnoses to the patients at the rural clinics. In one case, an initial diagnosis in a rural clinic of

bone cancer was revealed by radiologists at the central hospital to be an error in the radio film, saving the patient from an unnecessary amputation.¹³ In another example, Intelsat partnered with the Digital Solidarity Fund, an organization whose goal is to reduce the digital divide, to set up broadband satellite infrastructure in medical clinics in remote areas of the west African country of Burkina Faso. This enabled doctors at these clinics to communicate with other health professionals and receive ongoing training.¹⁴ Well-connected medical clinics in developing nations could contribute to many lives being saved.

Education

Education and the opportunities it provides are key to eliminating poverty. Schools in remote areas can benefit greatly from access to ICT. Distance learning courses allow teachers to continue their education and access curricula updates while students obtain information and educational materials that would not otherwise be available. Online education programs are also of great benefit for adult education and job training. Access to the Internet is essential for post-secondary students in developing nations because it is often the only method for viewing academic journal articles. Without this type of connectivity, it is almost impossible for students in developing countries to participate in and contribute to globally relevant research. One of the leaders in this field has been the Indian government, which recognized the potential of space technology for improving education. In 2004, ISRO launched EDUSAT, a communications satellite dedicated to educational uses. Within its first four years of operation, ISRO used the EDUSAT to provide connectivity to more than 30,000 classrooms. EDUSAT's broadcasts and interactive networks cover 20 states within India. In 2008, ISRO worked with the prestigious Indian Institute of Technology (IIT) in Bombay to provide satellite-based tele-education facilities to students and teachers at engineering colleges across the country.¹⁵

Disaster Relief

Reliable access to communication technology is essential before and after natural disasters. Without this, it is almost impossible to provide adequate advanced warning to populations in remote areas. Advanced warning systems may rely on satellites for sending real-time alerts, particularly to boats and airplanes. Tsunami early warning systems rely on ocean-based sensors that send warnings

to alert centers via communications satellites.¹⁶ After a disaster has occurred, satellite communication may provide the only reliable communication method. After Hurricane Katrina hit the United States, usage of satellite communications was estimated to be 30 times higher than normal. Within a week of the disaster, more than 10,000 satellite phones had been shipped to the region, with most being used by emergency-response agencies.¹⁷ Following a flood in Zambia in April 2008, the International Telecommunications Union (ITU) Framework for Cooperation in Emergencies provided 25 satellite terminals to aid in coordination of humanitarian aid efforts. As part of the effort, Thuraya satellite phones were used for voice communications and GPS locating, and Inmarsat terminals were used for voice and high speed data. These assets were critical for effective response.¹⁸ Satellite communication can also be essential for longer-term rebuilding. Construction workers in remote areas of Afghanistan have used satellite technology to communicate and send updated photographs and engineering plans to main offices. Previously, this communication would only have been possible through frequent trips into cities, greatly slowing their progress.¹⁹

Recommendations

Social Considerations

Bringing Information and Communication Technologies (ICT) to developing nations is not an automatic solution for every situation. There are scores of examples of projects that have failed due to inadequate understanding of social issues and local conditions. Equity of access and the effect on local culture must both be considered.²⁰ This may include relatively straightforward issues such as the ability of a non-English speaking community to make use of the Internet or Western keyboards. It could also include considerations of the effect of greater access to Western culture on remote societies.²¹

ICT must be need-driven rather than technology-driven, and the full lifecycle of a project should be considered. Adequate training must be provided when infrastructure is installed, and issues and costs associated with maintainability must be addressed.

Recommendation

Commercial satellite companies operating in developing nations should work closely with experts in international development and with local government or NonGovernmental Organizations (NGOs) to ensure that space solutions are culturally appropriate. This will allow solutions to be more readily adapted and accepted by these communities.

Regulatory Reform

For satellite communication technology to become a real solution in developing countries, it is important that governments in developing nations reform existing regulatory schemes or make efforts to improve public understanding of current regulations.²²

For instance, the regulatory framework for telecommunications varies among the 54 nations in Africa. Even within countries, existing regulations may be confusing. This makes coordination among nations difficult and provides challenges for international organizations, which must go through a wide variety of licensing procedures to operate in multiple countries.²³ Commercial companies and international organizations can help to provide guidance. Existing activities in this area, such as the coordination of regulatory workshops by the Global VSAT Forum, should be encouraged.²⁴

Recommendation

Governments in developing nations and commercial communications satellite operators should work together to develop a logical regulatory scheme in developing nations. In addition, clear guidance should be provided by governments on how to work within existing regulations.
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Identifying Specific Market Opportunities

According to *The Space Report 2009*, industry analysts agree that satellite transfer or "backhaul" of cellular communications, among other satellite services, will be key to the growth of the communications satellite industry.²⁵ The relevance of satellite-based information and communication technology among other options, such as cell phone or fiber-based ICTs, will vary by location. It is likely that in cities and other highly populated areas, cell phone towers and fiber optic

cables will provide most connectivity. However, this is usually not the case in more remote areas. In these regions, the cost per user of installing cell phone towers or cables may be prohibitive, while small satellite terminals are viable. However, these terminals still require a relatively large investment, and participation of national governments in promoting and distributing this technology is likely necessary. In addition to physical differences among regions, there will be differences in culture, economic well-being, and daily activities. Companies should take into account these differences, and tailor cost, business models and product designs to specific regions.²⁶

Communications satellite operators have recognized that developing nations provide a large potential market in need of connectivity. Some companies are already working to take advantage of this growing market. The O3B Networks, a small start-up company, aims to provide broadband connectivity for the "other 3 billion" people in the world who do not have Internet access. To do this, O3B plans to put five satellites into low Earth orbit by late 2010, with additional satellites at a later date. The mission is to lower costs and increase availability, particularly in developing nations in Africa, the Middle East, Asia, and Latin America. In addition, the International Telecommunication Union (ITU) "Connect the World" program aims to mobilize resources of companies, governments, and other organizations to provide connectivity to the places in the world where it is not yet available.²⁷ Additional projects that focus on the needs of this population are likely to grow. Better understanding of these needs may best be accomplished by partnering with local development organizations or local user communities.

Recommendation
Studies should be initiated to continue to define the market for communications satellite services in developing nations. This will provide an understanding of the complexities and differences in various areas and suggest the best ways to proceed in introducing new technology. This may be done by governments interested in understanding the most efficient method for investing in communications infrastructure, or by companies interested in identifying potential new markets.

Cost-effective Ground Infrastructure

The operation of communications satellites that provide service in developing nations must be complemented with cost-effective ground infrastructure to enable use of these services. Technology has advanced at an impressive rate, and there are a number of promising options to fill this need, including Very Small Aperture Terminals (VSATs) as well as Mobile Satellite Services (MSS).

Approximately 2.5 meters (8.2 feet) in diameter, VSATs are about 1/10th the price of older, larger satellite terminals.²⁸ Compared to fiber and towers, VSATs require less significant infrastructure investments. Remote terminals can be installed relatively quickly and easily by field technicians in all kinds of terrain. VSATs are designed for low power use, and can be run using built-in or attached solar panels if electricity is not available.²⁹ National governments should consider the integration of VSAT technology as a method of providing communications access in rural areas.

MSS technology can provide voice and data connectivity via handheld satellite phones. Certain models of handheld devices can be battery-operated and solar-charged. These small systems eliminate the need for complicated or costly installation efforts. In the United States, mobile chips are already being developed that integrate satellite and cellular communication technology, to allow mass market access to satellite connectivity.³⁰

Recommendation
Governments in developing nations should consider investing in affordable ground technology to provide satellite communication access in rural areas, particularly for clinics, schools, and other community centers. The technology would be used to directly address the UN Millennium Development Goals as well as national goals in health, education, and other areas.

Remote Sensing Satellites and Applications

Remote sensing satellites are well-suited to addressing some of the challenges faced in developing nations. These satellites provide the ability to observe large areas, without the need for scientists or data collection on the ground. This may be the only cost-effective way to collect data about large, sparsely populated areas in developing nations. For example, in Egypt, where 96 percent of the nation consists of desert, remote sensing offered one of the few methods for

studying the vast desert.³¹ In fact, the Egyptian Space Research Center was originally operated as a part of the Desert Environment Research Institute within Minufiya University.³² Remote sensing satellites vary in their capabilities and can gather imagery and data at more wavelengths than the human eye can perceive unaided. This technology has allowed a wide array of applications to be developed to address many of the needs of developing nations.

Medicine

Although malaria has been eradicated in the United States and other developed nations, it is still a serious concern in developing countries. According to the US Centers for Disease Control and Prevention, malaria, which is spread through mosquito bites, kills more than one million people each year, most of them young children in sub-Saharan Africa. Remote sensing satellites can identify meteorological conditions and geographical areas where mosquitoes are most likely to thrive. This data can be analyzed and combined with other information to generate risk maps. Officials are then able to target distribution of resources, such as mosquito nets for sleeping quarters, to prevent outbreaks in the regions most likely to be affected.³³ Similar processes can be used to predict and avoid outbreaks of many other diseases, including cholera, dengue fever, and dysentery.³⁴ Using these methods to target relief efforts can help developed nations provide aid more efficiently, thus reducing costs while saving more lives, and can help developing nations identify and try to provide long-term solutions in problem areas.

Land Use Planning

Remote sensing satellites often take multiple images of the same areas over an extended period of time. Analyzing changes in these images can provide insight into changes in land use and population. It is possible to see where land is being cultivated, where groundwater is available, and where deforestation is prevalent.³⁵ Governments can use this information to make coherent land use policies and support sustainable development and use of natural resources.³⁶ The Brazilian National Institute for Space Research operates a deforestation monitoring and warning system in the Amazon region.³⁷ Remote sensing data can also play a role in urban planning by allowing governments to monitor urban expansion over time.³⁸ This type of information will allow governments to make informed decisions about how to direct development, supporting growth in

areas with drinkable groundwater and arable land. A more organized development of urban areas could significantly improve the quality of life for people in these areas.

Disaster Prediction

A United Nations report in 1998 on the use of Space for Disaster Prediction, Warning, and Mitigation estimated that in 1992 the world economy lost more money (US \$62 billion) from natural disasters in the less developed countries than it spent on development aid (US \$60 billion).³⁹ Just as remote sensing data can be used to identify environmental conditions likely to lead to disease outbreaks, it can be used to identify conditions conducive to disasters, such as wild fires or famines. The Famine Early Warning System (FEWS), funded by the United States Agency for International Development (USAID), integrates remote sensing information with other data, such as market prices for food, to provide predictions of areas at risk of famine.⁴⁰ Fire prediction using remote sensing data has already been implemented in the United States and could be extended for use in developing nations.⁴¹ Research has also been carried out on earthquake prediction from space.⁴² Being able to accurately predict areas at risk of natural disasters allows nations to address these issues in advance, saving many lives, and conserving or redirecting funds that would otherwise have been spent on expensive relief efforts.

Satellite Image of a Large Dust Storm off the Coast of North Africa.



Picture courtesy of GeoEye Satellite Image

Disaster Relief

A natural disaster, such as an earthquake or tsunami, can have devastating effects on a developing nation. Remote sensing from space immediately following a disaster can allow a rapid assessment of areas most affected. Aid can then be targeted to these areas. Since there is often little communication or transportation infrastructure in developing nations, this information may be impossible to collect in any other way. The International Charter on Space and Major Disasters was developed by the European and French Space Agencies in 2000. Signatories to this charter commit space resources to support the provisions of the Charter and thus help to mitigate the effects of disasters on human life and property.⁴³ China, which is a member, activated the charter in response to the 2008 earthquake in Sichuan, giving response teams access to 18 satellites run by other charter members. Satellite imagery was used to assess damage and more efficiently distribute resources.⁴⁴ The United Nations Office for Outer Space Affairs partnered with the United Nations Development Program on a project called "Space-based Information for Disaster Management and Emergency Response" (UN-SPIDER). The mission of UN-SPIDER is to ensure that all countries have access to and develop the capacity to use space-based information to support disaster management.⁴⁵ However, this program is in its early stages, and further innovations in the use of remote sensing technology for disaster relief are essential to providing a more rapid response.

Efficient Aid Distribution

In conflict situations, it is common for large groups of people to flee their homes, resulting in internally displaced people and refugees. In these cases, the international community would like to provide aid as quickly and efficiently as possible, but locating such groups can be a challenge. The United Nations High Commission on Refugees (UNHCR) has found that imagery from space can be essential for locating displaced populations and coordinating the provision of aid. Satellite imagery can also be used to identify locations with adequate resources to support refugee populations and act as the basis of UN-supported refugee camps. For example, satellite images and geospatial information were used by the UNHCR to identify surface and ground water resources to assist Sudanese refugees in Chad.⁴⁶ Applying satellite technology in situations such as

this can save time, money, and lives. It is important that developed country governments and international aid organizations continue to develop satellite applications that allow for more targeted and efficient aid distribution.

Recommendations

Lower Cost and Improved Data Quality

Although remote sensing has the potential to be very useful, access can be limited by cost and availability of data. If developing nations do not own or do not have assured access to a satellite, it may be difficult to ensure that they will be able to obtain the appropriate data. Depending on the data quality and the level of correlation of the data with observed effects, uncertainty and error in prediction still pose a challenge.

The image resolution of remote sensing satellites continues to improve. This can include spatial resolution, which affects the level of detail that can be seen in a given area, as well as other types of resolution, such as radiometric, which allows scientists to distinguish more precisely between different types of materials detected. Increased precision in imaging will lead to more targeted and reliable prediction models, and a greater reliance on remote sensing in the future.

Recommendation
<ul style="list-style-type: none"> ● Remote sensing providers, developed nations that own remote sensing satellites, and developing nations should work together to define the means by which reliable and useful remote sensing data can be provided to developing nations, particularly for disease and disaster prevention. This would allow developing nations to begin making use of this data immediately for these essential efforts. ● Further research should be done to assist developing countries in employing space products to create useful operational models for disease and disaster prevention.

Increased Integration (Geospatial Information Systems)

Remote sensing is a very useful technology and its utility can be greatly enhanced by integrating or fusing remote sensing data with other location-specific data. This data, which includes geographic positioning information, is often referred to

as geospatial data. Comparing satellite imagery with historical information or ground-collected geospatial data can improve interpretive and predictive capabilities. Adding relevant parameters to models, such as economic or social conditions, will improve image-only predictions. This trend is already being seen in many academic studies and in programs such as FEWS. Adding supporting data to remote sensing models, or incorporating remote sensing data into existing models will provide more robust results. As integration with other data leads to more reliable observations and predictions, these models are likely to become further integrated into decision making processes, improving their effectiveness for informing policy and action. The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) is actively promoting the use of space-derived geospatial data for sustainable development. Multiple delegations to the committee noted that it is "of paramount importance for developing countries to develop their own national infrastructure for space-derived geospatial data."⁴⁷

Recommendation
Governments in developing nations should support efforts to integrate remote sensing data with other data sources through funding and policy initiatives. Governments should also seek to work with satellite operators in data integration efforts. Systems with integrated data will provide more robust outcomes and reduce uncertainty, helping to target action where it is needed.

Capacity Building and Space Applications

Science and technology drive innovation, and their importance to economic growth is recognized throughout the world. The ability of a nation to drive innovation and economic progress depends on its science and technology capacity. This includes "the infrastructure, investment, institutional and regulatory framework, and personnel available to conduct scientific research and technological development."⁴⁸ Much work has already been done to increase the science and technology capacity in developing nations.

If developing nations are able to foster their own science and technology sector, they can reduce reliance on other nations. They can create human capital and address the specific needs of their nation. Increased science and technology

capacity would allow developing nations to accelerate development. Well-trained scientists and engineers can increase communication and collaboration with other nations and improve international relations. Investing in the space sector is a productive method for nations to begin growing their capacity and addressing these issues.

There are already a number of developing nations that have space capabilities. Figure 2 shows a list of developing nations that have space programs or capabilities, along with their income level as defined by the World Bank in 2008.⁴⁹

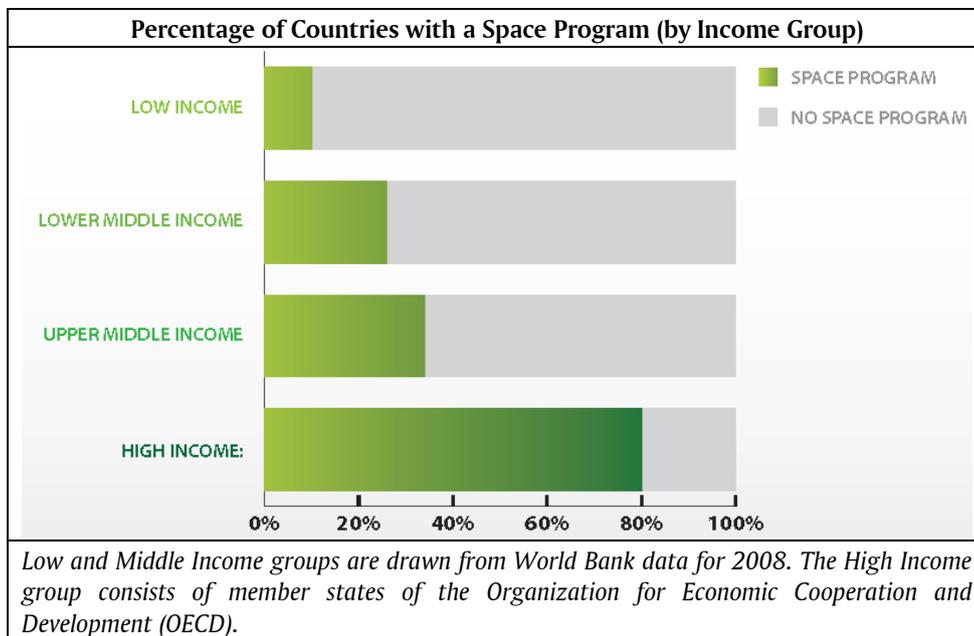
Country	Income Group*
Algeria	Lower Middle
Argentina	Upper Middle
Bangladesh	Low
Brazil	Upper Middle
Bulgaria	Upper Middle
Chile	Upper Middle
China	Lower Middle
Colombia	Lower Middle
Egypt, Arab Rep.	Lower Middle
India	Lower Middle
Indonesia	Lower Middle
Iran, Islamic Rep.	Lower Middle
Kazakhstan	Upper Middle
Korea, Dem Rep.	Low
Malaysia	Upper Middle
Mexico	Upper Middle
Nigeria	Low
Pakistan	Low
Peru	Lower Middle
Philippines	Lower Middle
Poland	Upper Middle
Contd...	

Contd...	
Romania	Upper Middle
Russian Federation	Upper Middle
South Africa	Upper Middle
Thailand	Lower Middle
Turkey	Upper Middle
Ukraine	Lower Middle
<p>* World Bank income groups as of 2008. According to the World Bank, "Low-income and middle-income economies are sometimes referred to as developing economies. The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status."⁵⁰</p>	

Investment and Infrastructure

There are many ways that a nation can create science and technology capacity, and supporting space activities should not be the only method undertaken. However, space programs are attractive because they can be developed incrementally. At a minimum, nations may cultivate space experts to help understand how space assets can be applied to national priorities. This knowledge would allow the country to have a voice in international efforts related to space and to take full advantage of international space application programs that already exist. A nation may choose to train professionals and develop facilities to apply data gathered by other nations' space assets to address its own priorities, without investing in its own hardware. Egypt followed this path when it opened a Remote Sensing Center in 1971, nearly three decades before launching its own remote sensing satellite in 1997.⁵¹ If a country does decide to develop hardware, this can be done through strategic partnerships to avoid the costs of developing the capability from scratch. Nigeria began by contracting China to build and launch its satellites, while also training Nigerian engineers in the process. The Nigerian government intends to gradually develop indigenous design, manufacturing, testing and integration capabilities. These practices allow nations to gain technological expertise while minimizing initial capital costs.

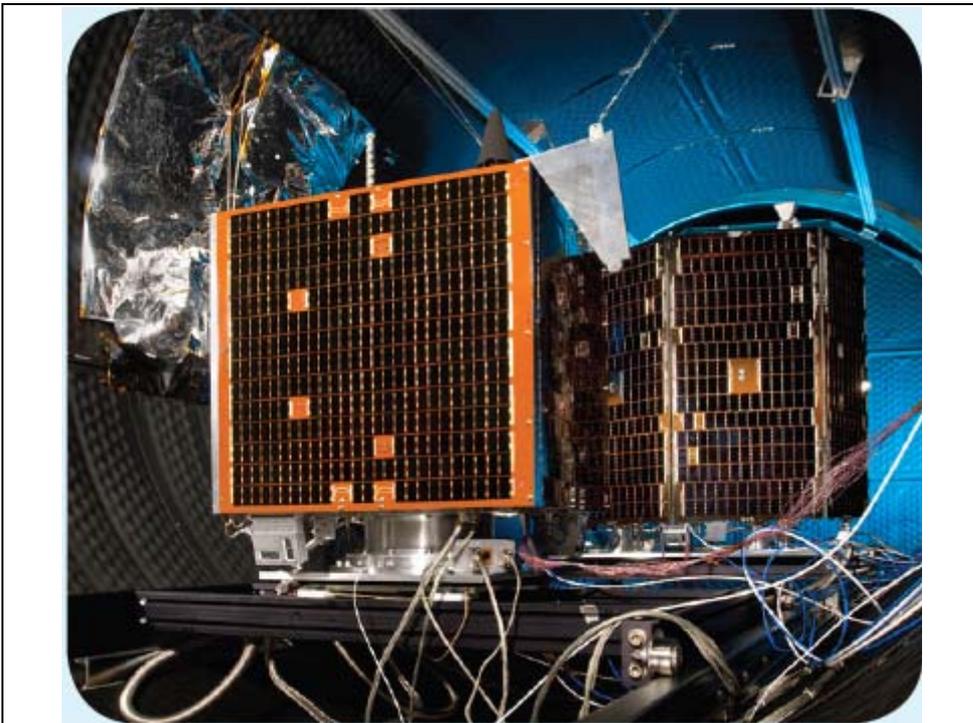
A space program can be one part of the science and technology infrastructure of a nation, but its development should be coordinated with the development of supporting institutions, whether public or private. The creation of a space program will necessitate the creation of other science and technology infrastructure in the nation. It will promote public investment in science and technology, and require prioritization of issues, policy making, and regulation. If a nation runs a domestic space program, it is able to focus research to address its own needs. All of these developments add to the science and technology capacity of a nation.



Technologically Advanced Workforce

By starting a space program, developing nations can grow and maintain a technologically advanced workforce. The space sector is recognized worldwide as an indicator of science and technology ability. A successful space program can help attract and maintain native talent. This is seen in India, as the successful launch of their lunar probe, Chandrayaan-1, has caused many highly trained Indian citizens living abroad to become interested in returning.⁵² In addition to scientists and engineers, a space program facilitates the growth and learning of technologically-savvy policy makers, which can be important to innovation policy

and future growth. Nigeria has made developing a pool of Nigerian satellite engineers a cornerstone of its space program. Already, Nigeria has more than 100 spacecraft engineers who have the capacity to design, assemble, integrate and test a satellite with available facilities. Nigerians have developed competency in spacecraft station-keeping as well as telemetry software engineering. These capabilities are now being channeled in applied research to address national needs and challenges.⁵³



*NX and NigeriaSat-2, the latest spacecraft manufactured for the National Space Research & Development Agency, under environmental testing at Rutherford Appleton Laboratory, Didcot UK. Both satellites were manufactured at SSTL Guildford.
Picture courtesy of SSTL.*

Education

Not only does the development of a space program result in the training and growth of the workforce in the program, it also leads to increased study of these topics in schools and universities. Knowing that there are opportunities for

employment encourages students to study science and technology. India has established a space university at Thiruvananthapuram where students train in space technology and applications specifically to support the personnel needs of its space program. Similar institutions have been founded in Nigeria. The United Nations has supported these efforts by creating five Regional Centres for Space Science and Technology Education, located in Mexico, Brazil, Morocco, Nigeria, and India. The principal goal of each centre is "the development of the skills and knowledge of university educators and research and applications scientists."⁵⁴ In addition to supporting advanced education by creating a need for scientists and engineers, space programs can provide the data needed to support advanced graduate research. For example, government-owned satellite imagery can be provided to universities for free, allowing graduate students, including those in non-technical fields, to work with relevant data.

Recommendations

Focus on Economic Benefit

Because space programs have traditionally been the province of large, developed nations, the cost of entry to this industry has typically been viewed as prohibitive to developing nations. Space activities are sometimes mistakenly considered to be purely a matter of prestige, without offering a direct benefit to society. In developing countries, which face high rates of poverty, famine, and disease, the logic of investing in space activities may not be obvious immediately. This could lead to a lack of public support for space activities, causing a nation to choose not to invest in this area.

Space agencies in developing nations should begin by focusing on addressing national priorities. The research and activities in these space agencies should be based on direct benefit to society rather than pure science or exploration. Space assets may include communication and remote sensing satellites, with less emphasis on astronomy research satellites or human space flight programs. This allows nations to make clear the benefits of a space agency and helps defend against arguments that space assets are not an efficient use of public funds. This is already seen in the large-scale efforts focused on these topics in places such as India, Brazil, and Nigeria.

Recommendation

Space programs in developing nations should begin by focusing on programs with a direct benefit to society. They should keep costs as low as possible and ensure that the benefits are clearly communicated to the public. It is advisable for governments to track the return on their investment so the public understands that the funds are being used wisely.
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National Legislation

As developing nations make the decision to begin space activities, it is necessary to create the policy framework to support these programs. Often national legislation is necessary in order to coordinate national space activities, regulate private sector involvement, or fulfill treaty obligations; however, regulation of governmental and non-governmental space activities is a complicated legal issue. To create legislation, it would be beneficial for developing countries to make use of existing space-related legislation. The United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) has recognized this need and created a working group on "National Legislation Relevant to the Peaceful Exploration and Use of Outer Space." One of the aims of this group is to develop a paper providing an overview of existing national regulatory frameworks based on information received from Member States. It has recognized that this would contribute to "capacity-building in space law" and would be particularly valuable to developing countries.⁵⁵

Recommendation

When creating their own national policies, developing nations should take note of other nations' existing national legislation on space activities. This effort should be coordinated with the United Nations' efforts to identify common principles, norms, and procedures among nations with existing space legislation.
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International Collaboration

Numerous international cooperative efforts are currently underway. These include regional space alliances, such as the proposed African Association of Remote Sensing or the Asia Pacific Satellite Communications Council. There are

also partnerships between developing and developed nations. The United States, Europe, Russia, and others have collaborated with developing nations to support space technology development. China has worked with both Nigeria and Venezuela to develop satellites and train space professionals.

In addition to official government-to-government interaction, there are events such as the Global Space Development Summit, organized by the Center for Strategic and International Studies in partnership with the Space Foundation, the American Institute of Aeronautics and Astronautics, and the Chinese Society for Astronautics. This event is intended to bring together individuals from around the world from governments, nonprofit organizations, industry, and academia to focus on the future of international coordination and governance structures for space development. Another event, the International Astronautical Conference, held by the International Astronautical Federation, the International Academy of Astronautics, and the International Institute of Space Law attracts an average of 1,500 participants a year and has been held in a wide variety of locations, including India and Brazil.

There are some developing nations, such as Kenya, Bolivia, and Nicaragua that do not have national space programs but are a part of UN COPUOS, which provides them a voice in the international space community. Collaboration can, and should, take place on multiple levels, including with universities, commercial companies, NGOs, national governments, and international organizations. Because nations may have difficulty developing space capabilities independently, there is likely to be an increase in international collaboration – both among developing countries and between developing and developed nations.

Recommendation
Developing nations should consider international collaboration as a method for incremental development of a space program. Working with developed nations, already experienced in creating space technology, can help to reduce risk and reduce costs.

Conclusion

Developing nations face a number of serious social and economic challenges. Developed nations provide aid, but often it is not distributed efficiently and does not help to build developing nations' capacity to address the root causes of these issues. Science and technology, and particularly space technology, can contribute to addressing these issues.

Communications satellites can be used to connect people in remote areas. They provide medical expertise to areas where specialized personnel are not available. Communications satellites can help students and teachers to access improved educational content. They promote business and growth. Remote sensing satellites improve health and safety by providing information that leads to disease avoidance and food security. Remote sensing can help sustainable development by informing policy-makers about changes in land use. It can be essential to providing timely aid in the event of a natural disaster. If developing nations choose to invest in space technology and develop their own space programs, they can enhance their science and technology capacity and experience increased economic growth.

Efforts must begin to increase awareness of the benefits of space assets to developing nations and the specific challenges that they face. This will lead to the development of space technologies tailored to the needs of these nations. Research should be done to develop applications for small scale entrepreneurial and agricultural uses. Research should address simpler, more automated applications for tele-education, telemedicine, and telebusiness. The developed world should provide support in building indigenous science and technology capacity in developing nations through increased cooperation in the space sector. By taking steps such as these, the benefit of space applications can be realized by developing nations.

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4

Cooperation in Space Science and Technology in IBSA: Overcoming Some Legal Challenges

*Jo-Ansie van Wyk**

This article presents and compares empirical evidence of the state of space S & T in individual IBSA Member States. It assesses the status of major Treaties on Outer Space in IBSA Member States before proceeding to analyse these countries' space diplomacy. Before addressing the legal challenges in respect of IBSA's space cooperation, the article analyses the international political economy of Outer Space as it relates to IBSA Member States. The article proposed space S & T as a main driver for regional integration given IBSA Member States' good global competitiveness in this area. This can be achieved if IBSA address these legal challenges. For this purpose, the chapter concludes with a series of policy and legal recommendations to IBSA and its Member States.

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Introduction

Established in 2003, the main objectives of the India-Brazil-South Africa (IBSA) Dialogue Forum (hereafter IBSA) are to promote South-South dialogue, cooperation and common positions on issues of international importance; trade and investment opportunities between the three regions of which they are part; international poverty alleviation and social development; the trilateral exchange of information, international best practices, technologies and skills, as well as to compliment each others' competitive strengths into collective synergies; and cooperation in a broad range of areas, namely agriculture, climate change, culture, defence, education, energy, health, information society, science and technology, social development, trade and investment, tourism and transport (IBSA, 2008a: internet).

Space Science and Technology (S & T) offer numerous socio-economic development possibilities to developing countries can effectively be applied to achieve sustainable development, disaster management and relief, Earth Observation (EO), navigation, environmental monitoring such as desertification and deforestation, urban planning, health applications, communications and agricultural planning. Moreover, space-based technological systems enable distance education, telemedicine, wireless communications and emergency telecommunications (Peter et. al., 2006: 445). Satellite remote sensing, for example, can assist developing countries vis-à-vis conflict resolution. Since the availability of remote sensing data, for example, governments have started to use this space application for developmental purposes. Notwithstanding this, some developing countries regard space applications such as remote sensing, for example, as 'merely tools of global neo-imperialism' (Sheehan, 2007: 127). However, the concern prevailed that developing countries in particular may be exploited by developed countries. To some extent, this view is no longer valid. *Developing* countries such as India, Brazil, Indonesia and China have acquired competitive space capabilities, which contribute to their development agenda. In Brazil, for example, space applications are directed towards development issues such as earth observation (agriculture, environment, natural resources and territorial organization), meteorology, oceanography, communications, navigation and geodesy (Anon, Undated: internet).

Classified as 'dynamic adopters' by the United Nations' (UN) Technology Achievement Index (TAI), which focuses on four dimensions of technological capacity – the creation of technology, the diffusion of recent innovations, the diffusion of old innovations and human skills – India, South Africa and Brazil are dynamic in the use of new technology such as space S & T and Internet, have important high-technology industries exporting successes, but their diffusion of old technology (such as telephones and electricity) is slow and incomplete (UNDP, 2001: 46-49). In fact, in the Brasília Declaration (IBSA, 2003: internet), the 'founding document' IBSA, acknowledged the role of S & T as a driver of cooperation, security, regional integration and development:

'While noting that their societies have diverse areas of excellence in science and technology and offer a broad range of potential opportunities for trade, investment, travel and tourism, they stressed that the appropriate combination of their best resources will generate the desired synergy. Amongst the scientific and technological areas in which cooperation can be developed are biotechnology, alternative energy sources, outer space, aeronautics, information technology and agriculture. Avenues for greater cooperation in defence matters should also be explored. The Ministers agreed upon putting forward to their respective governments that the authorities in charge of the portfolio for science and technology, defence, transportation and civil aviation, among others, also hold trilateral meetings, aiming at the creation of concrete cooperation projects.'

In 2008, the Foreign Ministers of the IBSA Member States reaffirmed in the Somerset West Ministerial Communiqué that 'IBSA provides a unique framework for trilateral coordination on international issues and cooperation in several sectoral areas whilst ensuring people-to-people interaction making the Forum a meaningful reality to the people of the three countries' (IBSA, 2008b: 1). So far, S & T cooperation has been limited to nanotechnology, climatology, oceanography and energy (IBSA, 2008b: 13). However, its agenda has so far lacked a special focus on the role of space S & T in achieving IBSA's objectives.

At the beginning of the 21st century, rapid technological globalisation and the unprecedented commercialisation of space are two key features of international relations. The aim of this chapter is to analyse cooperation on space S & T among IBSA Member States. The idea of selecting space S & T as an area of cooperation

within the IBSA context is not new (Soko, 2006; Gottschalk, 2007; Van Wyk, 2009). This chapter presents and compares empirical evidence of the state of space S & T in individual IBSA Member States. It assesses the status of major Treaties on Outer Space in IBSA Member States before proceeding to analyse these countries' space diplomacy. Before addressing the legal challenges in respect of IBSA's space cooperation, the chapter analyses the international political economy of Outer Space as it relates to IBSA Member States. The chapter proposed space S & T as a main driver for regional integration given IBSA Member States' good global competitiveness in this area. This can be achieved if IBSA address these legal challenges. For this purpose, the chapter concludes with a series of policy and legal recommendations to IBSA and its Member States.

Theoretical Approaches to the Study of Outer Space

During the Cold War, space affairs were predominantly approached from a Realist perspective. Since its first involvement in space affairs, individual IBSA Member States' approach to space affairs was predominantly Realist in a Cold War context. For example, India's programme was established to provide security in an unstable neighbourhood. South Africa assisted NASA and Brazil attempted to counter US' dominance in its region. The so-called Idealist 'myth of space demilitarisation', which characterised the 1980s was soon replaced by a Liberalist approach to space affairs. In the aftermath of the Cold War, European integration, for example, paved the way for greater cooperation in Europe. Through projects such as the International Space Station (ISS), for example, Liberalists' emphasis on the organisation of economic activities and the sharing of resources amplified the inadequacy of a Realist approach to the study of space (Sheehan, 2007: 15-16). However, more recently Constructivists' ideas have enhanced our understanding of international relations. Unlike Realism and Neo-realism, for example, which focus on the material in international relations, Constructivism focuses on the social aspects of international relations. In other words, Constructivists focus on the ideas and beliefs underlying actors' international behaviour and their shared understandings. Ideas, rather than material aspects, constitute the international system (Wendt, 1992 & 1999).

In space affairs, it is precisely this *social* aspect that drives international relations. States and other actors want to enhance their status and prestige, they

want to consolidate their national interests, and they want to improve the social conditions of their populations. Moreover, Constructivists argue that power remains unequally distributed in international relations and that states continue to be divided into the powerful and powerless. Increasingly, developing countries are indicating the importance of space science for their development. In this sense, space has been recently been re-constructed.

Despite its emphasis on human development, state structures in developing countries remain to be the main beneficiaries of space applications. Despite efforts to transform states' developmental strategies to comply with that of a competition state or a developmental state, state capture remains to negatively affect sustainable development. It reiterates the need for a new global space regime for human security and development rather than state security.

Space S & T in India, Brazil and South Africa

Despite their identity as developing countries, India, Brazil and South Africa, as table 1 indicates, have globally competitive space sectors.

Table 1: Selected Space Indicators			
(Brazilian Embassy Pretoria & UCLAS, 2006; 80; GCIS, 2006: 480; Anon, Undated: internet; ISRO, 2008: internet; Washington Post, 9 July 2008).			
	Brazil	South Africa	India
Political Framework			
Space agency	Brazilian Space Agency (AEB)	Approved by Cabinet	Indian Space Research Organisation (ISRO)
Space policy	National Policy on the Development of Space Activities (PNDAAE) and the National Space Program - PNAE	National Space Policy adopted in March 2009	Yes
Contd...			

Contd...			
Space Programmes			
	Space Applications, Satellites and Payloads, Satellite Launching Vehicles and Sounding Rockets, Space Infrastructure, Space Sciences, R&D on Space Technologies, Training and Development of Human Resources, and Support to the Qualification of the National Space Industry.	SumbandilaSAT, SALT, KAT and possibly SKA	Indian National Satellite System (INSAT), Indian Remote Sensing Satellite (IRS) System, Stretched Rohini Satellite Series (SROSS), Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV).
Space Infrastructure/Facilities			
	Alcântara Launch Center (CLA) & Barreira do Inferno (Rocket launch site)	Astronomy, testing facilities, satellite communications, satellite applications and ground segment, and research	Numerous facilities.
Satellites and Payloads			
	Small data collection satellites, remote sensing satellites (with China), micro-satellite, small earth observation satellites, equatorial low earth orbit satellite constellation (low cost communications to remote areas)	None	Small data collection satellites, remote sensing satellites (with China), micro-satellite, small earth observation satellites, equatorial low earth orbit satellite constellation (low cost communications to remote areas)
Contd...			

Contd...			
Space Activities			
Satellites launched 1998-2007	SCD-2 (1998), CBERS-1 (with China) (1999), CBERS-2 (2003)	Sunsat launched (private initiative) SumbandilaSat to be launched	11
Satellites manufactured 1998-2007	6	Sunsat manufactured by University of Stellenbosch SumbandilaSat manufactured by SunSpace (University of Stellenbosch) for South African Government	22
Satellite company revenue	US\$ 196m	Not available	US\$ 76m
Astronauts	1	One private self- funded	1
Budget			
Civil space budgets. NASA's annual budget is US\$17 billion.	US\$ 130m	Not available	US\$ 900m

All three states' space policies and S & T programmes operate in a specific legal and political framework. Brazil is the top earner of revenue, whereas India's space budget is by far the largest. South Africa seems to be the 'space cadet' in this trilateral relationship. Its ground station experience dates back to the 1950s, but its Outer Space capabilities are very limited. So far, South Africa's only astronaut was a self-funded initiative, and its only satellite that has been launched was under the auspices of the University of Stellenbosch. The South African Government's SumbandilaSAT is expected to be launched in 2009 – having been delayed repeatedly since 2006.

The Status of Space-Related Treaties in IBSA Member States

Five major UN Treaties as well as numerous other Treaties and agreements govern Outer Space. The five UN Treaties are:

The Outer Space Treaty (*Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* (Outer Space Treaty, or OST) of 1967 lays down specific International Space Law principles, including the prohibition of the use and installation of nuclear weapons, any kind of weapons of mass destruction and military bases, as well as the prohibition of exploration of any kind on the Moon and other Celestial bodies, in accordance with international law. The Treaty stresses the promotion of international cooperation in the exploration and use of space, the Moon and other celestial bodies. The OST establishes the principles of non-appropriation and the fact that no state can claim sovereignty of or occupy outer space, the Moon or any other celestial body.

The OST prescribes the role of non-governmental activities in outer space, the Moon and other celestial bodies, namely that their activities continue under the supervision of the appropriate state party to the Treaty. The responsibility for compliance of the activities of an inter-governmental organisation is borne by the relevant organisation and states party to the Treaty participating in such an organisation.

Finally, the OST addresses liability, the position of astronauts, as well as states' responsibility to inform the UN Secretary General and the international scientific community of the nature, conduct, locations and results of its activities. (OST in Haanappel, 2003: 210-213).

The Rescue Agreement (*Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*) of 1968 establishes the legal framework for emergency assistance to astronauts, which include immediate notification of the launching authority as well as the UN Secretary General. Notification must also be given about any space object which has returned to Earth. It also makes

provision for search and rescue operations, the prompt return as well as the recovery of space objects. The launching authority which may be a state is responsible for all costs incurred (Shaw, 2003: 479-486).

The Liability Convention (*Convention on International Liability for Damage Caused by Space Objects*) of 1972 imposes an international and an absolute liability on a launching state, or states, as well as on those states members of an inter-governmental organization for any damage caused by their space object. 'Launching state' is defined in Article I as 'a state which launches or procures the launching of a space object or from whose territory or facility a space object is launched' irrespective of the success, or not, of the launch. Furthermore, Article I defines damage as 'the loss of life, personal injury or any other impairment or health; or loss of damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations.' This also applies to any damage caused by a space object on the surface of the earth or to aircraft flight. In case no diplomatic solution is found for a claim of compensation, the parties concerned have to establish a Claims Commission comprising three members (Liability Convention in Haanappel, 2003: 259-265).

The Registration Convention (*Convention on Registration of Objects Launched into Outer Space*) of 1975 obliges states to register all space objects in a Register, which had been maintained by the UN Secretary General since 1962. States are required to furnish the following information, namely the name of the launching state(s), an appropriate designator of the space object or its registration number, date and territory or location of launch, basic orbital parameters such as nodal period, inclination, apogee and perigee, and the general function of the object (Registration Convention in Haanappel, 2003: 215-218).

Lastly, the **Moon Agreement** (*Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*) of 1979 extends International Space Law to govern activities on the Moon and other celestial bodies. One of the main thrusts of the Moon Agreement is the principle of the exclusive use of the Moon and celestial bodies for peaceful purposes, as well as its continued de-militarisation. However, military personnel may be used, but, as outlined in the OST, only for peaceful purposes. It designates

the moon as a global commons for all humankind, which are not subject to national appropriation and occupation. No private ownership is allowed, but all state parties have the right to exploration and use of the moon. The Moon Agreement obliges states parties to the agreement to establish an international regime to govern the exploitation of the natural resources of the moon once such exploration becomes feasible. As outlined in Article 11, the main purpose of this regime is:

- The orderly and safe development of the natural resources of the Moon;
- The rational management of those resources;
- The expansion of opportunities in the use of those resources;

An equitable sharing by all states parties 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 (Moon Agreement in Haanappel, 2003: 219-226).

Since 1992, a re-definition of the significant principles of International Space Law (ISL) followed in the form of UN General Assembly (UNGA) resolutions. Apart from the five Outer Space Treaties, the UNGA has adopted, apart from the *1963 Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space*, an additional set of legal principles, which provide for the application of International Law, the promotion of international cooperation and understanding in space activities, the dissemination and exchange of information through transnational direct television broadcasting via satellites and remote satellite observations of earth, and general standards regulating the safe use of nuclear power sources necessary for the exploration and use of outer space. These additional declarations and legal principles are the:

- Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (1996); and

- Application of the Legal Concept of the 'Launching State' (2004) and its ongoing work on State practice vis-à-vis the registration of space objects.
- Table 2 indicates the legal status of these and other space-related Treaties in individual IBSA Member States.

Table 2: Status of International Agreements Relating to Activities in Outer Space (OOSA, 2008: 9, 11 & 14)			
[R = Ratification, Acceptance, Approval, Accession or Succession; S = Signature only]			
	Brazil	South Africa	India
UN Outer Space Treaty (1967)	R	R	R
UN Rescue Agreement (1968)	R	R	R
UN Liability Convention (1972)	R	S	R
UN Registration Convention (1975)	R		R
UN Moon Agreement (1979)			S
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (1963)	R	R	R
Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite (1974)	S		
Agreement on the Establishment of the INTERSPUTNIK International System and Organisation of Outer Space Communications (INTR) (1971)			R
Agreement Relating to the International Telecommunications Satellite Organisation (ITSO) (1971)	R	R	R
International Telecommunication Constitution and Convention (ITU) (1992)	R	R	R
Convention on the International Mobile Satellite Organisation (IMSO) (1976)	R	R	R

Legally, as table 2 indicates, individual IBSA Member States have predominantly subjugated themselves to International Space Law (ISL). South Africa's non-ratification of the Registration Convention can be explained by the

fact that the country has not launched any space object yet. Yet, as the next section indicates IBSA Member States' space diplomacy remains limited and dominated by greater global powers.

An Overview of IBSA Member States' Space Diplomacy

International cooperation on space issues, or space diplomacy, can be divided into three types, namely global cooperation (such as the ISS), regional cooperation (such as the European Space Agency) and bilateral cooperation (such as the examples below). According to Noichim (2008: 10-12), when countries in the same geographical region cooperate in space issues and exploration they gain substantial benefits such as:

- Reducing natural resource competition such as the competition for the geosynchronous orbit, which is a limited resource;
- Increasing space S & T expertise;
- Increasing economic development; and
- Building knowledge of space together and addressing matters of mutual concern.

Individual IBSA Member States engage in various diplomatic practices related to space S & T.

Within the UN System: Subsequent to the launch of Sputnik-1, the UNGA established an ad hoc Committee on the Peaceful Uses of Outer Space (COPUOS), which, in 1959, was re-designated as a permanent Committee on the Peaceful Uses of Outer Space. COPUOS' mandate includes reviewing the scope of international cooperation in peaceful uses of Outer Space, devising programmes to be conducted under the UN's auspices, encouraging ongoing research, disseminating information on Outer Space matters, and studying legal challenges arising from the exploration of Outer Space. COPUOS performs its mandate through two standing Subcommittees, namely the Scientific and Technical Subcommittee and the Legal Subcommittee.

Developing countries' involvement in international space cooperation is very low. In fact, in April 2008, the Legal Subcommittee of COPUOS stated, '...the

transfer of space technology (not only North-South, but also South-South – my insertion) would increase the level of participation of developing countries in space activities and serve as an incentive for such countries to adhere to the United Nations Treaties on Outer Space' (COPUOS, 2008a: 7).

Almost from its inception, Brazil and India participated in COPUOS, whereas South Africa only joined it in 2004 (COPUOS, 2008b: internet).

Bi and Multilateral Space Diplomacy: Internationally, cooperation on space S & T is reflected in the diverse functional cooperative and regulatory activities coordinated by inter-governmental organisations such as, for example, the International Telecommunications Satellite Organisation (ITSO), the International Telecommunications Union (ITU), the International Maritime Satellite Organisation (IMSO) and the World Meteorological Organisation (WMO) (Sheehan, 2007: 71).

Established in 1994, the Brazilian Space Agency (AEB), under civilian control, is an example. The leading Latin American space agency, the AEB operates a spaceport at Alcântara and a. Initially, the AEB relied heavily on the US, but as issues pertaining to technological transferred emerged, it started to cooperate with developing countries such as, for example, Ukraine, Israel, Argentina and China. Brazil's bilateral international space cooperation includes, for example, cooperation with Ukraine, India and China.

The Indian Space Research Organisation (ISRO) was established 1969. Today, India's international space cooperation includes cooperation with, for example, Canada, China, European Space Agency, France, Germany, Hungary, Indonesia, Mauritius, Norway, Russia, Sweden, Syria, The Netherlands and Ukraine (ISRO, 2008: internet).

Developmental Diplomacy: Various initiatives and activities by states and commercial actors are indicative of the growing realisation that space S & T should be applied to address development challenges. In Brazil, China and their neighbouring countries have already benefited from the joint venture between China and Brazil, the China-Brazil Earth Resources Satellite (CBERS). Since 2004, it has, for example, distributed more than 320 000 images at no cost to these countries to be used in applications such as forest monitoring and agriculture support (COPUOS, 2007: 6).

Notwithstanding these diplomatic practices, which can be elaborated, IBSA collectively and its Member States individually are advantaged and disadvantaged by the International Political Economy (IPE) of Outer Space.

The International Political Economy of Outer Space

As states and private sector actors increasingly compete in the space industry, the International Political Economy (IPE) of Outer Space is amplified. IPE can be defined as the power relations that exist between states and businesses over access to and the distribution of resources such as power, influence, profit, intellectual property, services and technological expertise. Interactions between states and between states and commercial non-state space enterprises are intensely political, and rivalry over natural, political and economic resources, access to it, the ability to sell or distribute it, as well as the ability to generate it is increasingly distinguishing powerful and weak states from each other. This section identifies some of the major manifestations of the IPE of Outer Space, the main actors (states and commercial entities), and the main drivers (power, prestige and profit) of space-related activities. Moreover, existing rights and responsibilities in terms of International Space Law (ISL) is either insufficient or unenforceable, which contributes to actors' divergent interpretations of ISL. States' rights pertaining to Outer Space includes, for example equal access, whereas their responsibilities include, for example, the use of Outer Space for peaceful purposes only and the fact that Outer Space is regarded as part of the global commons. The strong emphasis on states has not kept up with the increased commercialisation of Outer Space – and therefore the need to develop International Commercial Space Law. The next section identifies the legal challenges posed to IBSA Member States in this regard.

The Role of States: A country's involvement in space-related activities is costly, lucrative and prestigious. No state's space program is driven by scientific interests only. Sheehan (2007: 1) observes that *'In space, as on Earth, we see the political power of ideology and nationalism, the use of propaganda and foreign aid, the centrality of questions of 'national security' and the pursuit of that security through the acquisition of military capabilities, tensions between the richer, more industrialised advanced states, and the poorer countries of the 'South.'* Space S & T are significant drivers of countries' wealth and power. Access to, the innovation

of and the distribution of space S & T has upset the balance of power between states, their wealth, status, prestige, and influence. Technological determinism - and its corollary social determinism - has resulted in technologically advanced countries to be politically more stable, economically more prosperous, and more educated.

Governments often take responsibility for the political and budgetary aspects of a state's space programme, the maintenance of space facilities, and its international space law obligations. A government's space policy and national legislation provides, or not, assurances to the space industry and foreign investors in these domestic industries. Primarily, governments want to decide who gets what, where, when and how in their state and prefer to control key space technology assets, whereas commercial enterprises such as multinational corporations need profits, clients and markets.

The IPE of Outer Space manifests also in states' developmental policies. Developed and developing countries agree that recourse to space technology can greatly enhance socio-economic development. A growing number of developing countries such as, for example, Argentina, Brazil, China, India and Nigeria are implementing national space programmes with a strong developmental focus (Z-Coms, 2006). Nigeria, for example, has stated that it regards its National Space Policy as 'an essential tool for its socio-economic development' and, in August 2002, South Africa with the UN and the European Space Agency (ESA) in support of the World Summit on Sustainable Development (WSSD), co-hosted a workshop on 'Space technology provides solutions for sustainable development'.

The Weaponisation of Outer Space: The USSR's launch of Sputnik in 1957 launched the space race. Now a different space race is emerging, which is increasingly featuring developing countries' space capabilities and ambitions. India, for example has announced its plans for a manned space program, and the European Union is set to collaborate on a manned space effort with Russia. China has satellites circling the moon, and India and Russia are also working on lunar orbiters.

The Commercialisation and Commodification of Outer Space: Globally, technology structures societies and global interactions by creating hierarchies of

power between the haves and have-nots, suppliers and users, and between states and market-driven multinational corporations (Chadwick, 2006). Advances in space technology, changes in the nature of space activities, and the increase in the number of space actors and the volume of such activities have contributed to the increased commodification and commercialisation of Outer Space (COPUOS, 2008: 9).

The Increased Competitiveness of Developing Countries: Increasingly, the ‘space club’ opens up to developing countries. Recently, the 2008 Space Competitiveness Index (Table 3), which ranks nine leading space countries according to 40 indicators of government spending, human expertise and the private sector, confirmed this.

Table 3: The Space Competitiveness Index
(The Economist, 7 April 2008: internet)

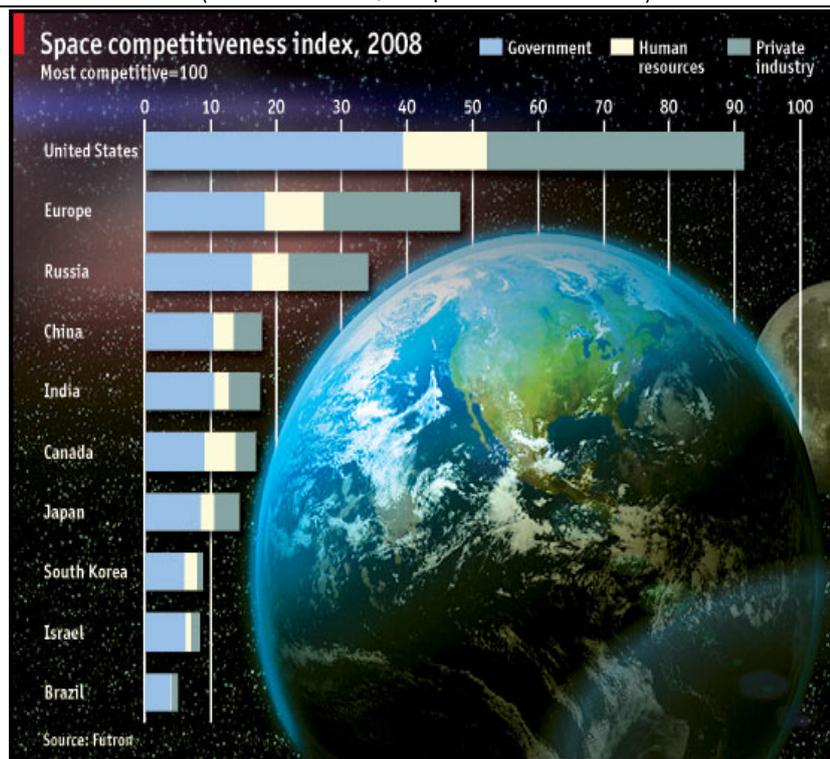


Figure 1: Elaborates on the indices of these states' competitiveness.

The Role of the Market: Space is big business. The increased commercialisation and militarisation of Outer Space has resulted in private actors competing with states. One implications of this development is the increased competition over the geosynchronous orbit, which is the orbit around the Earth where satellites operate. The use of and access to this limited resource is allocated by the ITU, an inter-governmental organisation, which excludes non-state actors from the allocation of resources.

The global satellite industry is a major driver of the IPE of Outer Space. Between 2002 and 2007, for example, the global satellite industry revenues reported an annual growth of 11.5%; i.e., from US\$ 71.3 billion to US\$ 123 billion. With its growth of 18% between 2002 and 2007, global satellite services remain the driver of the satellite industry (Satellite Industry Association, 2008: 5, 6 & 7). By 2003, revenues in excess of US\$ 91 billion were generated by the global satellite industry, and the consumption of satellite-based telecommunication and sensing services amounted to more than US\$1 trillion (Gallagher, 2005).

The global satellite industry consists of four industry segments.

One, satellite services including satellite television and radio broadcasting, remote sensing, mobile data and voice, and broadband. Space is now a \$100 billion per annum industry of global positioning systems, weather forecasting, mapping, and satellite TV and radio (*Washington Post*, 9 July. 2008: internet).

Two, satellite manufacturing including component manufacturing. By 2000, the global satellite industry has generated US\$64 billion and, by 2008, US\$ 90 billion in revenues (RSA, 2008: 13).

Three, the launch industry such as launch services, launch vehicle manufacturing and component manufacturing. As the privatisation of space affairs increases, more objects will be launched which will increase competition between states and commercial multinational corporations in the space industry. Currently, only eight states have an independent launch capability, whereas 27 – compared to three in 1980 – states have satellite-based earth observation resources. From 2006 to 2007, the global launch industry reported an increase of 19% in its annual revenues. By 2009, 25 space agencies operated globally (De Montluc, 2009: 20-28). Moreover, since 1957, approximately 6000 satellites

have been sent into orbit (*BBC News*, 12 February 2009: internet). The increase in launched objects eventually adds to space debris. It is estimated that of the 18000 tracked objects travelling around Earth that are larger than 10cm, only 900 are active satellites. The rest constitute space debris, which includes fragments from space equipment. The slightest piece of space debris can derail and destroy any communications or surveillance satellite (*The Economist*, 21 February 2009: 12). This was clearly illustrated by, for example, the collision of a US communications satellite with a defunct Russian satellite (launched in 1993) in February 2009. This situation calls for an innovation of the Registration Convention to address this issue as well as for a Convention on space debris; separate from the Liability Convention. Moreover, the legal definition of 'launching state' remains elusive and requires legal certainty.

Table 4 refers to the number of space vehicles launched between 2002 and 2005. The global launch industry earns states such as Russia, the US and France, which have launch facilities, major revenues annually. India and China, both regarded as developing countries, are two of the major launching states, which attract foreign investment to these countries.

Host country	2002	2003	2004	2005
Russia	23	19	17	21
United States	18	24	21	15
France	11	4	2	5
China	3	6	2	3
Japan	2	2	0	2
India	1	2	1	1
Israel	1	0	0	0
Sweden	0	0	1	1

The US has been largely pushed out of the business of launching satellites for other nations. Russia, India and China have become the preferred choice. Their clients include, for example, Nigeria, Singapore, Brazil, Israel and South Africa. The ESA is cooperating with China on commercial ventures, which includes a rival to the US space-based Global Positioning System (GPS). South Korea, Taiwan and Brazil have indicated their plans to further develop their space programs with the possibility of becoming low-cost satellite launchers.

Furthermore, Brazil and South Korea are both developing fully home-grown rocket and satellite-making capacities (*Washington Post*, 9 July 2008).

Four, ground equipment such as control stations, mobile terminals, direct broadcast satellite dishes, handheld phones, digital audio radio service equipment and global positioning system (Satellite Industry Association, 2008: 3). India, for example, established the Antrix Corporation Limited for the promotion and commercial exploration of products and services from the Indian Space Programme. Antrix markets Indian space products and services to global customers, including the global marketing of Indian Remote Sensing (IRS) Satellite Data Products. Antrix has also established International Ground Stations (IGS) and International Reseller Network to receive process and market IRS data products. It also supplies of reliable satellite systems and sub-systems. Furthermore, it has successfully launched commercial satellites such as Kitsat (Korea), Tubsat (DLR - Germany), BIRD (DLR – Germany), PROBA (Verhaert, Belgium), Lapan Tubsat (Indonesia), Pehuensat-1 (Argentina) aboard the ISRO's Polar Satellite Launch Vehicle (PSLV) in addition to the dedicated launch of Agile (Italy). It also provide support services to international space agencies such as availing services include World Space, PANAMSAT, GE Americom, AFRISTAT, and SHINSAT; Finally, Antrix provides a telemedicine network in different states of India (Antrix Corporation, 2008: internet).

Unequal Access to and Use of Limited Resources: Technologically advanced countries continue to benefit from the increased saturation of the geostationary orbit as these countries have the technology to access this limited resource. This discriminates against developing countries – especially those with a specific geographical position (COPUOUS, 2008a: 14). This is exactly the type of legal and economic imperialism that IBSA strives to terminate. If the developed and industrialised countries' approach continues, it will result space science and technology for development failing. Although it is need-orientated and to some extent ecologically sound (if the UN Treaties on Outer Space are adhered to), space applications for development is often not endogenous, cannot be self-reliant, and, for developing countries, is not based on the structural transformations of social agents and structures.

If IBSA is to achieve its objective (cited in the Introduction), it needs to offer practical legal and political solutions to global inequalities pertaining to the IPE

of Outer Space. This confronts the organisation with certain legal challenges – some of which individual IBSA Member States have attempted to address. Collectively, IBSA can be a major voice of the South in democratising Outer Space through the legal innovation of ISL.

Legal Challenges

IBSA's cooperation on space S & T is affected by several legal challenges and constraints which are discussed – albeit not exhaustively – in this section.

The Need for Urgent Innovation in ISL: The major tenets of ISL emanated from the Cold War period. Subsequent innovations remain currently insufficient to keep up with the increased commercialisation and commodification of space, which negatively affects developing countries. The five major UN Treaties on Outer Space requires strengthening and innovation. These Treaties' predominant state focus should be complemented by providing for the rights and obligations of non-state space actors.

The regime regulating dispute settlement is outdated. Here, the establishment of a permanent International Space Court (ISC) may be considered as the dispute settlements in existing Treaties are either outdated or not enforced. The UNSC plays a dominant role in space security matters. With strong space powers on the UNSC that can veto any decision which may affect their space weaponisation programmes, the rest of the global community are subjected to this. An ISC may be needed to address this situation.

There is a need for legal clarification pertaining to the definition of 'peaceful use of Outer Space' and 'launching state'. A definition is important as it will not only restrict actors, but also provide them with certain rights.

Establishing a New Outer Space legal regime: There are preliminary efforts to re-design the international space regime. Led by NASA from 2006, a group of 14 space agencies developed the Global Exploration Strategy outlining the rationales, objectives, schedules of future space exploration and exploitation (Schaffer, 2008: 94-103).

The Unequal Sharing of Limited Space-related Resources: Despite more developing countries acquiring space interests and capabilities, access to and the

benefits from space remain unequally distributed between the North and the South; notwithstanding the fact that ISL guarantees these rights. The following is illustrative of this. Declared a limited resource by the International Telecommunications Union (ITU) in 1973, GEO positions and radio frequencies are increasingly demanded by commercial and non-state commercial state entities, which, for example, have extended financial interests in the satellite industry. In 2004, for example, the global satellite industry generated US\$ 103 billion, and is expected to generate US\$ 158 billion by 2010. Telecommunication services are the largest segment of these revenues. The global space industry market is estimated to be US\$145 billion over the next decade, whereas the satellite market is estimated at US\$104.5 billion and the launch market at US\$40 billion. The growing demand for GEO positions and radio frequencies for military purposes contributed 45% of all satellite service revenues from 2002 to 2007, with the wars in Iraq and Afghanistan demanding large satellite bandwidths to support coalition military operations (Jakhu, 2007: 173-208).

Powerful States' Pre-occupation with National Rather than Global Security: Most countries strive to achieve common objectives such as security, autonomy, welfare, and status and prestige. States' search for national security is confirmed by the fact that all states maintain military forces to protect its national security, which governments often claim is subject to threats and vulnerabilities. The latter often refer to empirical characteristics of a state, namely its geographical location, which may make it easily accessible for an intervening military force. Threats refer to those vulnerabilities which an adversary can exploit. An important aspect of security is self-reliance. States want to maintain independence from others and address the needs of its population.

Space S & T applications improve states' national security. The US is by far the most dependent state in this regard. The usefulness of the application of space S & T in security matters is clearly illustrated in 2006 when electronic jammers in Libya interfered with the Thuraya satellite telephone system, apparently because the Libyan government wanted to make life difficult for smugglers in the Sahara desert (*The Economist*, 17 January 2008).

According to Hirst (2007: internet), the IBSA bloc has been particularly careful when addressing security issues. On the one side, no mention has been made of

an agenda involving South America, South Asia or Southern Africa conflict-resolution, regional security and/or even humanitarian intervention; On the other, the use of the concept of human security which addresses social and environment disruptions as threats has been avoided. However, IBSA has produced statements on disarmament and nuclear non-proliferation issues. It also has improved intra IBSA defence co-operation. All these three countries are major consumers of defence and related equipment.

Following on IBSA agreements on aviation and maritime co-operation, a joint IBSA naval exercise took place in 2008 (Matijila, 2007: internet). It was the first time, according to the South African Minister of Foreign Affairs (now called the Department of International Relations and Cooperation) that 'the three nations are cementing the geopolitical alliance with military cooperation - off the coast of Cape Town, as part of the IBSA maritime camaraderie (Dlamini-Zuma in Benton, 2008: internet).' 'Such exercises raised the visibility of the IBSA alliance and as such were very important', according to the Brazilian Minister of Foreign Affairs, 'allowing the world to see how the three countries worked together and provided an evolving geopolitical identity (Amorim in Benton, 2008: internet).'

If, and when, greater IBSA cooperation spills over to the security field, it can result in coordinated initiatives such as peacekeeping and humanitarian intervention. Hirst (2007: internet) suggests that this can contribute to the promotion of the UN' *An agenda for peace* via IBSA's involvement in conflict prevention and post-conflict rehabilitation. Second, it can promote a collaborative agenda between the UN and regional bodies (OAS, AU, ASEAN, MERCOSUR). Hirst (2007: internet) states,

'IBSA states could also lead in defining a new model for multilateral security measures. Indeed, it has become crucial to avoid the worrying tendency for humanitarian intervention to replace development aid, as it is for trade negotiations to subordinate to security priorities, and for formal democratic rule to overlook the protection of human rights. But this kind of cooperation will move more slowly. While the possibility of deepening inter-regional relations is one of IBSA main attributes this potential is accompanied by a subtle premise of non-interference in each other's

regional affairs. Notwithstanding, inter-regionalism can be meaningful in a world where regions are to become relevant actors in the promotion of political and security stability.'

The Increased Weaponisation and Militarization of Outer Space: The myth of space demilitarisation after end of Cold War endures as the US, China and Russia continues with military space programmes. The OST forbids nuclear weapons and weapons of mass destruction in the Earth's orbit or on Celestial Bodies. States are forbidden to establish military stations or conduct any military manoeuvres on the Moon or other planetary objects. However, the Treaty does not address the transit of nuclear weapons through space, the placement of conventional weapons in space and the launch of nuclear weapons from Earth into space. The militarization and weaponisation of space is further complicated due to the fact that none of the UN space Treaties defines or clarifies the 'peaceful use of Outer Space.'

Satellites continue to be part of warfare operations. Satellites do not execute actual combat operations, but are used, for example, to guide ground forces or give detailed intelligence information on potential targets. Anti-Satellite (ASAT) weapons and ballistic missiles, i.e., weapons intended to intercept missiles during their mid-course trajectory through space, remains the biggest concern. Hilpert (2007: internet) distinguishes between space weapons, 'Ballistic missiles are capable of intercepting Intercontinental Ballistic Missiles (ICBMs) while they are on their trajectory through space while ASAT weapons or systems can potentially be deployed from Earth or be carried by a satellite and are directed against satellites.' The US, China and Russia have already successfully conducted an ASAT weapons tests, which has created large amounts of space debris.

For the US', modern warfare relies on satellites. Four-fifths of America's military data is transmitted through commercial satellites. A single Global Hawk unmanned surveillance aircraft flying over Afghanistan can use several times more satellite bandwidth than was used for the whole of the 1991 war against Iraq (*The Economist*, 17 January 2008).

Several initiatives attempt to address the weaponization of outer space. A comprehensive disarmament of space is advocated by the UN Conference on Disarmament (CD), which has been deadlocked since 1998 when the US

opposed its plans to adopt a multilateral agreement on the Prevention of an Arms Race in Outer Space (PAROS). Hilpert (2008: internet) concludes, 'Without full support of the US, it will be difficult if not impossible for the international community to prevent the weaponization of space.' The EU is also currently formulating a code of conduct pertaining to this matter and, in February 2008, Russia and China jointly presented a treaty draft to ban weapons in space (Hilpert, 2008: internet).

Strengthening Legal Regulatory Regimes: IBSA Member States participate in numerous multilateral space-related fora such as COPUOS and GEOSS. There is a need for greater international involvement, cooperation and coordination to strengthen the international regulatory regime in order to provide uninterrupted telecommunication services.

Global Socio-legal Reform: IBSA Member States have placed special emphasis on the need to reform the UN framework and the current international financial architecture. In this regard, Hirst (2007: internet) observes, 'IBSA criticizes the distribution of power in specific agendas. Its aim is to push for the participation in the rule-making inner circle instead of accepting the condition of passive rule-takers. In this sense it intends to politicize but not ideologize world politics and economics. Furthermore the coalition has developed a niche diplomacy approach which addresses topics such as: the Palestine-Israeli peace process, the stability and unity of Iraq, a diplomatic solution for the Iranian nuclear program, the re-engagement in substantial work of the Conference on Disarmament.'

Space S & T in the Service of International Humanitarian Law: Consecutive meetings of COPUOS and the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) in 1999 have reiterated that the application of some types of space technology can enhance human security by, for example, reduce the risk of natural disasters, forecast crop yields, monitor environmental degradation and prevent the spread of infectious diseases (UNGA, 2007). For developing countries not in a position to participate in, develop and apply space technology, COPUOS system remains 'their preferred agent for deliberation and guidance for space affairs as well as a forum in which to express their political views (Sheehan, 2007: 130).' In this regard, Sheehan (2007: 130) states, COPUOS 'is the focus of their [developing

countries'] hopes and aspirations, fears and concerns, with respect to space. It provides the major forum for space-related issues – new regulations, proposed restrictive regimes, and challenges to Western world policies, politics and business practices.'

With the development of the norm of Responsibility to Protect (R2P), which was adopted by the UN, Member States can apply space S & T to International Humanitarian Law. Space technology is applied to, for example, early warning systems pertaining to droughts, floods and fires, as well as to the large population movements. Furthermore, space S & T's application can be useful in other areas such as the environment and population dynamics, desertification and erosion prevention, agriculture, food security, crop prediction, inventories and management of natural resources such as forests, oases, groundwater, dams, coasts and lakes, land-use and planning, monitoring volcanoes and earthquakes, and infrastructure development (COPUOS, 2007: 18-22, Kasturirangan, 2007: 159-166, Padma, 2007: internet).

The next section presents some recommendations to IBSA to address these legal challenges.

Recommendations to Overcome Legal Challenges

A significant driver of regional integration is states' cooperation on a particular issue. For IBSA, an integrated space policy can result in developing certain types of applied space technology, joint sponsoring of research and development on space, shaping market conditions for the space industry and for security purposes (Sheehan, 2007: 87). However, the 'nationalist nature' of space programmes is increasingly evident (De Montluc, 2009: 20-28). States' space capabilities are increasingly politically-coloured symbols of national pride, power and prestige. This 'techno-nationalism' is changing the geo-politics of space activities (Sheehan, 2007: 9). Developing countries are increasingly developing this asymmetrical capability, which contests the existing balance of space power (De Montluc, 2009: 20-28).

This section outlines some recommendations to IBSA to overcome legal challenges pertaining to improving greater regional and global cooperation on space S & T.

To IBSA

1. Strengthening intra-IBSA cooperation by signing Memoranda of Understanding, Protocols or agreements on space cooperation and include issues such as dispute resolution mechanisms and liability, identify areas of cooperation. These agreements can be similar to the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). Desirable criteria for a space collaboration mechanism must protect and advance the interests of IBSA, have the political backing of all IBSA Members States, have a clear scope but can allow Member States to retain some independence in key areas of national interest, protect strategic technologies and provide for technology transfers to other developing countries, be able to evolve over time, enable IBSA to engage with other multilateral space actors and be formalised in terms of ISL.
2. Establish an IBSA Working Group on International Space Law to contribute to the development of International Space Law on matters such as space debris, the militarization of space, the geostationary orbit, the definition of air space and Outer Space, and the role of developing countries;
3. Propose a permanent International Space Court with jurisdiction over space-related matters;
4. Formulate a common IBSA space policy; and
5. Adopt a common position on space-related issues at multilateral fora such as COPUOS.

To IBSA Member States

1. Ratify, sign and comply with the UN Treaties on Outer Space, and other international space-related agreements;
2. Align national space policies and space legislation with these Treaties and Conventions.

3. Establish research and exchange agreements between national space agencies.
4. Prioritise research and development in International Space Law, space sciences and technology development, application and management.
5. Develop space-related industries and service sectors to promote economic growth.
6. Establish Centres for Space Policy and Law Studies.
7. Invest in national launch industries.

To IBSA Academics, Civil society, Non-governmental Organisations

1. Arrange parallel events with IBSA and national space-related conferences;
2. Establish an IBSA-wide organization to identify issues of common concern and priority areas of common interest, and develop mechanisms for regional cooperation;
3. Compile a database of IBSA experts; and
4. Host an IBSA Space Leadership Conference.

To IBSA Foreign Affairs Ministries

1. Prioritise International Space Law in IBSA;
2. Educate and train diplomats in multilateral space diplomacy;
3. Educate and train officials in space science and its application to development;
4. Establish an intra-governmental IBSA and ISL Working Group;
5. Attend and participate in international space-related conferences, meetings and events; and
6. Establish directorates for Space Diplomacy and ISL.

Conclusion

IBSA consists of regionally-based middle powers, but, more importantly, these powers are *developing* countries. Moreover, IBSA as an institution is highly symbolic and, as Hirst (2007: internet) asserts, 'All three [IBSA Member States] carry strong identities within the international community: South Africa stands for the struggle against racism, India for the largest democracy and Brazil for the promotion of sustainable development.' IBSA remains an evolving trilateral inter-governmental organisation. One way of strengthening its integration and achieving its objectives is to concentrate on one particular area of mutual interest: space S & T. India, Brazil and South Africa have relatively well developed space expertise and interests. Moreover, these countries have individually committed themselves to the major Treaties, Agreements and Conventions on Outer Space. However, IBSA's space ambitions as well as that of its Member States are disadvantaged by the drivers of the IPE of Outer Space. In order to achieve global equity, IBSA are faced with several legal challenges which have been identified here. The article concluded with recommendations to IBSA, its Members, and civil society to overcome these legal challenges which can significantly improve ISL, regional integration, South-South cooperation and development in the organisation's Member States.

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In Defense of Advertising in Space

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The prospect of orbiting “space billboards” visible from Earth has disgusted many, and prompted a law against them in the United States along with plans to ban them by international agreement. We, however, disagree with the conventional view, and find legal prohibition of such signs unjustified. This article examines proposals to put billboards in space, considers the laws affecting such billboards, refutes the aesthetic and astronomical objections to space billboards, and finally concludes that restrictions on space billboards are not justified. Instead, space billboards should be permitted out of respect for private property and free-speech rights.

I. Billboards in Space

Advertising in space is not new, or particularly controversial in itself. Pizza Hut, for example, paid to place its logo on the side of an unmanned Proton rocket in 2000¹ – and Columbia Pictures advertised the famous Arnold Schwarzenegger flop, *The Last Action Hero*, on the side of a rocket carrying the first private

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commercial space mission.² Such publicity stunts have met with little, if any, negative reaction because, after all, they involve ordinary space vehicles people might not otherwise look at, and the money the sponsors pay presumably goes to fund further space ventures.³

Hereafter, when this paper refers to "space advertising" it has in mind something more novel and provocative than those relatively mundane efforts: space billboards. For more than a decade, technology has existed that could put billboards in space. Not merely billboards for the many anticipated space tourists of the near future to see as they pass by,⁴ but actual signs in low orbit that would be visible from the Earth's surface.

The first and, to our knowledge, only serious proposal to place billboards in orbit around the Earth came from Michael Lawson, chief executive officer of Space Marketing Concepts, Inc., in April 1993.⁵ He proposed "environmental billboards" that would carry – in addition to a marketing message – scientific instruments such as "ozone measuring devices."⁶

According to a report by the International Astronomical Union, the Space Marketing billboards would have been about one square kilometer in dimension and would have been comparable to a full moon in their size and brightness in the sky.⁷ Other reports, however, have suggested that space billboards might appear half the size of the moon, perhaps one tenth as bright, and only visible during certain hours, around dusk and dawn.⁸

Lawson's grandest and most specific proposal involved space billboards promoting, or visible during, the 1996 Olympic Games in Atlanta.⁹ The City of Atlanta's marketing director even proposed advertising the city itself on a space billboard to then-Mayor Maynard Jackson. He rejected the idea, deeming space billboards "environmental pollution" and noting that – proud as he presumably was of his city – he did not want to see a space billboard promoting it or anything else in the sky.¹⁰

Lawson's scheme failed for lack of funding – i.e., no one wanted to pay what it would have cost to advertise on one of his proposed billboards.¹¹ Nonetheless, his plans prompted the United States Congress to ban "obtrusive space

advertising" and establish a policy of encouraging other countries to do the same, as discussed in detail in the next section. As a result, no new space-billboard schemes appear imminent, at least in America.

Russian spacecraft designer Alexander Lavrynov, however, purports to have invented a method by which multiple satellites employing sunlight reflectors could create advertising images in the sky visible from Earth.¹² His plan's technological and economic feasibility remain unknown, but Russia has been at the forefront of other space advertising efforts,¹³ and also notably launched a failed space mirror intended to light up the night sky in 1999.¹⁴

II. The Law of Space Advertising

A. The United States

As noted above, entrepreneurial efforts to launch space billboards prompted the United States Congress to essentially ban "obtrusive space advertising," defined as "advertising in outer space that is capable of being recognized by a human being on the surface of the Earth without the aid of a telescope or other technological device."¹⁵

The statute,¹⁶ added October 30, 2000, provides:

Notwithstanding the provisions of this chapter [49 U.S.C. §§ 70101 et seq.] or any other provision of law, the Secretary [of Transportation] may not, for the launch of a payload containing any material to be used for the purposes of obtrusive space advertising –

1. issue or transfer a license under this chapter; or
2. waive the license requirements of this chapter.

The statute further prohibits anyone already holding a license from launching such a payload,¹⁷ and exempts "nonobtrusive commercial space advertising, including advertising on (1) commercial space transportation vehicles; (2) space infrastructure payloads; (3) space launch facilities; and (4) launch support facilities."¹⁸

Finally, when it passed the above statute, the US Congress also made requests of the US President: ¹⁹

1. The President is requested to negotiate with foreign launching nations for the purpose of reaching one or more agreements that prohibit the use of outer space for obtrusive space advertising purposes.
- 2 It is the sense of the Congress that the President should take such action as is appropriate and feasible to enforce the terms of any agreement to prohibit the use of outer space for obtrusive space advertising purposes.

In May 2005, the Federal Aviation Administration proposed new regulations enforcing this statute – essentially seeking to add to the Code of Federal Regulations the same language already in the statute, directing the FAA to review payloads "to determine if the launch of [a] payload would result in obtrusive space advertising."²⁰ Although the proposed regulations would have added nothing substantive to the already-existing law, they drew strong comments pro and con from the public.²¹ Ultimately, the FAA did not adopt the proposed regulations because it concluded that "the statutory prohibitions are sufficient to prevent the launch of a payload containing obtrusive space advertising."²²

To our knowledge, the United States so far has not had an occasion to enforce its prohibition on obtrusive space advertising.

B. The Rest of the World

The international agreements on space advertising that the United States Congress exhorted the President to enter have yet to materialize. Other major spacefaring nations, notably including Russia, have not enacted similar bans.

Little evidence exists that an international ban is a high priority. Sergei Negoda of the United Nations Office for Outer Space Affairs told NEWSWEEK in 2005 that the issue was "not on the agenda" and likely would not be "unless all member states . . . reach a consensus." He added that the present push for the commercialization of space (also spearheaded by Americans) made such an agenda item unlikely.²³

To our knowledge, no one has attempted to argue specifically that existing international law bans space advertising. Some, however, have of course maintained that the 1967 Outer Space Treaty – the foremost document in international space law – bans private property or restricts commercial activity in outer space generally. Such views have been widely rejected, however, and seem unlikely to find much support in light of the ever-increasing drive for private entrepreneurial activity in space.²⁴ Some might also argue that the Outer Space Treaty bars advertising because it requires that outer space be used "for the benefit of all mankind." As we will see below, however, benefits are subjective, and what is a benefit to one person almost certainly will not be viewed as a benefit by another – and conflicts between the two can only be resolved by the arbitrary exercise of violence in the absence of private property rights.

III. Aesthetic and Astronomical Objections to Space Advertising

The primary objections to advertising have been in two categories: aesthetic and astronomical. That is, people have claimed that space advertising should be restricted or banned because of the advertising's supposed aesthetic offensiveness, or because this mode of communication would restrict the supposedly more important activities of astronomers.

In this section, we consider these arguments and offer some ideas on why these objections fail to justify a ban on space advertising. In the next section, we will offer our view that private property rights are the only means of resolving the disputes regarding the appropriateness of space advertising.

A. Aesthetic Concerns

Perhaps the most widespread objection to space advertising is aesthetic.

For example, in exhorting his fellow Congressmen to enact the US ban on space billboards, Representative Edward Markey disparaged such advertising by claiming it would "turn our morning and evening skies, often a source of information and comfort, into the equivalent of the side of a bus."²⁵ A pamphlet from a gloomily monikered group called the International Dark-Sky Association declares that "worse still" than the alleged astronomical problems space

billboards cause is "the destruction of the pristine beauty of humanity's view of the universe."²⁶ A commenter on the FAA's proposed regulation of obtrusive space advertising argued that such advertising should be prohibited because of its similarity to "ugly billboards along highways."²⁷ And a legal commentator advocates a treaty banning such advertisements worldwide because of their potential to "interfere with nature in a truly profound way."²⁸

These negative views, however, do not tell the whole story.

1. Some People Just Might Like Space Billboards

While it is true that many people dislike the sight or even the thought of billboards or other publicly displayed advertising, it is not true that everyone feels that way. If everyone agreed, there would be no controversy.

In fact, some people appreciate terrestrial billboards for the information they convey.²⁹ Others may appreciate them simply for breaking up what they consider to be the monotony of the natural landscape.³⁰

In some cases, people may enjoy billboards aesthetically, independent of the substance of the billboards' message. For example, Sony recently hired graffiti artists to paint the sides of abandoned buildings – without even mentioning its brand names or indicating that it was advertising – to advertise its PlayStation Portable video game machine in Philadelphia. Some "anti-blight" advocates were appalled – but others appreciated the graffiti as "art" and considered it an improvement over the status quo.³¹

Further, in holding their apparent view that advertising is everywhere and to everyone unpleasant, anti-advertising advocates seem to forget that advertising is *intended to appeal* to as many people as possible in order to sell them a product.³² An advertisement that disgusts its viewers is unlikely to serve its purpose well. As economic journalist Virginia Postrel has noted, "Competition pushes commercial artists to create attractive, visually appealing images."³³

Indeed, given that advertisements are generally designed to be pleasing to people, it seems that those who only wish to see nature unfettered have the more peculiar view. After all, it is merely an accident that the Moon's face has been scarred in the way that it has been over the eons. What if, instead of looking

somewhat like a "man in the Moon", the Moon's face coincidentally looked like the Pizza Hut logo? In that case, presumably the anti-advertising advocates would have no problem with the logo's presence and would insist that no one tamper with it. So why is a given image acceptable only because it occurred according to no one's design? It seems to us that anti-advertising advocates bear a heavy burden in attempting to defend the accidental status quo over images actually intended to please and presumably benefit³⁴ humans.

2. A Sky Full of Spam?

Granted, there is at least one form of advertising that virtually everyone hates: e-mail spam. Indeed, spam has been invoked to scare people into supporting space billboard prohibition.³⁵ But e-mail spam is fundamentally different from ordinary spam in two critical ways.

First, there are the economics. E-mail spam is almost costless to transmit, so although almost everyone other than its senders hates it, even a tiny handful of favorable responses may make the enterprise worthwhile.³⁶ Further, spam is not necessarily intended to advertise to or otherwise please the recipient – often it contains nonsense or obscenities serving no apparent purpose. Space billboards, in contrast, would be expensive to create and launch. Indeed, the billboards Lawson proposed in 1993 apparently were so expensive (reportedly \$15 to 30 million)³⁷ that no one was willing to buy space on one. Presumably as technology improves, costs will decrease – but it seems highly unlikely that a spam-like glut will occur, with or without a ban.

Another crucial distinction between spam and space advertising is relevant to our argument in the section that follows. The spammer invades the property rights of the computerowner who does not wish to receive spam,³⁸ often with impunity because of the ease of hiding one's identity online. Space advertising, however, does not necessarily intrude upon property rights: a person who owns property on Earth does not own the sky above it, nor does anyone else who has not in some way actually possessed the space.³⁹

3. Space Advertising is not Aesthetically Unique

The idea that space advertising presents a novel situation requiring unprecedented legal restrictions fails, because similar forms of advertising already exist.

For example, at present, one can already advertise in the sky by pulling a banner behind an airplane. The Goodyear blimp provides another example of an arguably obtrusive advertising presence overhead – which tends to delight rather than disgust virtually all who catch a glimpse of it.

A case of space-advertising-in-reverse also recently occurred, as men's magazine *Maxim* placed a 75-by-100-foot reproduction of a magazine cover featuring actress Eva Longoria in the Nevada desert.⁴⁰ Whether or not this was actually "big enough to be seen from space," as the magazine boasted, it surely was visible to those, say, flying over in an airplane, whether they liked it or not.

Some may distinguish these examples by stating that those advertisements can only be occasionally seen in a relatively limited geographical area, while space billboards could conceivably always be visible.⁴¹ But to date no one except space billboards' opponents has raised the prospect of advertising that would be visible at all times, or in all places. A gigantic space billboard would likely have a limited lifespan in any event because of the large number of collisions with space debris it would face. The Space Marketing project, for example, expected its billboards to be struck by 10,000 pieces of debris per day until its ultimate destruction.⁴²

B. Astronomical Concerns

The present authors are not astronomers, and therefore do not question astronomers' claims that space advertising would make ground-based astronomical observation more difficult.⁴³ We do, however, question their claim that this justifies them in telling the rest of the world what it can and cannot do in the sky.

The common law has never recognized a right to a view – and, though it may have been altered in various cases by legislation, it still does not.⁴⁴ That is, for example, if A buys a piece of property and makes observations out of his window with a telescope, then B comes along and puts up a high rise on an adjacent piece of land such that A can no longer make his observations, A has no cause of action against B. Space advertising does not present a situation fundamentally different from this.

There are several serious practical and philosophical objections that can be leveled against the position that people have the rights to own views. First, on the pragmatic front, it would be extremely difficult to establish who owns which view. Merely looking at something is surely less discernable, not to say objective, than "mixing one's labor" with virgin territory, as in the case of homesteading.⁴⁵ Then, too, to own something is not merely to be able to (continue) to use it; it is also to be legally able to *prevent* others from so doing. Suppose Jones is the first to see the moon. Thus, under this theory, he owns the view of it. How is he to be able to prevent others from looking at this heavenly body? The problem here is that views are not rivalrous. More than two people, to say the least, can appreciate the sight of the moon. In contrast, cows, cars and candles are rivalrous: if one person uses these things, then others cannot. But the whole point of ownership in the first place is to have a rule determining which person can, and thus which one cannot, access the thing to be owned. If more than one person can look at the moon without interfering with another's view, and if, indeed, millions of people can do so, then what is the point of ownership? There isn't any.⁴⁶ Then there are truly anomalous situations; the first person to see a newborn child will in many cases be the obstetrician, not the mother or father. If view ownership is strictly interpreted – and how else are we to interpret it? – this would mean that the medical man, not the parents, is the rightful guardian of the child.

Another rule from the Roman and common law under which astronomers might claim a right to an unrestricted view of the skies has been rejected almost universally: the *ad coelum* doctrine. Under this rule, a party who owned a piece of land also owned everything above it, all the way up through the heavens.⁴⁷ This dubious doctrine necessarily died because it would have outlawed aviation and non-advertising satellites.⁴⁸

Thus, rather than invoke a property-rights rule, concerned astronomers seem to want an exception to the rules of property rights. We, however, will advance an argument for strict property rights – with no exceptions for astronomers, astronomer-lovers, or anyone else – in the following section.

For now, we will simply observe that astronomers have failed to make the case that ground-based astronomy is so essential to human well-being that it requires a deviation from the usual rules of property rights. After all, the space-based

Hubble telescope has offered unprecedented views of the universe in recent years, free from the so-called light pollution that hampers astronomers' efforts with earthbound telescopes. Undoubtedly, space advertising could reduce the overall level of astronomical observation that occurs – but astronomers have not made the case that an astronomy that tramples on the rights of others results in the economically optimal amount of astronomical research. In the absence of such evidence, the astronomers' efforts appear to be little more than common theft-seeking:⁴⁹ that is, seeking government privilege to ensure their continued employment or, at least, advancement of their own special interests.

As with the aesthetic concerns, we again face a situation of conflicting subjective preferences: some favor advertising and less ground-based astronomical observation, while others more highly rank no advertising and more ground-based astronomical research. In Section IV, below, we turn to our proposal to resolve these conflicts: strict private property rights. But first, we address some other pragmatic concerns.

C. Other Pragmatic Concerns

1. Space Advertising may be Inevitable

Regardless of the merits of the advertising haters, space advertising may be inevitable. The technology exists, and if someone wants to put up the money, he can have his name in lights in space. If the United States will not allow the launch, Russia or another country that cannot afford the luxury of turning down such business will.

If this is the case, then the issue is not whether we should allow space advertising, but whether individuals in a given country, such as the United States, should be allowed to take advantage of it. It seems to us a difficult case to make that one's countrymen should be disadvantaged vis-a-vis foreign competitors simply to make at best a fuzzy moral point.

Further, although we favor no regulation (as discussed below), those who dislike advertising may find the results of a lightly regulated domestic market more pleasing than the products of unfettered launches elsewhere – just as those who hate prostitution might, in a lucid interval, prefer regulated brothels to the

crude streetwalking that results from absolute prohibition. Advertisers may find it more economical to obey mild regulations restraining their advertisements at home than to go overseas to avoid them. Thus, those who succeed in achieving absolute prohibition of space advertising in their own country may actually harm their own cause.

2. Or It Might Not Happen at All

It may also be that space advertising will not proliferate regardless of whether it is prohibited or permitted. After all, the Space Marketing venture failed because no one wanted to pay the \$15 to 30 million the advertisements are reported to have cost.⁵⁰ If that is the case, then the prohibition may appear to be harmless. It is not necessarily harmless in any event, however, because it may discourage otherwise-useful innovation and technology that ultimately unsuccessful space-advertising ventures would have developed, or that those not primarily engaged in advertising do not develop for fear of running afoul of the space-advertising prohibition.

IV. Space Advertising, Property Rights and Free Speech

There are no objective criteria for resolving the aesthetic and subjective disputes discussed above. There is, however, a non-arbitrary means for determining whether space advertising should be permitted: private property rights. Several points must be made in this context.

Private property rights are the basis upon which all sorts of potential disputes are solved every day, before they become contentious issues. Who has the right to use a particular piano or canoe? Why, the owner of course. If ordinary decisions of this sort had to be settled by courts on a case-by-case basis, we would all die of starvation as litigiousness reached epic proportions and we simply had no time to do anything else. Judges, properly, only rule on the smallest tip of the iceberg in this regard. Virtually all other disputes of this sort are settled by property rights, with no fuss. How does this come about? Initially, virgin territory is turned into the private domain by homesteading; then, it changes hands through any legitimate title transfer⁵¹ such as trade, purchase, gifts, settlement for gambling debts, etc. Should this grocery store carry venison? Should that pizza parlor feature red or blue tablecloths? Should this car be

painted orange? Such decisions are commonly made by their owners. Why should the decision as to whether or not to allow advertising be made in any other way?

Second, property rights and free speech are inextricably intertwined. There cannot be the one without the other. For, precisely as in the case of all these other "pedestrian" decisions, the determination of what may properly be said in any given place inevitably falls upon the owner of the property in question. May David Duke or Louis Farrakhan speak at the college campus? This depends upon the views on this matter of the owners of the university, the board of trustees. Is it licit that the sonnets of Shakespeare be recited in someone's living room? That crucially depends upon the opinions on this matter of the owner of said living room. The surest enemy of free speech is to allow government to own all pens, paper, ink, printing presses, and the like. For then the issue becomes one of allocation of "society's" scarce resources, and, seemingly, no long a matter of free speech rights, of which there can be none without such implements.

Third, it is entirely possible that advertising in space will not prove economically feasible. Or, if it does, and there is an outcry against it, that anyone whose products are advertised therein will *lose* customers, not gain them. It is entirely possible that advertising might be allowed on Mount Rushmore or in the Grand Canyon, and that it would *backfire* in this regard: a corporate emblem there would be the death knell of sales. But the only way this can be determined is empirically: fashion the law so that this is allowed, and then make a determination post hoc.

Our property-rights view, though it may strike many as radical today, was once the law, not only in space, but also on Earth. In the United States, at least, Courts long recognized that aesthetic issues are inherently subjective⁵² and accordingly refused to allow governments to violate property rights solely on aesthetic grounds.⁵³ As the Ohio Supreme Court put it, "[M]ere aesthetic considerations cannot justify the use of the police power. It is commendable and desirable, but not essential to the public need, that our aesthetic desires be gratified."⁵⁴ Similarly, the California Supreme Court struck down a prohibition on terrestrial billboards in 1909, finding that the fact that "appearance of billboards is, or may be, offensive to the sight of persons of refined taste" does

not suffice to justify such "a radical restriction of an owner of property to use his property in an ordinary and beneficial way."⁵⁵ In recent years, however, the Courts have abandoned this view, essentially giving lawmakers carte blanche in restricting uses of private property because of aesthetic concerns, allowing them to do so either for its own sake or where ostensibly linked to putative "health or safety" concerns.⁵⁶

V. Conclusion

Those who would abrogate private-property and free-speech rights face a heavy burden, and here they have failed to meet it.⁵⁷ Therefore, space advertising through private property should be presumed legitimate, all laws against it should be repealed, and no treaties restricting it should be established.

Endnotes

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- 2 Don E. Tomlinson & Rob L. Wiley, *People Do Read Large Ads: The Law of Advertising from Outer Space*, 47 FED. COMM. L. J. 535, 541 (1995) (quoting Devera Pine, *Selling America on Orbiting Ads*, OMNI, Feb. 1994, at 27, 27).
- 3 Presumably criticism of such advertising efforts would come primarily from those who object to any commercial activity in space. On those who object to human activity in space generally, see J.H. Huebert & Walter Block, *Space Environmentalism, Property Rights, and the Law*, 37 U. MEM. L. REV. (forthcoming 2007).
- 4 On the booming space tourism business, see, e.g., John Schwartz, *More Enter Race to Offer Space Tours*, N.Y. TIMES, Feb. 18, 2006, at C1.
- 5 Tomlinson & Wiley, *supra* note 2, at 539 (citing *Orbiting-Billboard Proposal Gets Astronomers' Attention*, SKY & TELESCOPE, at 10, 10).
- 6 *Id.*
- 7 United Nations General Assembly Committee on the Peaceful Uses of Outer Space, Background paper by the International Astronomical Union, *Obtrusive space advertising and astronomical research* (2001) (hereafter "International Astronomical Union"), available at http://www.unoosa.Org/pdf/reports/acl05/A C105_777E.pdf
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- 11 International Astronomical Union, *supra* note 7, at 4.
- 12 *Billboard in the Sky*, *ADVERTISER* (Adelaide, Australia), Mar. 12, 2004, at 32.
- 13 See, e.g., Todd Halvorson, *Russia Takes the Lead in Space Age Advertising*, *SPACE.COM*, May 31, 2001, <http://www.space.com/news/spaceagencies/russiamarketO10531-1.html>
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- 16 49 U.S.C. § 70109a(a).
- 17 49 U.S.C. § 70109a(b).
- 18 49 U.S.C. § 70109a(c).
- 19 US Public Laws 106-391, Title III, § 322(c) (2000).
- 20 70 Fed. Reg. 29,164, 29,168 (May 19, 2005).
- 21 These can be read on the FAA docket at <http://dms.dot.gov/search/searchResultsSimple.cfm?numberValue=21234&searchType=docket>
- 22 71 Fed. Reg. 51968, 51969 (Aug. 31, 2006).
- 23 Gersh Kuntzman, *Space Invaders*, *NEWSWEEK* web-exclusive commentary, June 20, 2005, <http://www.msnbc.msn.com/id/8292906/site/newsweek/>
- 24 See, e.g., Glenn H. Reynolds, *International Space Law: Into the Twenty-first Century*, 25 *VAND. J. TRANSNAT'L L.* 225, 230 (1992) (arguing that academic consensus supports private property under the Treaty). And on the view that, regardless of what the Treaty means, it *should* allow for private property, see, e.g., Kurt Anderson Baca, *Property Rights in Outer Space*, 58 *J. AIR L. & COM.* 1041, 1083-85 (1993); Huebert & Block, *supra* note 3; Wayne N. White, Jr., *Real Property Rights in Outer Space*, in 40 *COLLOQUIUM ON THE LAW OF OUTER SPACE* 370 (1998).
- 25 *No Place in Space for Adverts*, *NEW SCIENTIST*, July 10, 1993, at 5.
- 26 *Grass Root Opposition to Space Billboards*, International Dark Sky Association Information Sheet No. 71 (2000), <http://www.darksky.org/resources/information-sheets/is071.html>
- 27 71 Fed. **Reg.** at 51,969.
- 28 Tomlinson & Wiley, *supra* note 2, at 563 (Mr. Tomlinson advocates a complete ban; his co-author, Mr. Wiley, does not).

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- 30 See, e.g., Walter Block, *Billboards*, LIBERTARIAN FORUM, Nov.-Dec. 1979, at 8.
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- 33 Virginia Postrel, *The Esthetics Police*, FORBES, NOV. 1, 1999, at 174.
- 34 Some, such as John Kenneth Galbraith (*THE AFFLUENT SOCIETY* (1958)) would disagree with this statement. But see these critiques: Friedrich A. Hayek, *The Non- Sequitur of the "Dependence Effect,"* in *STUDIES IN PHILOSOPHY, POLITICS, AND ECONOMICS* (1967); George Reisman, *Galbraith's Neo-Feudalism*, MISES.ORG, <http://www.mises.org/web/2793>. For other defenses of advertising, see Lee Benham, *The Effect of Advertising on the Price of Eyeglasses*, 15 J. L. & ECON. 337 (1972); WALTER BLOCK, *The Advertiser as Hero*, in *DEFENDING THE UNDEFENDABLE* 68 (Fox & Wilkes 1991) (1976); Walter Block, *Tobacco Advertising*, INT'L J. OF VALUE BASED MGMT., May 1997, at 221; Walter Block, *Coordination Economies, Advertising and Search Behavior in Retail Markets by Bagwell and Ramey: A Comment*, CROSS CULTURAL MGMT., Vol. 10, No. 1, at 80 (2003); Walter Block, William Barnett II & Stuart Wood, *Austrian Economics, Neoclassical Economics, Marketing and Finance*, Q. J. AUSTRIAN ECON., Summer 2002, at 51; Ronald H. Coase, *Advertising in Free Speech*, 6 J. LEGAL STUD. 1 (1977); ROBERT B. EKELUND & DAVID S. SAUMAN, *ADVERTISING AND THE MARKET PROCESS* (1985); DAVID OGILVY, *OGILVY ON ADVERTISING* (1985); MURRAY N. ROTHBARD, *MAN, ECONOMY, AND STATE* 978-83 (Ludwig von Mises Institute 2004) (1962).
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- 37 Tomlinson & Wiley, *supra* note 2, at 539 (citing *Orbiting-Billboard Proposal Gets Astronomers' Attention*, SKY & TELESCOPE, NOV. 1993, at 10).
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- 39 The precise manner of homesteading that would be necessary to acquire property rights in an orbital path or position above the Earth is beyond the scope of this paper. In any event, under no proper theory does one gain property rights in a space vast distances away simply by looking at it in its present state for a long time. The precise manner of homesteading that would be necessary to acquire property

rights in an orbital path or position above the Earth is beyond the scope of this paper. In any event, under no proper theory does one gain property rights in a space vast distances away simply by looking at it in its present state for a long time.

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- 41 See, e.g., Tomlinson & Wiley, *supra* note 2, at 563.
- 42 See International Astronomical Union, *supra* note 7, at 4.
- 43 See, e.g., *id.* at 2-3.
- 44 Walter Block, *Homesteading, Ad Coelum, Owning Views and Forestalling* (2006) (unpublished, on file with the author).
- 45 See Walter Block, *Earning Happiness Through Homesteading Unowned Land: a comment on 'Buying Misery with Federal Land' by Richard Stroup*, J. Soc. POL. & ECON. STUD., Summer 1990, at 237; HANS- HERMANN HOPPE, *THE ECONOMICS AND ETHICS OF PRIVATE PROPERTY: STUDIES IN POLITICAL ECONOMY AND PHILOSOPHY* (1993); JOHN LOCKE, *SECOND TREATISE OF CIVIL GOVERNMENT* (Henry Regnery 1955) (1690); ELLEN FRANKEL PAUL, *PROPERTY RIGHTS AND EMINENT DOMAIN* (1987); MURRAY N. ROTHBARD, *FOR A NEW LIBERTY* (1973).
- 46 N. Stephan Kinsella makes the same point with regard to patents and copyrights; once the information is widely known, A's use of it detracts from B's use by not one whit. See N. Stephan Kinsella, *Against Intellectual Property*, J. LIBERTARIAN STUD., Spring 2001, at 1.
- 47 This highly problematic doctrine could be interpreted to cut both ways. That is, according to *ad coelum*, the owner of a few square miles of earth, and thus the proprietor of an increasing sized conical area extending up into the "heavens," would be justified in placing advertising in "his" area of ownership miles above the earth.
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- 49 The term most economists would use in this context is "rent seeking." See Gordon Tullock, *Rent Seeking*, in 4 THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS 147 (1987). But we see no need to besmirch the ancient and honorable practice of renting by juxtaposing it with such a nefarious practice. For more on this, see Walter Block, *Watch Your Language*, MISES.ORG, Feb. 21, 2000, <http://www.mises.org/story/385>
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- 54 *Id.* (quoting *Youngstown v. Kahn Bros. Bldg Co.*, 148 N.E. 842 (Ohio 1925)).
- 55 Charles F. Floyd, *Billboards, Aesthetics, and the Police Power*, AM. J. ECON. & Soc. (forthcoming), http://www.scenic.org/pdfs/Police_power.pdf (quoting *Varney & Green v. Williams*, 100 P. 867 (Cal. 1909)).
- 56 See Bobrowski, *supra* note 53, at 708.
- 57 We would argue that they fail to meet it in all cases, but that is beyond the scope of this paper. *But see generally* Rothbard, *supra* note 45.

6

ITAR and the US Space Industry

*Micah Walter-Range**

The United States government regulates the US space industry's international trade by means of the International Traffic in Arms Regulations (ITAR). These regulations, which have their origins in the Cold War era, impose significant costs upon the US space industry. The stated purpose of the system is to prevent sensitive technologies from being used to harm the United States or its allies. An unintended consequence is that large amounts of time and resources are spent ensuring compliance with ITAR, even though many of the controlled items are freely available from foreign manufacturers or have no significant military value. Not only do the regulations affect the commercial sector, they also have an impact on the ability of US government agencies to cooperate with their foreign counterparts. This article explores the effects of ITAR and its implications both for the health of the US space industry and for national security.

Executive Summary

The United States currently possesses the largest and most active space economy in the world. It is also the most technologically advanced, although other nations have excelled in certain aspects of space technology.

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This leadership position is being challenged as other spacefaring nations seek to develop their capabilities in cooperation or in competition with the United States. The US space industry is concerned that its competitiveness is being undermined by the export control regime that regulates trade between the US and the rest of the world.¹ It is difficult to quantify the total effect of export controls on the space industry, as much of the evidence presented in the past has been anecdotal in nature.

The Space Foundation conducted a survey in 2007 to provide data on the effect of the International Traffic in Arms Regulations (ITAR), which govern the export of space technology. The intention was to see if ITAR had affected the business practices and the cost structures of the space industry in a significant way. The survey contained both quantitative and qualitative questions and the results showed that most responding US companies are aware of the need for protecting certain technologies but they do not believe that ITAR is working the way it should. The results also indicated that smaller respondent companies are more likely to feel adverse effects from ITAR than large companies. This is a matter of some concern, as lower-tier contractors are a significant source of the new technology and innovation that enables the United States to remain a world leader in space. By continuing to operate an export control regime designed during the Cold War, the United States reduces the competitiveness of its space industry in the global market and potentially harms the domestic innovation processes that enable US space leadership.

It is not only the space industry that has concerns about the process, but also military and civilian government personnel. Deputy Secretary of Defense Gordon England has expressed the view that technology exports should be encouraged because "in this world of coalition warfare and building partnership capacity, it's essential for us and our friends and allies to have greater interoperability ... even with vastly different levels of investment."² At every level of military activity, from discussions of interoperable hardware designs to battlefield support, the unintended consequences of ITAR can affect the ability of troops and their support personnel to carry out vital tasks.

The Space Foundation does not suggest that ITAR be abolished, as there are certain space technologies that the United States must protect. However, both the

regulations and the processes of implementation need to be modernized to reflect the current global market, the state of space technology, and the increasing pace of innovation. With this goal in mind, we submit the following issues and recommendations for consideration by government and industry.

Issue
The export licensing process is lengthy, unpredictable, and inefficient. The expertise required to understand the technical details often lies outside the State Department and consultation is time-consuming.

- The State Department should hire several employees with space expertise when fulfilling the staffing requirements under consideration by Congress.
- The Senate should ratify the defense trade treaties with the United Kingdom and Australia, enhancing collaboration with two strong US allies and decreasing the volume of licensing requests substantially.
- The enforcement of ITAR should shift its focus from a system that regulates individual transactions to a system that reviews the scope of the entire project.

Issue
ITAR restricts the ability of US firms to compete because foreign companies do not operate under equal restrictions. Technology remains on the United States Munitions List (USML), even when it is commercially available in other countries, because lists of critical US military technologies are seldom updated.

- When reviewing the USML and ITAR, the State Department should take into account the availability of space technology in the global market. US companies should be allowed to compete freely to sell goods and services that are not materially different from those offered by international competitors. In addition, exports should only be governed by ITAR if they represent a technological advantage that is militarily significant.
- A validated end-user program should be created for ITAR-controlled exports, enabling transactions that require exporters to notify the State Department instead of applying for a license. This would enable US firms to offer competitive bids in a timely manner to companies that had been approved by the US government previously.

Issue
Small firms do not have sufficient resources to comply with ITAR so the cost of compliance is a barrier to entry; this is a concern since lower-tier companies are a major source of innovation. Regulations also deter or delay collaboration with foreign partners, increasing the financial burden on a sole firm.

- Any plans to use export licensing fees to sustain additional duties by the State Department should avoid placing undue financial burden on lower-tier suppliers.
- Transfers of technology between US and overseas divisions of the same company should not require a license, provided all sites are ITAR-compliant.
- A database of recipients should be made available to exporters, enabling them to see which customers have been granted access to certain categories of ITAR-controlled exports and which customers require greater scrutiny for certain transactions. This database would also provide incentives for foreign entities to maintain ITAR compliance, since a negative listing would decrease their chances of doing business with US companies.
- The licensing process should be as transparent as possible, without harming national security or the competitiveness of the companies involved. This will enable the industry to engage in regular dialogue with the State Department to reach a better consensus regarding what needs to be controlled and how to make the process more efficient.

Introduction

In the United States, exports of space products and services fall under the jurisdiction of the Department of State regardless of their purpose, whether it is military, civil, commercial, or academic. The International Traffic in Arms Regulations (ITAR) which govern these transactions are considered by some members of the space industry to be a government-imposed hindrance that prevents the United States from reaching its full potential as a leader in global space activity.³

Many feel that the export of technical data, defense services, technology, and commodities is overly restricted under the current export control regime, in which individual licenses are required for each transaction and minimal exceptions are made. They believe that the export control process should be routine and

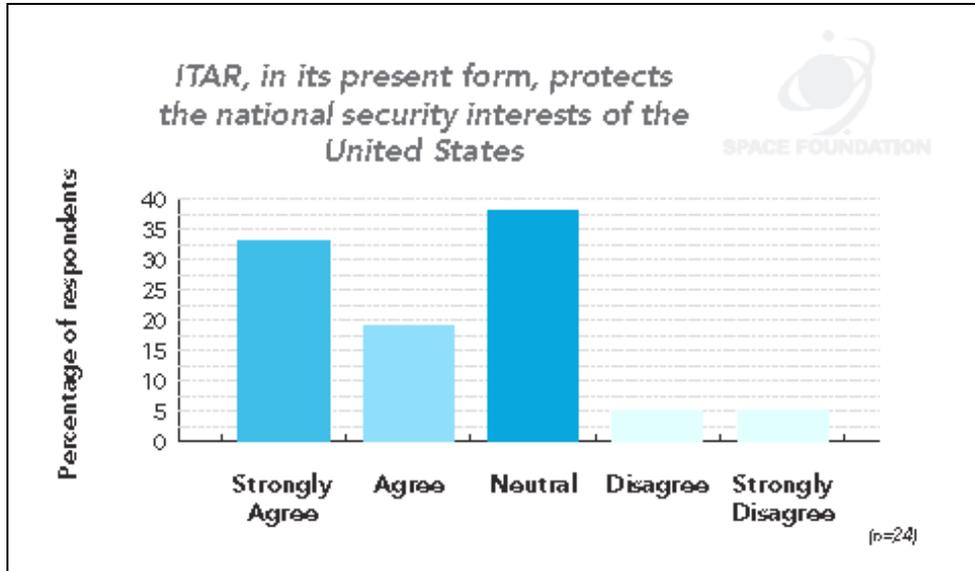
transparent with timely and consistent license application procedures, upholding vital national security safeguards and enabling continued US technological and economic competitiveness.

Recent initiatives by the Administration and Congress have addressed some of these concerns, as well as laying the foundation for future reforms. This is a positive sign, but it remains to be seen whether the implementation of these measures will truly make a difference in the way that the export process works. The "problem" of ITAR for the space industry is not an insurmountable one, but it may be extremely difficult to address unless the parties with a stake in the matter have a common understanding of the issues. Without this shared perspective, efforts to modernize the export process are likely to add to the complexity of an issue that is already complicated. The results of the Space Foundation's ITAR survey, presented below, are intended to help inform the debate about how to shape the relevant policies and guidelines for maximum efficiency and effectiveness.

Findings and Recommendations

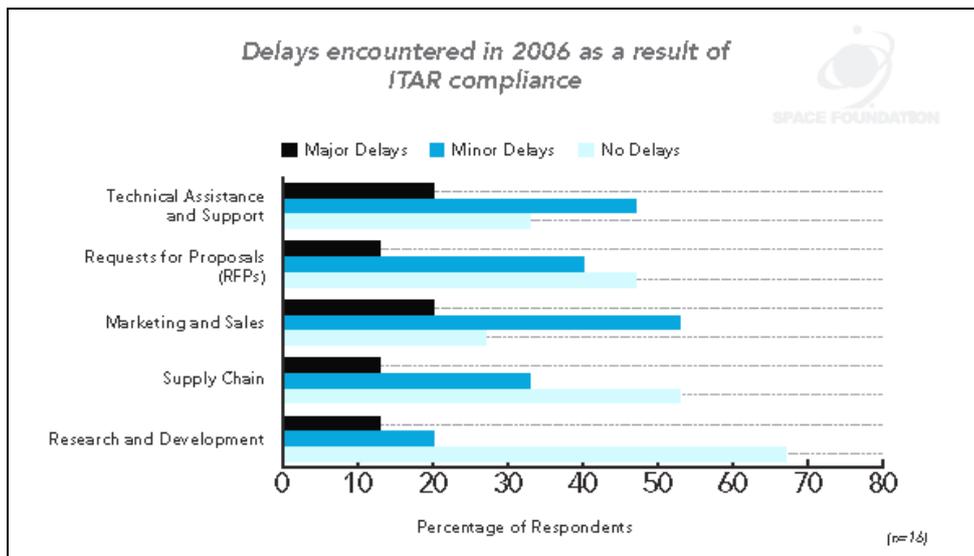
The concerns of the US space industry with regard to ITAR encompass issues of competitiveness, access to the global market, technological development, and leadership in the space domain. The industry recognizes that there are valid national security concerns with regard to space technology that ITAR is trying to protect. Of the respondents to the Space Foundation's ITAR survey, more than half believed that ITAR, in its present form, protects the national security interests of the United States.

This corresponds closely with a 2006 survey of executives in the broader aerospace and defense community, which revealed that two out of three believed that the export control system effectively protected US national security interests.⁴ However, the export control process is *not fully* protecting the interests of the United States because it is damaging the health of the space industrial base.



One of the reasons that the US space industry finds fault with the current regulatory regime is because it perceives ITAR as a barrier to fair competition. A US government study conducted in 2007 revealed that export controls were considered to be the number one barrier to entry for US firms attempting to penetrate foreign markets, with foreign purchasing preferences ranked as a distant second.⁵ Since foreign firms do not have to deal with an equivalent set of export regulations, it gives them a competitive advantage in the global marketplace. In the fast-moving world of the telecommunications industry, a company might issue a request for proposals with a significantly shorter timeline than would allow a US company to receive the necessary approval from the State Department's Directorate of Defense Trade Controls (DDTC) to bid on the project. Foreign companies may view this as regrettable if they are interested in buying from the United States, but foreign governments sometimes intentionally set deadlines that they know US companies will be unable to meet due to ITAR, thereby effectively creating a trade barrier and protecting their own space industries without the risk of diplomatic repercussions.⁶ In this way, the security measures of the United States can have a negative effect on the health of its domestic space industry, even in circumstances where the export would have been approved by the US government eventually.

The length of the licensing process has long been a cause for complaint; there are several factors that contribute to the delays. Due to the nature of the items and services being traded, the expertise required to understand the technical details often lies outside the State Department and consultation is time-consuming. However, there have been some positive actions on the part of the government in this regard. New management of DDTC since May 2007 has been instrumental in reducing the backlog of some 10,000 licensing applications. On January 22, 2008, President Bush signed National Security Presidential Directive 56 (NSPD 56) on defense trade reform. NSPD 56 directed the State Department to complete its review and adjudication of licensing applications within 60 days of receipt, unless national security exceptions are applicable.⁷



The US House of Representatives supported and expanded upon NSPD 56 in May 2008 with H.R. 5916, the *Security Assistance and Arms Export Control Reform Act of 2008*.⁸ The bill acknowledged several of the problems inherent in the export control regime and prescribed changes to the licensing process. Government statistics showed the median processing time for arms export cases (of which space technology forms a subset) had doubled over the period from 2002 to 2006.⁹ Space-related deals are typically complex and may require multiple licenses at various stages of the project as modifications are made and

as construction of the final product progresses. This opens the door to cumulative delays and the House recognized that the backlog in applications and the long processing times "led to an impairment of United States firms in some sectors to conduct global business relative to foreign competitors."¹⁰

The legislation under consideration by Congress determined that DDTC should have at least one licensing officer for every 1,250 applications.¹¹ It also set forth a minimum number of personnel to review applications for commodity jurisdiction (i.e., whether or not something is controlled by ITAR). According to an estimate from the Congressional Budget Office, an Delays encountered in 2006 as a result of ITAR compliance additional 35 licensing officers would need to be hired in order to meet these thresholds.¹²

Recommendation
Due to the increasing technical complexity of licensing applications, the State Department should include several employees with space-related expertise in its plans to fulfill the staffing requirements under consideration by Congress.

On the diplomatic front, the US Senate should ratify the treaties with the United Kingdom and Australia and the government should seek out other possibilities for cooperation with allies. If wars in the future are to be multilateral affairs, it is essential for the US military to achieve interoperability with the forces supplied by allied nations. The battlefield is the worst place to accomplish this task; it is safer for the troops if they are prepared beforehand to work with their allies when the time comes. Ideally, this would involve joint training exercises, personnel exchanges, and shared classes in military doctrine. It would also be beneficial if the equipment of US allies were compatible with US space systems or at least capable of being easily adapted for interoperability. Unfortunately, it is difficult to achieve any of these steps in the environment of distrust that is engendered by the US approach to export controls for space technology, which encompasses technical information as well as hardware. It would be regrettable if the United States was forced to engage primarily in unilateral action because it was incapable of integrating allied forces into its battlespace.

A different approach to licensing for the United Kingdom and Australia should not be considered as a reward or an incentive for providing assistance in the future; it is a practical change to make in light of the trade relationship that

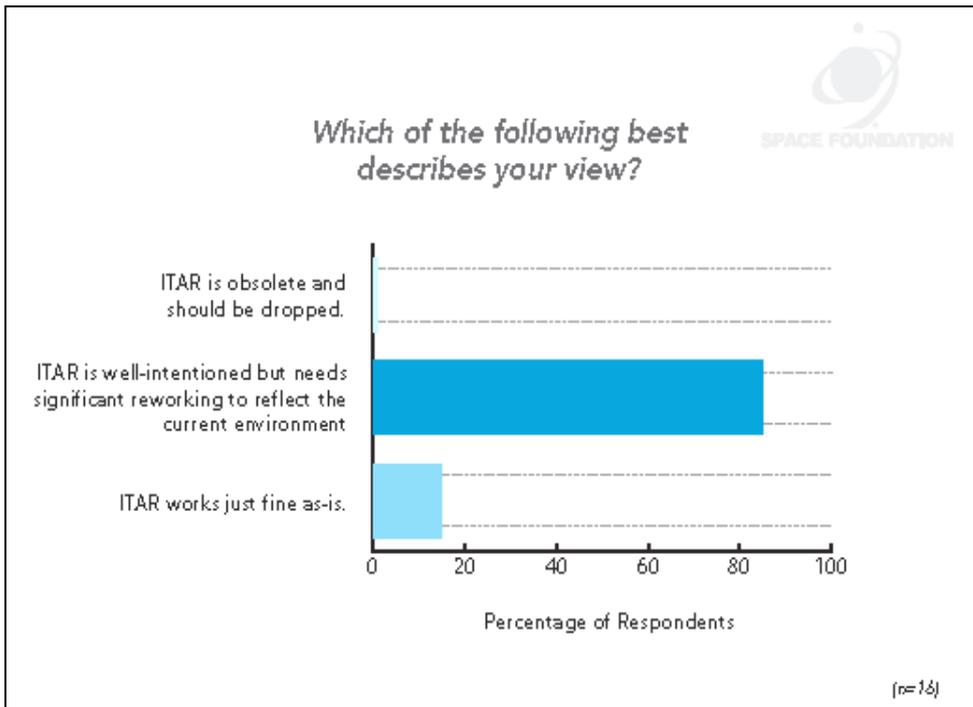
already exists. In 2007, the State Department processed 8,000 licenses for these two nations, 99 percent of which were approved.¹³ By changing from a transaction-based system to an end-user system of approval, more opportunities for cooperation would arise and close US allies would have prompt access to the equipment and support they need to engage in future coalition operations.¹⁴ Companies and agencies would be able to perform the same tasks that they are already doing, but in a more timely and efficient manner, which increases the likelihood of undertaking more projects of mutual benefit.

Recommendation
The Senate should ratify the defense trade treaties with the United Kingdom and Australia. This would enhance collaboration with two strong US allies and it would decrease the volume of licensing requests substantially.

The Administration is not seeking similar treaties with other countries because there are no other candidates with whom the US government has a similar "special relationship". In response to the difficulty of doing business with US space companies under the constraints imposed by ITAR, some foreign companies have begun to advertise their products as "ITAR-free", highlighting the fact that potential customers will not have to navigate the complex and demanding terrain of ITAR compliance.¹⁵ This is a particularly strong selling point for foreign companies that provide components for spacecraft. It is more convenient for a foreign satellite builder to use ITAR-free components because it will then be able to sell the final product to whomever it pleases (in compliance with the domestic laws of its home nation). For example, several European governments are financing the development of a commercial telecommunications satellite that will be available both with and without ITAR-controlled components. The ITAR-free version is expected to be more expensive, but customers may see this as a viable trade off for avoiding the prospect of ITAR-related delays.¹⁶ It would also enable customers to take advantage of low-cost Chinese launch services, which are currently off-limits for products controlled by ITAR.

The legislation under consideration by Congress instructs the President to submit a report on satellite export controls, which takes into account "the extent to which comparable satellites and related items are available from foreign sources

without comparable export controls."¹⁷ The space industry would welcome such a review, both for satellites and for other space goods and services, as the majority of the industry is of the opinion that ITAR needs significant reworking to reflect the current environment.¹⁸



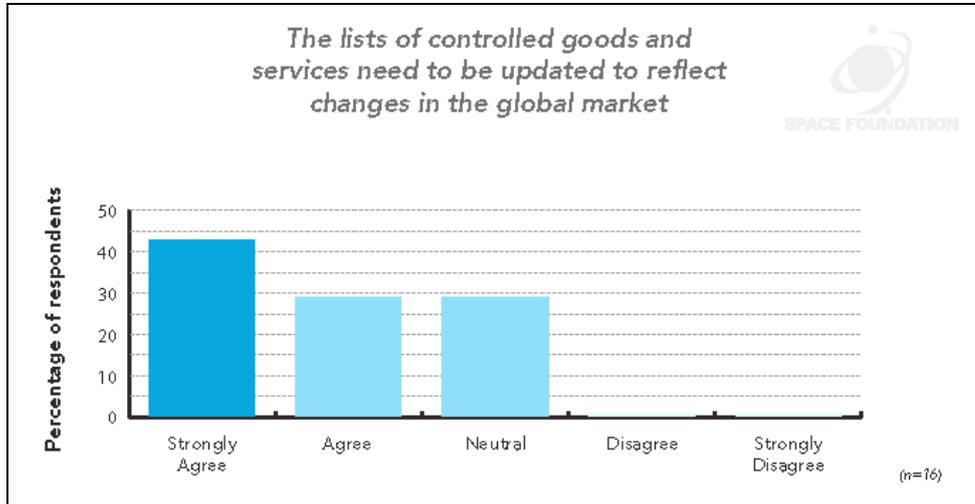
The terms of the treaties between the United States and its allies, the United Kingdom and Australia, hint at a possible solution. If it were possible for DDTC to issue license for a particular project or enterprise rather than overseeing each distinct detail, then the State Department could review a proposed deal and approve it with the proviso that further review would be necessary only if the terms of the deal changed according to a specific set of conditions. This would remove the necessity for multiple licensing applications unless the scope of the project went beyond the limits imposed by DDTC. Alternatively, a "validated end-user" system could be implemented in which it is understood that the recipient of technology is in compliance with US security requirements, thereby promoting joint business ventures between these trusted foreign partners and US companies.

Recommendation
The enforcement of ITAR should shift its focus from a system that regulates individual transactions to a system that reviews the scope of the project.

Recommendation
A validated end-user program should be created for ITAR-controlled exports, enabling transactions that require exporters to notify the State Department instead of applying for a license.

If the goal of export control is to prevent sensitive technology from falling into the hands of parties hostile to the United States, then the government needs to define the categories of goods and technical knowledge more clearly and appropriately. The US military should assess the current state of military technology and determine what is inappropriate for export. As has been mentioned previously, one part of this assessment should take into account the availability of spacecraft components on the global market so as not to prevent US companies from selling goods that could have been purchased from a foreign competitor. On a broader scale, the list of controlled items should be narrowed significantly to include only the parts of a spacecraft that can truly be said to be sensitive technology.

These lists have not been subject to regular review in the past, so they have not been kept in sync with the reality of the marketplace. In addition, the definition of "military" usage as opposed to "dual-use" is often unclear, but the penalties for non-compliance are so high that companies are often inclined to submit excessive license applications, many of which are improperly written, thereby contributing to the workload (and backlog) at DDTC.¹⁹ The US space industry understands that there are some things that must be protected, but it is frustrated by the excessive resources that go into protecting things that have no strategic military significance.²⁰ It is encouraging to note that the House of Representatives wants the Secretary of State to review the United States Munitions List (USML) and ITAR, *with the assistance of United States manufacturers and other interested parties.*²¹ The purpose of this review is to determine which technologies warrant different or additional controls.



Recommendation

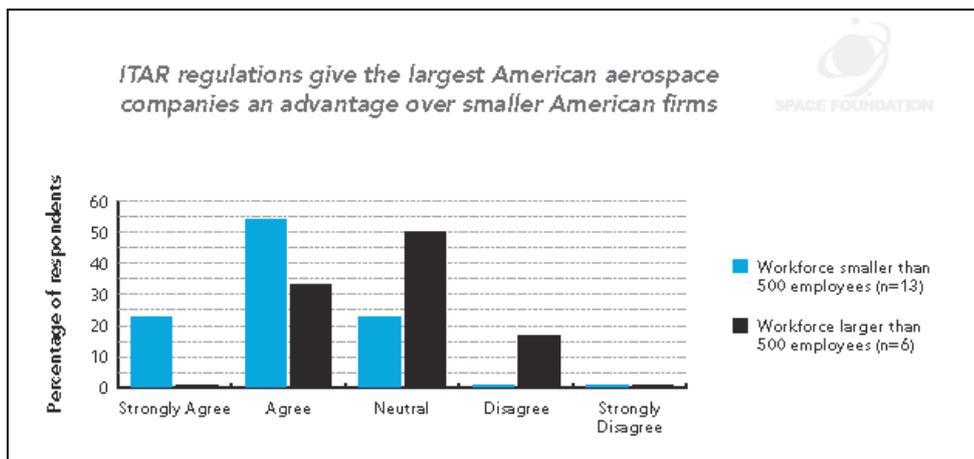
When reviewing the USML and ITAR, the State Department should take into account the availability of space technology in the global market. US companies should be allowed to compete freely to sell goods and services that are not materially different from those offered by international competitors. In addition, exports should only be governed by ITAR if they represent a technological advantage that is militarily significant.

In terms of creating an uneven playing field, ITAR does not only engender a disparity between domestic and foreign companies, but it also imposes costs upon US companies unequally. A large prime contractor is likely to have an entire department of staff working on ITAR compliance for the company as a whole, and these people have the experience necessary to handle any space-related ITAR paperwork. By contrast, second- and third-tier suppliers are more likely to be at a disadvantage as they may not have the personnel to ensure that everything is being done in accordance with ITAR. The proportional cost of ensuring compliance is much higher for them, up to eight times that of a first-tier supplier, and this is a significant concern since many lower-tier suppliers have relatively small profit margins.²²

The extra costs imposed by ITAR constitute a barrier to entry for small companies, thereby discouraging them from seeking to expand their customer

base on a global scale. Consequently, they rely on US domestic space activity, which is cyclical in nature. If it were easier to compete globally, these small companies would have a better chance of survival during the lean times in the US market. Lower-tier suppliers play a significant role in innovation, so the loss of these companies could lead to a decline in the development of new technology.²³

An example of a subsection of the space industry that is facing difficulty is the entrepreneurial sector, comprised of the companies which are developing commercial passenger spacecraft and orbital habitats. Often funded privately, these companies are under extreme pressure to keep their costs down and they would like to work with foreign suppliers whenever it is more cost-effective to do so. However, the barriers to communication imposed by ITAR make it a slow and arduous process to provide technical requirements to the foreign suppliers and to engage in follow-up discussions that could improve the safety and reliability of the end product. One such entrepreneur, Elon Musk, is working to provide an orbital launch vehicle that is intended to conduct flights for NASA and the Department of Defense, among other customers. In public statements, Musk has emphasized the importance of minimizing the regulatory burden on startup companies and has questioned the wisdom of government-imposed obstacles to cooperation with companies in trusted nations such as New Zealand, the United Kingdom, and Canada.²⁴



The House of Representatives has suggested that DDTC examine the possibility of placing itself on a 100 percent self-financing basis.²⁵ This is potentially problematic for smaller suppliers, which may rely on a high volume of relatively low-value sales to sustain themselves. Depending on the mechanism for assessing licensing fees in order to finance DDTC, lower-tier suppliers may find the cost of international sales too high to contemplate. According to the US government's industrial base assessment of the space industry, some of these small companies have already self-eliminated from foreign markets because of ITAR restrictions and the unwillingness of foreign customers to deal with ITAR-related bureaucracy.²⁶ An increase in licensing costs is likely to reinforce this behavior.

Recommendation

Any plans to use export licensing fees to sustain additional duties by the State Department should avoid placing undue financial burden on lower-tier suppliers.
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The barriers to communication imposed by ITAR exist not only between US companies and foreign entities, but also within companies that have sites located around the world. By imposing barriers that affect intercompany operations, the US government is discouraging the space industry from harnessing the talent and expertise that exists in foreign countries. Companies are able to apply for licenses to conduct specific joint ventures involving their foreign offices, as would be the case for any foreign partnership; however, it may be more efficient to adopt a long-term solution that allows for regular interchanges. If a company is willing and able to meet the conditions of ITAR at its foreign sites, it makes sense to permit continuous collaboration, possibly within a certain set of parameters established by DDTC in advance.

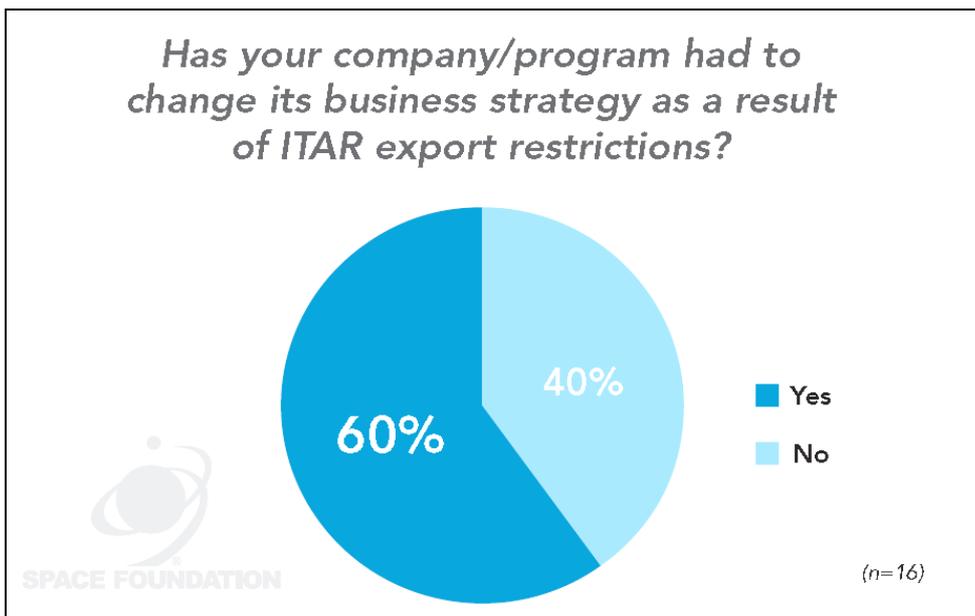
Recommendation

Transfers of technology between US and overseas divisions of the same company should not require a license, provided all sites are ITAR-compliant.
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If the export system makes the transition from transaction-based approval to end-user approval, it will be necessary to provide the US space industry with the information it needs to determine who it can trade with. The US government currently maintains lists of countries, entities, and persons who are prohibited from receiving ITAR-controlled goods and services. A corresponding list could be created of trusted agents who have been verified as ITAR-compliant. This would

allow US companies to see which foreign entities are easiest to trade with and it would also help lower-tier suppliers to find business opportunities overseas, thereby funding the creation of new technology for use domestically. Ideally, the list would be updated as licenses are approved, allowing the space industry to gain a real-time picture of which entities are trusted by the government.

Recommendation
A database of recipients should be made available to exporters, enabling them to see which customers have been granted access to certain categories of ITAR-controlled exports and which customers require greater scrutiny for certain transactions. This database would also provide incentives for foreign entities to maintain ITAR compliance, since a negative listing would decrease their chances of doing business with US companies.



The US space industry is interested in working with the government on the issue of export controls, but such efforts will not succeed unless there is a free flow of information in both directions. Companies can supply expertise and advice, but they also need to know the reasoning behind government decisions. If licensing decisions are made available to the space industry, with safeguards in place to protect industrial secrets and competitive data as necessary, then the

industry as a whole will be able to adapt its business strategy in the interest of efficiency while still complying with (modernized) ITAR. This is nothing new for the industry – most companies have already had to adopt strategic changes due to the present export regime – but companies would be able to make their decisions based on a better understanding of the government's behavior. The information would also enable the industry to better engage with the government on a regular basis to discuss the changing face of the global market and the appropriate updates to ITAR that should follow.

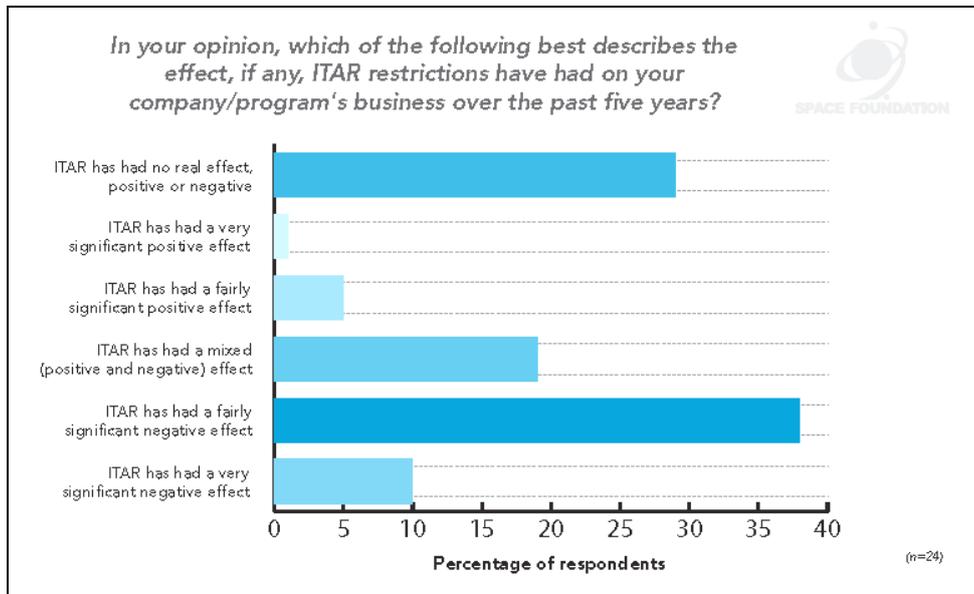
Recommendation
The licensing process should be as transparent as possible, without harming national security or the competitiveness of the companies involved. This will enable the industry to engage in regular dialogue with the State Department to reach a better consensus regarding what needs to be controlled and how to make the process more efficient.

Conclusion

On the political front, the space industry needs to do a better job communicating the message that it is an important commercial and national security asset to the nation. Space advocates must work to build an understanding within the government that there should be a balance between necessary export restrictions and the health of the industry. The national security implications of an enfeebled and uncompetitive domestic space industry must be made clear, in order to explain why an overly restrictive export control regime can ultimately do as much damage to national security as a lax regulatory system. If the expertise of the US space industry is allowed to deteriorate, or if it is slowed to the point where other nations catch up (and this has already happened in some areas), then the United States is effectively ceding the dominant position in space that it has enjoyed for some time. Considering the dependence of modern militaries on space assets, especially the US military, the danger of falling behind in terms of technological progression is not to be taken lightly.

The control of space exports under the International Traffic in Arms Regulations is a contentious issue that pits national security concerns against the desire to cooperate with foreign entities for purposes of profit or scientific research. By working together, it should be possible to create a regulatory environment that protects militarily critical technologies and technical expertise,

while allowing commerce and international partnerships to flourish and the space industry to prosper.



The difficulty lies in overcoming the arguments of parties on both sides who have become entrenched in their positions and who are more willing to recount the injustices or misdemeanors of the past than to work toward a better future. To succeed, it will be necessary to muster the political will of the Executive Branch to oversee the necessary alterations in the regulatory process, and the cooperation of the Legislative Branch with regard to adjusting the laws to allow the State Department more latitude in terms of determining the trustworthiness of end-users. The space industry must also play a role in the process and it will need to make solid information available to policymakers so that any policy changes will be helpful and well-reasoned.

Appendix A

Additional Information about ITAR

The United States regulates the exports of certain goods and technologies through several laws: the 1979 Export Administration Act, for controlling the export of dual-use items and technologies, and the 1976 Arms Export Control Act, which governs the trade in defense articles, services, and technical data. The US government publishes two lists to identify those goods and services which are subject to export controls. The Commerce Control List, for dual-use items, is managed by the Department of Commerce under the Export Administration Regulations, while the United States Munitions List (USML) for military items and munitions is managed by the Department of State's Directorate of Defense Trade Controls (DDTC) under the International Traffic in Arms Regulations (ITAR).²⁷

Space technology is separated into two distinct categories within the USML, depending on whether it is associated with launch vehicles or spacecraft.

Category IV of the USML Contains

- Rockets, launch vehicles (including missiles), and advanced composite materials.
- Launch vehicle powerplants.
- All specifically designed or modified components, parts, accessories, attachments, and associated equipment for the articles in this category.
- Technical data and defense services directly related to the articles in this category.

Category XV Contains

- Spacecraft, including all common types of satellites.
- Ground control stations.
- GPS receiving equipment specifically designed for military use.
- A variety of high-performance components that would be suitable for use in a spacecraft.

- Spacecraft systems and associated equipment.²⁸

It is evident from these lists, particularly the items that lay claim to "associated equipment," that it is practically impossible to find a space item that would not be controlled by ITAR. The exception would be a component that was originally designed for a non-space purpose and which had not been modified in any way before being incorporated into a spacecraft.

In light of the all-encompassing nature of ITAR, it is essential for the space industry to understand the requirements for complying with the regulations. In general, any person or company who intends to export a defense article must obtain the approval of DDTC prior to the export. Collaborative efforts that involve the exchange of a defense service, technical data or assistance, or manufacturing know-how require a license called a Technical Assistance Agreement. The assistance and know-how is what distinguishes an "Agreement" from other authorizations issued by the Department of State. In either case, ITAR broadly covers the exports of data, know-how, manufacturing, defense articles, and hardware.

The fact that ITAR covers technical knowledge in addition to hardware can make things difficult for the space industry. If knowledge is transferred to a non-US citizen, either intentionally or unwittingly, this is a "deemed export," meaning that the information is considered to have been exported even if the recipient has no intention of leaving the country or communicating the knowledge to a third party. Companies can sidestep the issue to some extent by hiring only US citizens, but they must deal with the ITAR paperwork if they wish to do business with foreign entities or if they wish to employ non-US citizens. Similarly, foreign business partners are required to disclose and receive approval for their employees who would have access to information that is ITAR-controlled. This licensing process can be quite time-consuming and expensive for both the US company and the foreign partner.

Licenses under the ITAR are authorized on a "transactional" basis, which means that a license is required for each separate instance of export, for each different item, or different destination. In addition, jurisdiction extends to any US part or component on a foreign product or system, as well as to third-party exports by the intended recipient. Details required for the application include the

value of the agreement, the nature of the export, a signed agreement between the exporting and importing parties, and, as has been mentioned, the countries of all third-party nationals that may be employed by the foreign signatory. Once the license application has been submitted, any changes (e.g., the addition of new parts or components, transfer of additional data, extension of term of the agreement, or increase of the value of the agreement) require an application for an amendment to the license.

Exceptions to ITAR are minimal, whether for an individual transaction or for a particular end-user. Most US allies or NATO countries require a license and some country exclusions require Presidential approval for the proposed export. If the "defense articles or services" are valued at \$100 million or more, and if the intended recipient is not a member of NATO or a close ally, then congressional approval is required.²⁹ The financial threshold for allies is higher, but the fact that telecommunications satellites often cost several hundred million dollars means that the majority of them must face congressional scrutiny. Congress is required to reach a decision on a deal within 30 days of its submittal, but the common practice is to wait until all other issues related to the contract have been settled before submitting it to Congress, thereby lengthening the process. It would be considerably more efficient if the notification requirement could be fulfilled concurrently with the license application.

Appendix B

Historical Background

During the Cold War, the policy of the United States was that all exports of space-related goods and technologies be regulated by the State Department as munitions. This policy made sense for national security reasons at a time when the United States and the Soviet Union used space technology as a means of demonstrating technological superiority and as a means of keeping watch over each other's military assets. As relations began to thaw, however, US companies saw an opportunity to expand their business and they lobbied the government to ease some of the restrictions that were in place.

In 1988, President Reagan lifted the ban on the use of Chinese launch vehicles for commercial satellites, thereby allowing American companies to take advantage of significantly lower launch prices.³⁰ During the 1990s, President Bush made a similar decision with regard to Russia, setting the stage for joint ventures, such as International Launch Services.³¹ A subsequent presidential decree in 1992 ordered the removal of dual-use items from the USML unless they posed a clear danger to national security. Industry trade associations lobbied for the inclusion of communications satellites in the group of items to be removed, pointing out that the United States was the only nation that treated these satellites as munitions.³² As a result, the State Department transferred jurisdiction of some commercial communications satellites to the Department of Commerce in 1992, provided that the satellites did not exceed certain technical specifications that would make them "military-grade."

In an effort to complete the changeover of communications satellites from State to Commerce, an interagency group called the Trade Promotion Coordination Committee submitted a report in 1993 that advocated an administrative review of dual-use items that remained on the munitions list. This was followed by a review from an interagency Comsat Technical Working Group, which attempted to create a better definition for militarily sensitive technologies. The recommendation of this group was for the State Department to reduce and tighten its list of sensitive technologies, but it also advised against transferring all communications satellites to Commerce. This decision did not please the Department of Commerce, which subsequently argued the matter

before the National Security Council and President Clinton. Eventually, President Clinton ordered the transfer of all communications satellites, requiring Commerce to consult with the Departments of State, Defense, and Energy, as well as the Arms Control and Disarmament Agency before issuing licenses.³³ The change of jurisdiction was completed by October 1996. It should be noted, however, that the State Department continued to control the related communications *technologies* and the rest of the space items on the USML remained under its jurisdiction.³⁴

This division of responsibility for communications satellites between the two departments proved to be problematic when two satellites were lost during launch attempts in China in 1995 and 1996. In an attempt to determine the cause of the rocket failures, China requested and received information from the US companies that were involved in the manufacturing of the satellites. The purpose of these requests was ostensibly to help create an analysis of the failure to fulfill insurance requirements. A Department of Justice investigation into this transfer of technical data to China determined that the Department of Commerce should have consulted with the State Department before authorization. The US companies – Lockheed Martin, Loral, and Boeing – paid a fine of \$65 million, but it was not possible to prevent the incident from being used as fodder for opponents of President Clinton's approach to export control policy.³⁵

In response to the situation, Congress established a select committee in 1998 (known as the Cox Commission) to complete an inquiry into the transfer of technology, information, goods, or services to China that may have enhanced their missile or intelligence capabilities. The Commission also reviewed US government and private sector behavior with respect to any such matters. In response to the Cox Commission's report, Congress returned jurisdiction to the State Department with the fiscal year 1999 Defense Authorization Act, whereby all satellites and satellite technologies were once again placed on the USML and exports were governed by ITAR. The Act also decreed that the President must notify Congress 15 days prior to a transfer of satellite technology to China and must also verify that the transfer would not harm US launch companies or aid the development of Chinese missile technology.³⁶

In the years that followed, there have been occasional attempts to ease the restrictions imposed by ITAR, especially with regard to close allies. However, these efforts have been staunchly opposed by Members of Congress who advocate a tight export control policy in the interest of national security. For example, Britain and Australia have long sought exemptions to US export controls, but US presidential support and the precedent of similar exemptions for Canada were insufficient to overcome the objections of certain elected representatives. This opposition was due to concerns over perceived flaws in the export control policies of Britain and Australia and the potential for technology transfers to third countries. These concerns apply to all items on the USML, not just space technology.

In June 2007, President Bush and Prime Minister Tony Blair signed a defense trade treaty that will ease the passage of defense goods and services between the two nations if it is ratified by the US Senate. The Defense Trade Cooperation Treaty would not remove congressional oversight for arms sales, but it would remove the export licensing requirements for "an approved community" of US and British entities. An individual, company, or facility would have to be approved by the governments of both nations before it could take advantage of the exemptions set forth in the treaty.³⁷ Since the State Department already grants its approval to the vast majority of licensing applications for destinations within the United Kingdom, the effect of the treaty will be to reduce the time and effort required for each transaction, thereby encouraging transatlantic partnerships. A similar agreement with Australia, signed in September 2007, is another step toward the relaxation of ITAR, but it is unlikely that there will be other nations whose relationship with the United States is strong enough to warrant such a treaty. The regulations will continue to be applied, and the US space industry must adopt a different approach if it is to conduct business with nations other than those with which we have a "special relationship".

Appendix C

Space Foundation Survey Methodology

The Space Foundation conducted its ITAR survey, facilitated by The Everett Group, LLC, from late May through September 2007, gathering inputs from invited space industry members through a Web-based online questionnaire, custom-designed and hosted at www.itarsurvey.org (the domain's registration was allowed to lapse after the completion of the survey fieldwork). The initial survey invitations went to the Space Foundation's Corporate Members and to members of the Space Supplier Council. The Space Foundation prepared and issued a press release announcing the survey and invited participants to log onto the survey site. Additional invitations containing the survey URL were posted on various industry listservs and message boards. We gathered usable responses from 24 different organizational representatives (including 16 Space Foundation Corporate Members). Because the survey invitees were not selected randomly from the population of US space industry members, the quantitative results cannot be generalized to that population and inferential statistical tests are unsupported. The survey results should be interpreted as intuitive, non-statistical evidence.

Endnotes

- 1 US Department of Defense and Department of Commerce, *Defense Industrial Base Assessment: US Space Industry. Final Report* (Dayton, OH, 2007), 14.
- 2 "Deputy Secretary of Defense Urges Easing US Export Controls," *Satellite Today*, May 19, 2008, <http://www.satellitetoday.com/smd/23097.html> (accessed May 20, 2008).
- 3 For the sake of simplicity, "space industry" includes the government and academic sectors in addition to the commercial interests that the term implies. For instance, NASA must comply with ITAR when engaged in projects with international partners. In some cases, as with the International Space Station, the process is expedited due to the safety concerns involved in human spaceflight, although these exceptions are often difficult to negotiate.
- 4 Marty Bollinger and Joshua M. Boehm, *Moving Toward a Faster and More Predictable Process of Licensing Defense Articles and Services for Export: Recommendations for Government and Industry* (Booz Allen Hamilton, 2006), 1.

- 5 US Government, *Defense Industrial Base Assessment*, 14.
- 6 John Hillery, *US Satellite Export Control Policy*, Center for Strategic and International Studies, http://www.csis.org/media/csis/pubs/060921_sat_export_controls.pdf (accessed August 4, 2008).
- 7 US Department of State, "Policy on Review Time for License Applications," *Federal Register* 73, no. 73 (April 15, 2008): 20357.
- 8 The House of Representatives passed H.R. 5916 on May 15, 2008. The Senate had not yet considered the bill at the time this paper was written.
- 9 US House of Representatives, *Security Assistance and Arms Export Control Reform Act of 2008*, 110th Cong., 2d sess., 2008, H.R. 5916, 7.
- 10 House of Representatives, *Export Control Reform Act*, 8.
- 11 House of Representatives, *Export Control Reform Act*, 21. This is not intended to be a quota for each licensing officer since licenses vary in complexity. However, it is supposed to ensure that DDTC's staffing levels are appropriate to the volume of licenses.
- 12 House Committee on Foreign Affairs, *Report on H.R. 5916, the Security Assistance and Arms Export Control Reform Act of 2008*, 110th Cong., 2d sess., 2008, H. Rep. 110-626, 25.
- 13 Frank Ruggiero, interview by Vago Muradian, Washington, DC, April 21, 2008, <http://www.state.gov/t/pm/rls/rm/104012.htm> (accessed August 5, 2008).
- 14 Expedited processing is available for items urgently needed by coalition troops in Iraq and Afghanistan, but this does not cover long-term cooperative projects which can fall behind schedule due to a slow export system. This adds to the financial cost for the parties involved. A reduction in unnecessary export-related delays would be a prudent fiscal policy.
- 15 Wolfgang Demisch, "ITAR's End", *Aviation Week & Space Technology*, July 17, 2006.
- 16 Peter B. de Selding, "ITAR-Free Version of Small GEO Planned," *Space News*, May 28, 2008, <http://www.space.com/spacenews/marketmonitor/SmallGEOweb052808.html> (accessed August 5, 2008).
- 17 House of Representatives, *Export Control Reform Act*, 42.
- 18 US Government, *Defense Industrial Base Assessment*, 43.
- 19 Bollinger and Boehm, *Moving Toward a Faster Process*, 3-4.
- 20 US Government, *Defense Industrial Base Assessment*, 42-44. For additional information on the discrepancy between critical technologies and export controls, see: US Government Accountability Office, *Defense Technologies: DOD's Critical Technologies Lists Rarely Inform Export Control and Other Policy Decisions*, GAO-06-793 (Washington, DC, 2006).

- 21 House of Representatives, *Export Control Reform Act*, 25.
- 22 US Government, *Defense Industrial Base Assessment*, 36.
- 23 US Government, *Defense Industrial Base Assessment*, 28.
- 24 Jeff Foust, "Two scenarios and two concerns for personal spaceflight," *The Space Review*, April 25, 2005, <http://www.thespacereview.com/article/362/1> (accessed May 2, 2008).
- 25 House of Representatives, *Export Control Reform Act*, 34.
- 26 US Government, *Defense Industrial Base Assessment*, 13.
- 27 Government Accountability Office, *Export Controls: Challenges Exist in Enforcement of an Inherently Complex System*, GAO-07-265 (December 2006), 5.
- 28 United States, Government Printing Office, "The United States Munitions List," *Code of Federal Regulations*, 22 CFR 1 21.1. For the sake of brevity, these descriptions have been paraphrased. The intent is to provide a general description rather than a detailed list.
- 29 H.R. 5916 raised this threshold – it used to be \$50 million. As of May 29, 2008, the Bill had been passed by the House of Representatives and had not yet been considered by the Senate.
- 30 George Abbey and Neal Lane, *United States Space Policy: Challenges and Opportunities* (Cambridge, MA: American Academy of Arts and Sciences, 2005), 8.
- 31 International Launch Services, "ILS Legacy," <http://www.ilslaunch.com/ils-legacy> (accessed May 2, 2008). This partnership originally involved Lockheed Corp. and two Russian companies: Khrunichev State Research and Production Space Center, and RSC Energia. Lockheed later sold off its share in the business. ILS came to be entirely Russian-owned in May 2008.
- 32 Ryan Zelnio, "A short history of export control policy," *The Space Review*, January 9, 2006, <http://www.thespacereview.com/article/528/1> (accessed April 16, 2008).
- 33 *Ibid.*
- 34 Abbey and Lane, *United States Space Policy*, 8.
- 35 *Ibid.*, 9.
- 36 Zelnio, "Short history of export control policy."
- 37 William Matthews, "Proposed Treaty Would Ease Defense Exports to UK" *Space News*, July 31, 2007, http://www.space.com/spacenews/archive07/congress_0723.html (accessed May 1, 2008).

FY-1C and USA-193 ASAT Intercepts: An Assessment of Legal Obligations under Article IX of the Outer Space Treaty

*Michael C. Mineiro**

This article examines the legal obligations of States Party to the Outer Space Treaty within the context of recent kinetic anti-satellite activities of the United States and China. Article 9 of the Outer Space Treaty explicitly articulates obligations of due regard that are relevant to ASAT intercepts and outer space environmental modification. However neither Article 9 nor other Treaty provisions provide definitive standards on when such obligations are triggered and how they are to be fulfilled. What are “appropriate international consultations” and when does a State “have reason to believe” an ASAT activity “would cause potentially harmful interference”? These and related questions are examined through a historical jurisprudential study applied

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*to the real-life scenarios of the FY-1C and USA-193 intercepts.
This article includes a determination as to whether China and
the United States fulfilled their legal obligations under Article 9.*

I. Introduction

On January 11, 2007¹ (EST), China performed a successful Anti-satellite (ASAT) missile test using a kinetic kill vehicle launched from the Xichang Satellite Launch Center (XSLC), a facility in Sichuan Province, China.² The kinetic kill vehicle destroyed an aging, but functioning, Chinese weather satellite, the *Feng Yun 1C* (FY-1C), in polar orbit at an altitude of approximately 537 miles.³ This was the first such destruction of a satellite since the kinetic ASAT missile tests conducted during the Cold War by the United States and the Soviet Union.⁴

One year later, on February 14, 2008, the United States announced it was planning to destroy *USA-193* (a.k.a. *NROL-21*), a derelict satellite that was decaying out of orbit and falling back to Earth.⁵ On February 21, 2008, the United States successfully destroyed *USA-193* at an altitude of approximately 133 miles with a kinetic ASAT missile.⁶

In the wake of these State actions, the question is raised: What, if any, affirmative legal obligations does Article IX of the Outer Space Treaty⁷ impose on States Party to the Treaty planning to or carrying out ASAT (anti-satellite) activities or experiments in outer space? Did China and the United States act in accordance with Article IX?

In the following article, these questions are assessed under a methodology of treaty interpretation consistent with the Vienna Convention on the Law of the Treaties. The negotiating history and historical contest of Article IX and the Outer Space Treaty are examined. Article IX is assessed within a matrix of principles and corresponding articulations of affirmative obligations. This assessment is then applied to the facts publicly known regarding the *FY-1C* and *USA-193* intercept for the purpose of concluding whether or not Article IX obligations were applicable and if applicable whether they were fulfilled. Finally, conclusions are reached as to the Article IX legality of the *FY-1C* and *USA-193* intercepts and discussed within the greater context of international law and governance.

II. Treaty Interpretation Methodology

All too often analyses of treaty obligations are written without first defining the methodology of treaty interpretation adopted for the analyses. This can result in the discussion being directed not to the question of interpretation methodology and law, but instead on presumptions formulated from premises neither party articulates. Let us avoid this pitfall by defining and adopting a method of treaty interpretation.

Numerous methods of treaty interpretation exist. Common methodologies include the textual, subjective, and teleological approaches, and variants thereof.⁸ Often no single approach is adopted, but rather an amalgam of two or more approaches. Common among these approaches is the shared premise that "the validity of an international agreement rests solely on the will or consent of the parties to be bound and, thereof, treaty interpretation is the process of attempting to establish the context of the consent."⁹

The standard method of treaty interpretation, as adopted by the International Court of Justice, is articulated in Articles 31 and 32 of the Vienna Convention on the Law of the Treaties.¹⁰ Articles 31 and 32 are considered by the Court as having attained the status of customary international law.¹¹ Article 31, General Rule of Interpretation, states:

1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.
2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:
 - a. any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty;
 - b. any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.

3. There shall be taken into account, together with the context:
 - a. any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;
 - b. any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;
 - c. any relevant rules of international law applicable in the relations between the parties.
4. A special meaning shall be given to a term if it is established that the parties so intended.

Article 32, Supplementary Means of Interpretation, states:

Recourse may be had to supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of article 31, or to determine the meaning when the interpretation according to article 31:

- a. leaves the meaning ambiguous or obscure; or
- b. leads to a result which is manifestly absurd or unreasonable.

As articulated in Article 31(1), the Vienna Convention adopts first and foremost an objective textual approach based on the premise of a neutral third party observer. Although focused on the textual approach, the Convention is not strictly textual as both subjective and teleological approaches are included within the methodology of the articles.¹² Inherent in the objective textual approach is the recognition that "the primary aim of international law is not to provide the ideal method of resolving disputes, but to prevent disputes from arising."¹³ The objective textual approach prioritizes clear, simple, and precise resolution of interpretative dispute. As a result, subjective intent articulated in the preparatory work and circumstances of conclusion is subjugated as a supplementary means of interpretation.

For the purposes of the analysis in this article, the Vienna Convention is adopted as the methodological approach of treaty interpretation subject to the following caveat. While the Convention does provide a reasonable method of interpretation, the Outer Space Treaty warrants Article 32 of the Convention to play a more prominent role than perhaps it would otherwise when interpreting other treaties.

With the exception of Article IV of the Outer Space Treaty and provisions related to procedural aspects of it, all other Treaty articles are articulations, and in some cases verbatim copies, of the principles articulated in GA Res 1962 (XVIII), *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*.¹⁴ As a result, the Outer Space Treaty is primarily a treaty of principles, crafted for the purposes of *proscribing* norms to an area that was *without law*. These proscriptive principles, by their very nature, cannot embody their object and purpose by solely reviewing their text. It is for this reason that the historical circumstance of human advancement into outer space is closely intertwined with the object and purpose of these principles.

Article 32 of the Vienna Convention does allow for supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of Article 31. When interpreting the Outer Space Treaty, confirmation of the meaning of text should be undertaken with an examination of the preparatory work of the treaty and circumstances of its conclusions.

III. Historical Context of Article IX

Prior to assessing Article IX obligations, it is necessary to have an understanding of the historical process that led to Article IX and the Outer Space Treaty. Therefore let us examine, in a chronological order, the historical development of the Article.

Important Historical Events related to Article IX of the Outer Space Treaty							
Year	Sputnik Launched [1957]		Project Westford Initiated GA RES. 1721 (XVI) [1961]		Project Westford (Cont.) Limited Test Ban Treaty GA RES.1962 (XVIII) [1963]		Treaty Signed [1967]
[1945] UN Charter		[1958] GA RES.1338(XIII) First High Altitude Nuclear Test		[1962]		[1966] USA and USSR begin treaty negotiations	

A. UN Charter, Sputnik, HANDs, and Project West Ford

The UN Charter entered into force on October 24, 1945. Article 13(a) of the Charter grants to the General Assembly authority to initiate studies and make recommendations for the purpose of "promoting international co-operation in the political field and encouraging the progressive development of international law and its codification."¹⁵

On October 4, 1957, the former Soviet Union launched *Sputnik*, the first manmade satellite, into orbit. The launch of *Sputnik* accentuated the debate on what law, if any, does apply to outer space, and on what law, if any, should apply. The United Nations General Assembly took action on December 13, 1958, and in accordance with their authority under Article 13(a) of the Charter, passed GA Res. 1348(XIII).¹⁶ This resolution established the ad hoc Committee on Peaceful Uses of Outer Space (COPUOS) and tasked the Committee to report

to the General Assembly on "the nature of legal problems which may arise in the carrying out of programs to explore outer space."¹⁷ COPUOS was established as a full committee on December 12, 1959.¹⁸

1958 was also the first year of High Altitude Nuclear Detonations (HAND). From 1958 until 1962 the United States and Soviet Union conducted a series of HANDs. These nuclear tests affect the operation of applications that utilize outer space and the Earth's atmosphere. The COPOUS Scientific and Technical Sub-Committee considered high altitude and outer space nuclear weapon tests one aspect of potentially harmful space interference that needed to be addressed.¹⁹

In 1961 the General Assembly articulated two principles that were later incorporated into the Outer Space Treaty: "International law, including the Charter of the United Nations, applies to outer space and celestial bodies" and "outer space and celestial bodies are free for exploration and use by all States in conformity with international law and are not subject to national appropriation."²⁰

Also in 1961 the United States initiated *Project West Ford*, a space communications experiment. *Project West Ford* involved placing hundreds of millions of small copper dipoles into orbit²¹ for the purpose of investigating the technical feasibility of using such dipoles as passive reflectors for communications.²² *Project West Ford* raised concerns amongst the international community that the copper dipoles could cause potentially harmful interference with radio astronomy, optical astronomy, space communications, and space travel.²³ The International Astronomical Union (IAU) passed a resolution appealing "to all governments . . . launching space experiments which could possibly affect astronomical research to consult with the IAU before undertaking such experiments and to refrain from launching until it is established beyond doubt that no damage will be done to astronomical research."²⁴ The International Council of Scientific Unions (ICSU) Committee on Space Research (COSPAR) established the Consultative Group of Potentially Harmful Effects of Space Experiments (CGPHESE). CGPHESE conducted a study of *Project West Ford* and recommended that "any proposals for future experiments of this sort" should be evaluated thoroughly by the scientific community.²⁵ It was within this historical context that in 1962 the Soviet Union submitted the first draft declaration in COPOUS to address the issue of harmful interference.

B. COPUOS and General Assembly Resolution 1962 (XVIII)

GA Res. 1962 (XVIII), the progenitor to the Outer Space Treaty, was drafted in 1962 and 1963. This drafting process involved members of COPUOS circulating a series of draft declarations and negotiating amongst themselves to achieve consensus on a declaration that could be transmitted to the First Committee of the General Assembly.

On June 6, 1962, the Soviet Union submitted a draft declaration to be considered by COPUOS (USSR Draft). The USSR Draft contained a provision that stated in paragraph 6: "Co-operation and mutual assistance in the conquest of outer space shall be a duty incumbent upon all States; the implementation of any measures that might in any way hinder the exploration or use of outer space for peaceful purposes by other countries shall be permitted only after prior discussion of and agreement upon such measures between countries concerned."²⁶

The USSR Draft met resistance from the UK and the United States.²⁷ The UK and United States maintained that the USSR Draft "introduced a veto on the activities of other in outer space" and seemed less effective than action already taken by COSPAR, which had established CGPHESE.²⁸ France "agreed with the idea of consultations between States engaged in the exploration of outer space in order not to obstruct outer space activities of other States" but "objected to making prior consent imperative for the such activities by another State."²⁹

On December 4, 1962, the UK submitted to COPUOS a draft declaration (UK Draft) that responded to the Soviet position. The UK Draft contained a provision that stated exploration and use of outer space "shall be exercised by all States with due regard to the interests of other States in the exploration and use of outer space, and to the need for consultation and cooperation between States in relation to such exploration and use."³⁰ This draft differed from the USSR Draft in two significant ways. First, while the USSR Draft spoke of mutual assistance and co-operation as a duty, the UK Draft articulates the principle of due regard. Second, the UK draft did not require prior consent, nor did it place an affirmative duty to consult. Instead the UK draft simply spoke of the need for consultation and co-operation.

Ultimately COPUOS adopted a provision that struck a balance between the USSR draft and the UK draft, similar to the position articulated by France. Paragraph 6 of *Declaration of Legal Principles Governing the Activities of Outer Space* (Declaration) states:

In the exploration and use of outer space, States shall be guided by the principle of co-cooperation and mutual assistance and shall conduct all their activities in outer space with due regard for the corresponding interests of other States. If a State has reason to believe that an outer space activity or experiment planned by it or its nationals would cause potentially harmful interference with activities of other States in the peaceful exploration and use of outer space, it shall undertaken appropriate international consultations before proceeding with any such activity or experiment. A State which has reason to believe that an outer space activity or experiment planned by another State would cause potentially harmful interference with activities in the peaceful exploration and use of outer space may request consultation concerning the activity or experiment.³¹

As will be discussed in further detail below, the language of the Declaration imposes an affirmative duty to consult but does not require prior consent. The Declaration was adopted by the General Assembly on December 13, 1963, as GA Res. 1962(XVIII).

Comparison of Draft Declarations and the Evolution of Paragraph 6 GA Res. 1962 (XVIII)		
USSR Draft Declaration June 6th 1962	UK Draft Declaration December 4th, 1962	Draft Declaration accepted by consensus and adopted as G.A. Res. 1962
<ul style="list-style-type: none"> • Prior consent required for “any measures that might in any way hinder the exploration and use of outer space” • Duty of “cooperation and mutual assistance” 	<ul style="list-style-type: none"> • Due regard to the interests of other States in the exploration and use of outer space • The “need for consultation and cooperation between States in relation to such exploration and use” 	<ul style="list-style-type: none"> • Due regard for the corresponding interests of others States • Appropriate International consultations required for activities planned that State has reason to believe “would cause potentially harmful interference with activities of other States in the peaceful exploration and use of outer space”

C. Limited Test Ban Treaty

The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Limited Test Ban Treaty) entered into force on October 10, 1963. This treaty addressed one issue of potentially harmful interference – the detonation of nuclear devices in the atmosphere and in outer space. Each Party to the Limited Test Ban Treaty undertakes "to prohibit, to prevent, and not to carry out nuclear weapon test exploration, or any other nuclear explosion, at any place under its jurisdiction or control" in the atmosphere and beyond its limits, including outer space.³²

D. Outer Space Treaty and Article IX

The Outer Space Treaty was negotiated in COPUOS in 1966 and entered into force October 10, 1967. With the exception of the harmful contamination clause, the operative language of Article IX is a verbatim copy of GA Res. 1962 (XVIII) paragraph 6.³³ The harmful contamination provision was proffered by Canada during the 1962-1963 COPUOS negotiations on the *Declaration of Principles*, but was not included in the final draft Declaration.³⁴ Canada voiced concern that with the exclusion of a harmful contamination provision from the *Declaration* a Party "is not specifically asked to undertake consultation if an experiment planned by it or its nationals might involve a risk of modifying the natural environment of the Earth in a manner likely to be prejudicial for the well-being of human life or the interests of another State."³⁵

During the course of the 1966 Outer Space Treaty negotiations, a harmful contamination provision was added and Article IX of the Treaty was adopted as follows:

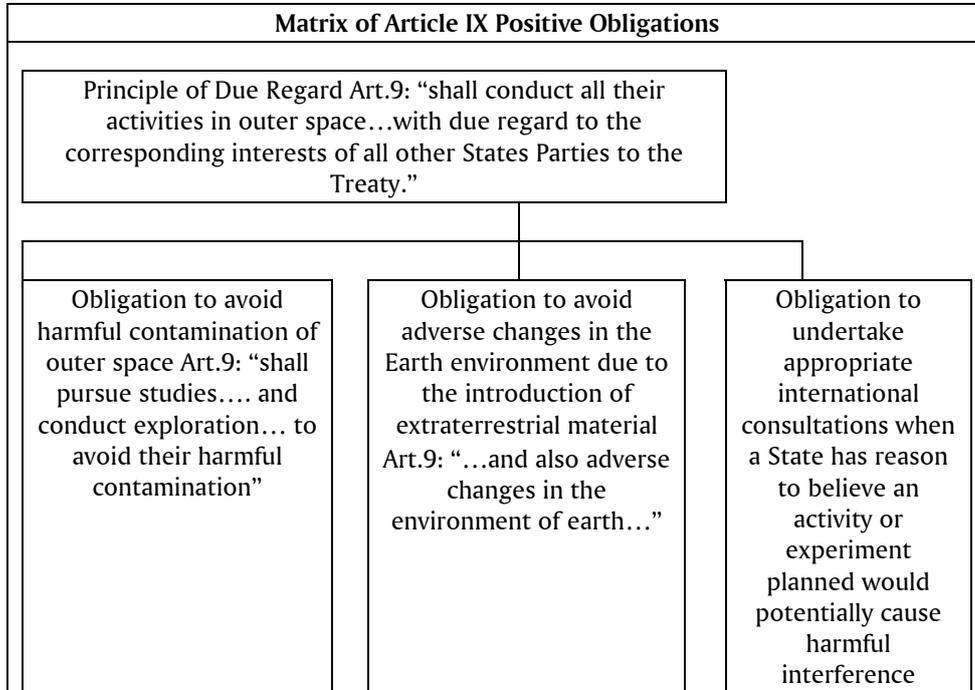
In the exploration and use of outer space In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful

contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.

IV. Legal Interpretive Analysis of Article IX Obligations

Activities in outer space are governed by the principle of due regard as articulated in the first sentence of Article IX, which states: "In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty...shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty."

The second and third sentences of Article IX elaborate upon the principle of due regard and prescribe three *proscriptive* positive legal obligations. First, studies and exploration are to be conducted so as to avoid harmful contamination of outer space. Second, studies and exploration are to be conducted so as to avoid adverse changes in the environment of Earth from the introduction of extraterrestrial matter. Third, appropriate international consultations shall be undertaken before proceeding with any activity or experiment that a State has reason to believe would cause potentially harmful interference with activities of other States in the peaceful exploration and use of outer space. The matrix below illustrates the relationship of these obligations.



It is important to note that Article IX does not distinguish between military and civilian activities, therefore the requirements of Article IX apply fully to military activities in space.³⁶ The application of Article IX to military activities is however subject to the Charter of the United Nations and general international law, including international law governing armed conflict.³⁷ As such, in certain situations Article IX obligations may be preempted by other norms of international law.³⁸

A. Obligation to Undertake Appropriate International Consultations

Article IX of the Outer Space Treaty contains a mandatory international consultation clause that states:

If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial

bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.³⁹

In order for a State to be under an obligation to undertake international consultations, three conditions must be satisfied:

1. There is an activity or experiment in outer space (e.g. an ASAT activity or test), including the Moon and other celestial bodies, planned by the State or its nationals;⁴⁰ and,
2. The State must have reason to believe the activity or experiment (e.g., an ASAT activity or test) would cause potentially harmful interference;⁴¹ and,
3. That this potentially harmful interference must potentially interfere with the activities of other States Parties to the Outer Space Treaty in the peaceful exploration and use of outer space, including the Moon and other celestial bodies.⁴²

i. Condition 1: Activity or Experiment in Outer Space

The terms "activity," "experiment," "outer space," and "planned" are not defined by the Treaty. The term activity is more encompassing than experiment, as an experiment is only one type of activity that can be undertaken. Thus, except for actions excluded from the scope of Article IX by preemptive norms of international law, the term activity can be reasonably interpreted as any action.

Outer space is not defined under international law and some dispute may arise as to whether the spatial location of an activity is occurring within outer space or airspace.⁴³ Also, there is a question as to whether or not an activity or experiment that is terrestrial based is also within the scope of the term "in outer space." For example, is an ASAT experiment that targets ground based satellite uplinks to disrupt the operation of orbiting satellites an experiment that is occurring in outer space or is it simply a terrestrial experiment that impacts an object in outer space?

"Planning" for something incorporates an element of premeditation and intent. An unplanned activity or experiment in outer space is possible, although highly unlikely.⁴⁴ If an unplanned activity or experiment did occur, the

international consultation clause would not apply. This is a reasonable interpretation because international consultations are required before proceeding with an activity or experiment and one cannot undertake consultations for an activity or experiment they did not plan or intend to conduct.

ii. Condition 2: Reason to Believe that the Activity or Experiment would Cause Potentially Harmful Interference

The terms "has reason to believe," "would cause," "potentially," and "harmful interference" are also not defined in the Treaty. "Reason to believe," when read in conjunction with "would cause potentially harmful interference," is indicative of a burden of proof threshold. Reason to believe is not synonymous with certainty and one can exclude certainty of potentially harmful interference as the appropriate interpretation of this provision. "To believe," in this context, is related to holding an opinion or thought.⁴⁵ "Reason," when read in conjunction with "to believe" is commonly understood to be a statement of some fact employed to prove or disprove some assertion, idea, or belief.⁴⁶ Therefore, reason to believe should be interpreted as having knowledge that proves the assertion that a planned activity would cause potentially harmful interference.

This language "has reason to believe" raises interesting questions. Is this standard of "reason to believe" a subjective or objective standard? If it is subjective, how does a State determine if it has reason to believe? If it is objective, what body decides? These questions illuminate the *principled* nature of the Treaty and illustrate that Article IX was designed to *guide* and provide *proscriptive* general rules of conduct.

"Would cause" is self-explanatory to the extent that the planned activity would result in potentially harmful interference. The potentiality element of the phrase "potentially harmful interference" is abstruse. As one cannot predict with certainty the results of an action before the action is carried out, attempting to predict whether or not a space activity or experiment will cause harmful interference is difficult. At the time the phrase "potentially harmful interference" was negotiated, significant concern existed that the planned, but yet conducted, second *Project West Ford* experiment would result in harmful interference to space activities. Furthermore, *Project West Ford's* purpose was to discover what result, be it interference or otherwise, the dispersal of copper dipoles would have on radio

communications. In this sense, the term "potentially" expands the reading of the provision beyond planned actions or experiments that *would* cause harmful interference; and instead encompasses activities and experiments that would cause interference that is potentially harmful.

This in turn leads to the question of what is "harmful interference." Harmful is ordinarily defined as "of a kind likely to be injurious."⁴⁷ "Interference" is ordinarily defined as an obstruction or hindrance.⁴⁸

Harmful interference in outer space can be divided into three primary categories: (1) Observational Interference (i.e., either terrestrial based astronomical observations or space based terrestrial observations), (2) Radio Frequency Interference, and (3) Physical Interference (i.e., interference with the freedom of physical movement and/or physical operations in outer space). The ITU defines harmful interference as "interference, which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with Radio Regulations."⁴⁹ The ITU definition fits within the category of radio frequency interference.

Read together, the operative language of "has reason to believe that an activity or experiment...would cause potentially harmful interference" places the responsibility and authority to determine whether a State has reason to believe and whether the planned action would cause potentially harmful interference with the State charged with the affirmative obligation to consult. As will be discussed in further detail *below*, this in turn allows States a wide degree latitude to determine whether or not this triggering condition is met.

iii. Condition 3: Potentially Harmful Interference with the Peaceful Exploration and Use of Outer Space

Condition 3 requires potentially harmful interference to interfere with the peaceful exploration and use of outer space of other State Parties. This raises the question of whether or not other State Party activities meet the criteria of peaceful use and exploration. If the exploration and use of other States Party to the Treaty are not peaceful, the there is no obligation to undertake appropriate international consultations with regards to potentially harmful interference of

non-peaceful use and exploration of outer space. For example, an experiment that would cause potentially harmful interference with a space object of a State Party carrying nuclear weapons in orbit would not trigger Condition 3, so long as the orbiting nuclear weapons are not sanctioned under international law.

iv. What are Appropriate International Consultations?

The Treaty neither proscribes the procedure for appropriate international consultations nor designates an agency to which States should turn for the authoritative evaluation of proposed uses or experiments.⁵⁰ As a result, the procedure and substantive nature of "appropriate international consultations" will depend on the nature of the planned activity or experiment.⁵¹ One can logically infer that a State is procedurally obligated, at minimum, to contact States Parties to the Treaty whose peaceful explorations and use of outer space would experience potentially harmful interference. One can also logically infer that the substantive obligation requires, at minimum, that these States be provided with information sufficient to take appropriate action to prevent potentially harmful interference with their uses or explorations in outer space, the Moon and other celestial bodies.

Consider that the object and purpose of Article IX is guided by principles of "cooperation and mutual assistance" with "due regard to the corresponding interests of all other States Parties to the Treaty."⁵² Interpreting the international consultation obligation provision as ad minimum requiring a State to fulfill the aforementioned procedural and substantive obligations is a good faith interpretation of the Treaty given the terms of the Treaty in their context and in the light of its object and purpose. Imposing any less of an obligation would emasculate the international consultation clause of Article IX, a result that is unreasonable.

B. Obligation to Avoid Harmful Contamination

Article IX contains a harmful contamination clause that states: "States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination"⁵³

The Treaty does not define harmful contamination. Harmful is ordinarily defined as "of a kind likely to be injurious."⁵⁴ Contamination is ordinarily defined as "to make unfit for use by the introduction of unwholesome or undesirable elements."⁵⁵ One can conclude that harmful contamination of outer space is the introduction of elements that make outer space unfit for use or are likely to be injurious to users of outer space.

Article IX does not prohibit harmful contamination of outer space. Instead states are obligated only to avoid harmful contamination. The Treaty is silent on appropriate measures or authoritative evaluations to determine whether a State has taken appropriate measures to avoid harmful contamination. Until State practice more clearly establishes appropriate standards for the avoidance of harmful contamination, States are granted a wide degree of latitude to determine what action is appropriate. State action is restricted to the extent that their actions must be conducted in good faith in accordance with the principles of the Treaty and international law.

C. Obligation to Avoid Adverse Changes in the Environment of the Earth

Article IX obligates States to pursue studies and exploration of outer space to avoid "adverse changes in the environment of the Earth resulting from introduction of extraterrestrial matter, and where necessary, shall adopt appropriate measures for this purpose." This provision, in and of itself, is substantively lacking.

The verb "avoid" does not prohibit adverse changes. The adjective "adverse" qualifies the "change" that is to be avoided. Only change resulting from one specific cause, the introduction of extraterrestrial matter, is addressed. A literal interpretation of this provision excludes adverse changes to the Earth's environment resulting from space based electromagnetic radiation sources, the blocking or interference of solar emissions, gravitational and magnetic fields, and other forms of energy that are not considered "extraterrestrial matter."

V. Article IX Analysis of FY-1C and USA-193 ASAT Activities

In the following section the *FY-1C* and *USA-193 ASAT* activities are assessed in light of Article IX of the Outer Space Treaty. This assessment determines whether

or not the obligation for international consultation was applicable and if applicable whether the obligation was fulfilled. Article IX obligations to avoid harmful contamination of outer space are also assessed.

A. FY-1C

On January 11, 2007, China conducted an ASAT test which resulted in the destruction of the *Feng Yun 1C (FY-1C)* weather satellite in polar orbit at an altitude of approximately 537 miles. This was the first such destruction of a satellite since the kinetic ASAT missile tests conducted during the Cold War by the United States and the Soviet Union.⁵⁶ Prior to conducting the *FY-1C* ASAT experiment on January 11, 2007, China did not take any steps to consult or inform the international community. Following the *FY-1C* ASAT test, Britain, Australia, Canada, Japan, Taiwan, India, South Korea and the European Union joined the United States in protesting and calling upon Beijing for consultations.⁵⁷ It was not until January 23, 2007, that China publicly confirmed it had conducted the ASAT experiment.⁵⁸

i. International Consultation Obligation

Was China obligated to conduct international consultation, and if so did China satisfy this obligation?

As previously discussed, before a State is obligated to undertake international consultations three conditions must be satisfied: (1) There is an activity or experiment in outer space (e.g. an ASAT activity or test), including the Moon and other celestial bodies, planned by the State or its nationals,⁵⁹ (2) the State must have reason to believe the activity or experiment (e.g. an ASAT activity or test) would cause potentially harmful interference,⁶⁰ and (3) that this potentially harmful interference must potentially interfere with the activities of other States Parties to the Outer Space Treaty in the peaceful exploration and use of outer space, including the Moon and other celestial bodies.⁶¹

On January 11th, 2007, China conducted a kinetic ASAT experiment against the weather satellite, *FY-1C*, operating in a polar orbit. An ASAT test against an orbiting satellite falls within a good faith interpretation of "activity or experiment in outer space."⁶² Therefore, the first condition triggering mandatory international consultation is satisfied.

A successful ASAT test against an orbiting satellite with a kinetic kill vehicle will result in the destruction of the targeted satellite and the creation of dangerous fast-moving space debris. The resulting space debris is harmful interference that has the potential to damage or destroy other objects in outer space, in particular objects operating in similar orbits or intersecting orbits. The destruction of *FY-1C* is a large space debris generating event, with thousands of pieces of debris cataloged by the United States Space Surveillance Network.⁶³ Furthermore, due to the altitude and orbital mechanics of *FY-1C*, this debris threatens all spacecraft flying below 2,000 km and will remain in orbit for decades.⁶⁴ As a result, this debris caused and is causing potentially harmful interference with the activities of the International Space Station, the Space Shuttle, and other space objects in polar orbit and LEO which were and are conducting peaceful exploration and use of outer space.⁶⁵ This harmful interference can be categorized as physical interference with physical movement and/or operation of vehicles and personnel in outer space.

The Chinese should have had "reason to believe" that the successful destruction of *FY-1C* would create a debris field that would cause potentially harmful interference. The Chinese are sophisticated enough to conduct an ASAT test against an orbiting satellite, are aware of the basic laws of physics that underlies kinetic ASATs and the motion of objects in outer space, and therefore have sufficient knowledge to conclude that their planned activity would create space debris and that resulting debris field would be long lasting and threaten spacecraft over a range of orbits. Of course, it can still be argued that subjectively the Chinese assessed prior to conducting the experiment that there was no reason to believe potentially harmful interference would occur. The weakness of this position is an implied presumption of certainty as to the potentiality of harmful interference. To argue that one had *no reason to believe* that *potentially* harmful interference would occur is beyond the standards of good faith and due regard that are foundation of Article IX.

Interpretation of treaty obligations can be construed either broadly or narrowly. States often interpret agreements to provide greatest latitude of State freedom of action. However, even if Article IX is interpreted broadly for the purpose of providing State freedom of action, the principle of due regard and

good faith, when read in conjunction with terms of the Treaty in light of its object and purpose, cannot justify an interpretation that concludes China did not have "reason to believe" not "reason to know," but only the "reason to believe."

It is on these grounds that the Chinese "had reason to believe" and the second condition triggering mandatory international consultation obligation is satisfied.

Other States Party to the Treaty, including the United States, were peacefully using and exploring outer space in polar orbits or intersecting LEO orbits with *FY-1C* on January 11, 2007. The peaceful exploration and uses of space within these orbits are diverse, ranging from the *International Space Station* to weather satellites. On this basis the third condition triggering mandatory international consultations under Article IX is satisfied.

Since these three conditions were met prior to China conducting the *FY-1C* ASAT experiment, China was obligated to conduct appropriate international consultations. These international consultations were obligated to be conducted appropriately with other States Parties to the Treaty that China had reason to believe the *FY-1C* ASAT experiment would cause potentially harmful interference to their respective peaceful uses and exploration of outer space.

China did not take any steps to consult or even inform any such States Party to the Treaty *prior* to conducting the *FY-1C* ASAT experiment. It was not until January 23, 2007, that China publicly confirmed it had conducted the ASAT experiment.⁶⁶ The Treaty grants States broad discretion by not defining appropriate international consultations. However, as discussed above, ad minimum it can be inferred that appropriate international consultations is the transmission of information to potentially affected States that is sufficient for affected States to take appropriate action to prevent potentially harmful interference with their activities or experiments. China took *no action* prior to conducting the *FY-1C* ASAT experiment, not even *informing* potentially affected States of the upcoming activity. China's nonfeasance was a violation of Article IX's obligation to conduct appropriate international consultations.

Prior to January 11, 2007, United States intelligence agencies detected two previous tests of the Chinese ASAT system and weeks before the *FY-1C* ASAT test US intelligence agencies were aware the Chinese were preparing another ASAT

test.⁶⁷ This fact raises the question: is the obligation to conduct international consultations affected or voided when States have knowledge of planned activities gained through intelligence apparatus? The answer is no. The international consultation obligation applies whether or not other States have knowledge of planned activities that they gained through intelligence apparatus. The critical point is that Article IX requires States to *consult* and does not distinguish or modify this obligation towards States that have independently gained knowledge of a planned space activity or experiment. The obligation to consult is not modified or negated even though States *may request* consultation concerning an activity or experiment they have reason to believe would cause potentially harmful interference with activities in the peaceful exploration and use of outer space.

China's violation of the international consultation obligation must be considered in light of State practice. During the Cold War, The United States and Soviet Union experimented with various ASAT weapons. ASAT experiments against orbiting satellites were successfully carried out by the United States and Soviet Union. The last successful kinetic ASAT experiment was carried out by the United States in 1985 on the *Solwind* satellite.⁶⁸ Neither the United States nor the Soviet Union conducted international consultations in accordance with Article IX prior to conducting their kinetic ASAT activities. The Chinese failure to undertake appropriate international consultations prior to conducting their ASAT tests is consistent with the Cold War practices of the United States and Soviet Union.

Do the Cold War practices of the United States and Soviet Union establish an agreement of State Parties to the Treaty to interpret Article IX as not requiring appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space? Article 31(3)(B) of the Vienna Convention states: "[t]here shall be taken into account, together with the context...any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation." "It is not necessary to show that each party has engaged in a practice, only that all have accepted it, albeit tacitly."⁶⁹

Let us assume that the US and Soviet kinetic ASAT activities did trigger the obligation to undertake appropriate international consultation. In that case, one can argue that the Cold War practice of the United States and Soviet Union

establishes an agreement among States Party to the Treaty to interpret Article IX as not requiring appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space. In support of this argument, one can present a lack of objection to the practice as tacit approval by other States Party to the Treaty. One can also argue that when taking into account subsequent State practice, more weight should be given to the subsequent practice of States that have actually conducted kinetic ASAT experiments in outer space. To date, only three States (the United States, the former Soviet Union, and China) are known to have conducted such experiments and none of these States presumably undertook appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space. It can be argued that the subsequent practices of these three States establish an agreement among Parties that excludes kinetic ASAT tests from Article IX's obligation to conduct appropriate international. It can be further argument that all have accepted it by tacit approval.

While these arguments have merit, they fail to overturn the presumption that States intend to be bound by the terms of their written agreements in accordance with the ordinary meaning to be given to the treaty in their context and in light of its object and purpose.

First, consider that subsequent practice in the application of the treaty is much more effective at establishing agreement as to treaty interpretation when the treaty is bilateral or has a limited number of State Parties and that the Outer Space Treaty has almost half of the world's nations as States Party. While three States have presumably failed to conform to Treaty obligations, no State has formally supported an exclusion of kinetic ASAT tests from Article IX international consultation obligations. Furthermore, there is uncertainty as to what States have or had the technological capacity to monitor, detect, and verify a kinetic ASAT test has occurred and by whom the test was conducted. During the Cold War these technological limitations presumably only allowed a handful of States to verify firsthand an ASAT test occurred. It is unjust to argue tacit approval by States when States did not have independent methods of ASAT test verification.

Also consider that following the *FY-1C* ASAT test, Britain, Australia, Canada, Japan, Taiwan, India, South Korea and the European Union joined the United

States in protesting and calling upon Beijing for consultations.⁷⁰ While the lack of objection during the Cold War is an important subsequent practice, so are the objections raised after *FY-1C*.

The reasonable conclusion is that subsequent state practice has not yet established that Article IX's appropriate international consultation obligation excludes consulting for kinetic ASAT activities or experiments in outer space. However, if States continue to perform kinetic ASAT experiments without conducting appropriate international consultations, the argument in favor of subsequent State practice establishing an agreement among States Party to exclude kinetic ASAT activities from Article IX's international consultation provision is strengthened.

ii. Obligation to Avoid Harmful Contamination of Outer Space

Did China satisfy the Article IX obligation to avoid harmful contamination of outer space?

Polar (PO) and Low-Earth Orbits (LEO) are used for a variety of purposes. Remote sensing, manned space flight, communication satellites, the *International Space Station*, and a variety of other space objects and personnel occupy PO and LEO at any given time. The Chinese ASAT test introduced thousands of pieces of potentially hazardous space debris into PO and LEO⁷¹ that will be in the outer space environment, in substantial amounts, for decades.⁷² This space debris has modified the PO and LEO environment making orbits that intercept the Chinese ASAT debris field unfit (or at the least dangerous) for use. Given the amount of debris released, it seems reasonable for this contamination to be considered harmful or of a kind likely to be injurious.

Article IX does not prohibit harmful contamination of outer space. Instead, states are obligated to *avoid* harmful contamination. China only violated this provision if they did not conduct the ASAT test to avoid harmful contamination. Determining whether an action satisfactorily avoided harmful contamination is difficult because the Treaty does not provide the procedure for appropriate international consultations nor designate an agency to which States should turn for an authoritative evaluation.⁷³

Conducting an ASAT test on an orbiting satellite does not in and of itself constitute *unavoidable* harmful contamination of outer space. It is possible that the underlying target or technology of an ASAT test will generate unavoidable space debris. However, kinetic ASAT tests can be conducted against targets in orbits with altitudes and inclinations that would minimize harmful contamination.

It does not appear that the Chinese attempted to modify the target satellite's orbit in order to avoid harmful contamination or minimize the amount of time the resulting debris field would remain in outer space. On this basis, an argument exists that the Chinese did violate the harmful contamination provision of Article IX. However, this argument is tenuous due to the ambiguous and subjective nature of establishing a standard for *avoiding* harmful contamination. Therefore, it cannot be definitively assessed whether the Chinese ASAT test violated the harmful contamination provision of Article IX.

B. USA-193

In January 2008, the United States announced publicly that it had lost control of a satellite, *USA-193* (a.k.a. *NROL-21*), whose orbit was decaying and would eventually bring the satellite into the Earth's atmosphere.⁷⁴ On February 14, 2008, the United States Department of Defense held a news briefing publicly addressing the decay and planned kinetic ASAT intercept of *USA-193*. US officials indicated they were communicating with other countries and various organizations (e.g., the UN, NATO, and ESA) to inform them of the actions the US planned to take regarding *USA-193*. However, the US Deputy National Security Advisor stated:

The United States has certain obligations based on treaties and other agreements related to activities in space. The 1967 UN Treaty on Exploration and Use of Outer Space, in particular, calls on states to keep others informed of activities of potential concern. While we do not believe that we meet the standard of Article IX of that Treaty that says we would have to consult in the case of generating potentially harmful interference with other activities in space, we do believe it is important to keep other countries informed of what is happening.⁷⁵

This statement reveals that the United States did not believe the planned intercept of *USA-193* triggered the international consultation provision of Article IX. Was this statement legally accurate or did the planned intercept of *USA-193* trigger the international consultation provision?

The US planned on intercepting *USA-193* with a kinetic ASAT missile just prior to it hitting the Earth's atmosphere.⁷⁶ The US estimated that over 50 percent of debris generated from the interception would be de-orbited within the two orbits. The US did consider whether unmanned bodies in space, in low-Earth orbit, and the space station would be at increased risk of space debris collisions.⁷⁷ The US stated they were planning their activities with "due regard" to the safety of people in orbit.⁷⁸

On February 21, 2008, the US successfully intercepted *USA-193*. In accordance with the Outer Space Treaty and Registration Convention, the United States notified the UN⁷⁹ The interception occurred at an altitude of approximately 133 miles.⁸⁰

i. International Consultation Obligation

Did the planned intercept of *USA-193* trigger the international consultation provision or was the US correct in asserting that their planned ASAT intercept did not meet the standard of Article IX?

As discussed above, before a State is obligated to undertake international consultations three conditions must be satisfied: (1) There is an activity or experiment in outer space (e.g., an ASAT activity or test), including the Moon and other celestial bodies, planned by the State or its nationals,⁸¹ (2) the State must have reason to believe the activity or experiment (e.g., an ASAT activity or test) would cause potentially harmful interference,⁸² and (3) that this potentially harmful interference must potentially interfere with the activities of other States Parties to the Outer Space Treaty in the peaceful exploration and use of outer space, including the Moon and other celestial bodies.⁸³

It can be argued that the planned intercept of *USA-193* was not going to occur "in outer space." The failure of international law to delimitate airspace and

outer space leaves some ambiguity as to whether the height of the *USA-193* intercept was in outer space. However,

since no State has ever claimed that a satellite orbiting the Earth was infringing its national airspace, it is possible to say that in international law, outer space begins *at least* from the height above the Earth of the lowest perigee of any existing or past artificial satellite that has orbited the Earth without encountering any protest.⁸⁴

On this basis, the intercept of *USA-193* did occur in outer space.

Article IX only requires international consultations when a State has reason to believe a planned activity or experiment would cause potentially harmful interference with other States Parties in the peaceful exploration and use of outer space. *USA-193*'s intercept was designed to limit the lifetime of space debris generated from the event by conducting the intercept as *USA-193* entered the final stages of a decaying orbit. It is questionable whether the US had reason to believe the planned intercept would cause potentially harmful interference because it was estimated the debris would remain in orbit a short time and that the bulk of the debris would be in an orbit not often utilized. The intercept would definitely have caused interference, but whether or not it gave reason to believe potentially harmful interference with other State activities is not conclusive.

Comparing *USA-193* to *FY-1C*, while the *FY-1C* intercept would certainly generate significant space debris that would remain in orbits that are utilized by other States, the *USA-193* intercept would occur in a decaying orbit, at a low altitude, with a minimal lifetime for space debris generated.

It was concluded above that China should have had reason to believe that their planned experiment would have caused potentially harmful interference. In that analysis, China was appropriately held to the standard that when interpreting and applying Article IX Treaty obligations a State must do so in good faith and due regard to the Treaty. If one applies the principle of good faith and due regard to the *USA-193* intercept, concluding that the US had "reason to believe" is with merit even though the anticipated impact of *USA-193*'s intercept would be significantly less than *FY-1C*'s.

While concluding the US had "reason to believe" has merit, the United States was also correct in stating the position that "we do not believe that we meet the standard of Article IX of that Treaty that says we would have to consult in the case of generating potentially harmful interference,"⁸⁵ because this is a statement *only* of the United States own evaluation whether they have reason to believe their planned activities would cause potentially harmful interference. Solely on the basis of the US evaluation, the intercept of *USA-193* was not subject to Article IX international consultation obligations. The US position is defensible because the objective evidence presented prior to the planned intercept of *USA-193* does not conclusively establish whether the planned intercept would give "reason to believe" that interference would be generated that was potentially harmful to other State activities in outer space. Unlike *FY-1C*, the interception orbit of *USA-193* would not result in a long lasting debris field of significant size and any debris generated would primarily be in a low altitude decaying orbit. It was within the discretion of the United States to conclude the planned intercept of *USA-193* did not give "reason to believe" potentially harmful interference would occur because the facts did not definitely establish the US should have had "reason to believe."

While this exercise of this discretion by the United States was within the bounds of Article IX, it was also arguably a strategic mistake. As discussed above, the Outer Space Treaty is primarily a treaty of principles, crafted for the purposes of *proscribing* norms to an area where uncertainty existed as to what law, if any, applied. These proscriptive principles, by their very nature, cannot embody their object and purpose by solely reviewing their text. As a result subsequent State actions play a role in the interpretation and application of the Treaty. The US is able to defend its conclusion that Article IX consultation were not triggered in part because State practice has yet to clearly establish the scope of the consultation obligation.

Why was denial a mistake? Even though the US denied Article IX applied to the *USA-193* intercept, the US still undertook international consultations and informed the international community of their planned activity. The US essentially fulfilled the minimum requirements of appropriate international consultations: to contact States Parties to the Treaty whose peaceful explorations and use of outer

space would experience potentially harmful interference and provide them with information sufficient to take appropriate action to prevent potentially harmful interference with their uses or explorations in outer space, the Moon and other celestial bodies.

The US could have proffered that Article IX international consultation obligations were applicable. If so, the procedure and substantive nature of the consultations the United States undertook would have established a precedent of State practice with regards to Article IX. This was a unique opportunity to guide the application of Article IX. Instead, the US essentially fulfilled the Article IX requirements without establishing a precedent to clarify Article IX obligations. As a result, other States planning kinetic ASAT activities and experiments will not have an historical legal precedent of a State Party recognizing and adhering to Article IX international consultation obligations. If the US had recognized Article IX's application, States that plan to conduct kinetic ASAT experiments would be under greater scrutiny if they failed to recognize Article IX's application and conduct appropriate international consultations. US recognition would also have set a threshold of debris generation that clarifies when a State should "have reason to believe" their planned activity or experiment in space would cause potentially harmful interference.

ii. Obligation to Avoid Harmful Contamination of Outer Space

As discussed above, conducting a kinetic ASAT intercept on an orbiting satellite does not in and of itself constitute unavoidable harmful contamination of outer space. It is possible that the underlying target or technology of an ASAT test will generate unavoidable space debris. However, kinetic ASAT tests can be conducted against targets in orbits with altitudes and inclinations that would minimize harmful contamination.

The Treaty is silent on appropriate measures or authoritative evaluations to determine whether a State has taken appropriate measures to avoid harmful contamination; however, the United States recognized *USA-193* would create harmful contamination and took measures to avoid it by intercepting the satellite in a decaying orbit at a low altitude, minimizing the lifetime of space debris generated and other potentially harmful contaminants in the outer space environment. These actions were in accordance with the principle of due regard

enumerated in Article IX and the US fulfilled the obligation to avoid harmful contamination by taking these actions. As an example of subsequent State action, the harmful contamination and debris mitigation measures undertaken by the US will contribute to interpreting the obligation of harmful contamination avoidance, at least with regards to kinetic ASAT satellite intercepts.

VI. Conclusions

China's *FY-1C* ASAT experiment violated the appropriate international consultation provisions of Article IX of the Outer Space Treaty. The orbit of *FY-1C* was of such a nature that it was reasonable to conclude prior to conducting the ASAT experiment that a successful intercept would create a debris field of size and duration that would cause potentially harmful interference with the peaceful uses and explorations of other States Party to the Treaty.

In the defense of China, their lack of consultation *prior* to the ASAT experiment is consistent with the Cold War practices of the United States and the Soviet Union (assuming the Cold War kinetic ASAT experiment of the United States and Soviet Union triggered the international consultation obligation). Nonetheless, State practice has yet to definitively establish that kinetic ASAT activities and experiments are granted an exception to Article IX obligation to conduct appropriate international consultations.

The *USA-193* intercept arguably did not violate and may not have been subject to Article IX's international consultation obligation. If the planned *USA-193* intercept did trigger the obligation to conduct appropriate international consultations, the United States met the *ad minimum* requirements of this obligation.

The United States denied that Article IX's international consultation obligation was applicable to the planned *USA-193* intercept. By denying its application and not recognizing its application and establishing precedent of State practice, the United States lost a strategic opportunity to shape the interpretation and development of Article IX.

The violation of Article IX's international consultation provision by China continues a disturbing trend of States not recognizing the application of this

provision to kinetic ASAT activities. If this trend continues, the argument in favor of subsequent State practice establishing an agreement among States Party to exclude kinetic ASAT activities from Article IX's international consultation provision is strengthened. Fortunately several States protested China's failure to consult in the days following *FY-1C*'s destruction, reversing the trend of States' tacit approval implicit by silence.

One reason Article IX has failed to ensure States fulfill their obligations is because the Outer Space Treaty does not provide a procedure for appropriate international consultations nor designate an agency to which States should turn for an authoritative evaluation of their planned activities.⁸⁶ As a result Article IX's procedural and substantive application is largely left to the discretion of States, and States determine themselves whether the obligation to consult is triggered. In our anarchic system of international relations, States have little motivation to interpret and apply agreements to restrict their freedom of actions without assurance that other States will act in kind. This failure is a manifestation of the much greater problem: the vacuum of supranational authority in international law. Today no supranational authority exists that can rule on the legality of State action and enforce this judgment independent of State influence. As a result, the immediate self-interests of States support restrictive interpretation and application of Article IX.

Even with self-interest supporting restrictive interpretations, as discussed *supra*, an interpretation of the Outer Space Treaty based on the Vienna Convention methodology does provide some degree of objectivity for States who are assessing their planned activities. For example, States are obliged to consider their planned activities in light of the principle of due regard and interpret provisions of Article IX in good faith.

In instances of ambiguity, the Outer Space Treaty does not provide a mechanism of interpretation or dispute resolution. Fortunately, in the event of dispute arising due to interpretation and application of the Treaty States can rely on and should make use of the UN Charter's mechanism of pacific settlements of disputes.⁸⁷ When a State clearly violates Article IX, the international community should react with unified condemnation, take appropriate actions to discipline the violator (in accordance with the UN Charter), and ensure violations are not

repeated in the future. It is critical for States to appreciate that at this point in history, State practice and application of Article IX will largely determine whether or not Article IX is rendered ineffectual. It is in the interests of all nations for Article IX to be a substantive provision and not just empty words. As the *FY-1C* experiment demonstrated, the failure of States to consult prior to conducting activities increases mistrust, raises tensions, and undermines international peace and security.

The international community should take concrete steps towards strengthening Article IX. An additional protocol to the Outer Space Treaty could be negotiated that provides a procedure and authoritative body for determining whether a planned activity warrants international consultation and whether appropriate measures have been planned to avoid harmful contamination of outer space and adverse changes to the Earth's environment. Another option is for the international community to agree to standards of harmful contamination and harmful interference mitigation independent of an additional protocol.

Concluding that Article IX imposes a substantive obligation and further concluding that the *FY-1C* intercept violated this obligation is a serious charge. While we all bring to a discussion the bias of our individual human experience, this author recognizes such bias exists and has attempted to assess the *FY-1C* and *USA-193* intercepts objectively. There is no doubt that all people, regardless of nationality, share the common human desires of self-preservation and peace. It is therefore with hope that these conclusions are made. The hope that States, when given greater clarity as to the scope of Article IX's legal obligations, will more fully respect and carry out their respective agreements.

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Endnotes

- 1 The test occurred on January 11, 2008 in the United States, but because of the difference in local times the event occurred on January 12, 2008 in China.
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- 8 Francis Jacobs, *Varieties of Approach to Treaty Interpretation: With special reference to the Draft Convention on the Law of Treaties before the Vienna Diplomatic Conference*, 18 INT. AND COMP. L. QUART. 318, 319 (1969).
- 9 Kenneth Vandervelde, *Treaty Interpretation from a Negotiator's Perspective*, 21 VAND. J. TRANSNAT'L L. 281, 287 (1988).
- 10 Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331.

- 11 ANTHONY AUST, *MODERN TREATY LAW AND PRACTICE* 232 (2d ed., (Cambridge University Press, 2d ed., 2007).
- 12 *Jacobs, supra* note 8.
- 13 Vandervelde, *supra* note 9 at 342.
- 14 Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, GA Res. 1962(XVIII) [hereinafter Declaration].
- 15 UN Charter art 13(a).
- 16 Question of the Peaceful Use of Outer Space, GA Res. 1348 (XIII) (1958).
- 17 *Id.* at para. (1)(d).
- 18 International Cooperation in the Peaceful Uses of Outer Space, GA Res. 1472(XIV) (1959).
- 19 Opening Statement by the Chairman, GA 18th Sess., Annex II, para. (e). UN Doc. A/5482 (1963) at 10. See also, *The Peaceful Uses of Outer Space*, in 1962 UNITED NATIONS YEARBOOK 42 (1962) [hereinafter UNITED NATIONS YEARBOOK].
- 20 International Cooperation in the Peaceful Uses of Outer Space, GA Res. 1721(XVI) (1961).
- 21 See C.F.J. Overhage & W.H. Radford, *The Lincoln Laboratory West Ford Project - An Historical Perspective*, in 52 (5) PROC. OF THE IEEE 452-54 (May 1964) [hereinafter *The Lincoln Laboratory*].
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- 23 See *The Lincoln Laboratory, supra* note 21.
- 24 DELBERT TERRILL, *THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL OUTER SPACE LAW* 65 (Maxwell Air Force Base: Air University Press, 1999) (quoting R. Cargill Hall, *The International Legal Problems in Space Exploration, An Analytical Review* 41- 42 (June 1966) (unpublished master's thesis, California State University at San Jose)).
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- 26 USSR Draft Declaration of the Basic Principles Governing the Activities of States in the Exploration and Use of Outer Space, GA 18th Sess., Annex III, para.6. UN Doc. A/5482 at 11 (1963) [hereinafter Draft Declaration].
- 27 UNITED NATIONS YEARBOOK, *supra* note 19, at 42.
- 28 *Id.*
- 29 *Id.*

- 30 Draft Declaration, *supra* note 26, at 11.
- 31 Declaration, *supra* note 14, at para. 6.
- 32 Treaty Banning Nuclear Weapon Tests in Atmosphere in Outer Space and Under Water, Oct. 10, 1963, 480 U.N.T.S. 43.
- 33 Article IX of the Outer Space Treaty added additional language to formulate ¶ of GA Res.1962(XVI) to ensure enforceability as a treaty provision ("State Party to the Treaty") and to clarify the scope of outer space to include the moon and other celestial bodies. See Outer Space Treaty, *supra* note 7, at art. IX.
- 34 Verbatim Record of the 24th meeting of COPUOS, Nov. 22, 1963, Doc. A/5549/Add.1 Annex 1 at 17.
- 35 *Id.*
- 36 Robert Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1, 76-77 (2000).
- 37 See Outer Space Treaty, *supra* note 7, at art. III.
- 38 For example, ASAT activities or experiments conducted during a time of armed conflict sanctioned under international law, directed against a belligerent, or sanctioned by the UN Security Council necessary for the maintenance of international peace and security may be governed by norms of international law that preempt Article IX positive obligations. See Ramey, *supra* note 36. See also Michel Bourbonniere, *National- Security Law in Outer Space: The Interface of Exploration and Security*, 70 J. AIR L. & COM. 3, 7-14 (commenting that "the Outer Space Treaty was not meant to change the law governing means and methods of warfare.").
- 39 See Outer Space Treaty, *supra* note 7, at art. IX.
- 40 *Id.*
- 41 *Id.*
- 42 *Id.*
- 43 For example, a high-altitude activity or experiment may be protested against by a subjacent State on the grounds that the activity or experiment is occurring within the State's sovereign airspace even though no legal delimitation of air and space is established under international law.
- 44 As humankind increases outer space utilization, the likely of accidental (e.g., unplanned) outer space activities or experiment will likewise increase, with some level of correlation proportional to use.
- 45 1 THE SHORTER OXFORD DICTIONARY, (1993).
- 46 *Id.*

- 47 MERRIAM-WEBSTER'S ONLINE DICTIONARY, <http://www.m-w.com/dictionary/harmful> (last visited Oct. 21, 2008).
- 48 THE SHORTER OXFORD DICTIONARY, *supra* note 45.
- 49 Bourbonniere, *supra* note 38, at 57 (quoting the Convention of the International Telecommunication Union, Dec. 22, 1992, S. Treaty Doc. No. 104-34 (1996)).
- 50 Ivan Vlastic, *The Space Treaty: A Preliminary Evaluation*, 55 CAL. L. REV. 507, 517. Also, consider that during the negotiations of GA Res.1962 (XVIII), Australia, Brazil and India suggested that international consultations could be explicitly linked with international forums existing at the time, such as COSPAR's CGPHESE. The United States considered the CGPHESE an appropriate forum for consultation but argued it would be inappropriate to specify one particular mode of conducting international consultations exclusively and for all time. Ultimately, the position of the United States prevailed.
- 51 See Brandon Hart, *Legal Implications Surrounding Recent Interception of Spy Satellite*, JOINT CENTER FOR OPERATIONAL ANALYSIS (JCOA) J. 34 (June 2008).
- 52 See Outer Space Treaty, *supra* note 7, at art. IX.
- 53 *Id.*
- 54 See MERRIAM-WEBSTER'S ONLINE DICTIONARY, *supra* note 47.
- 55 *Id.*
- 56 Kan, *supra* note 4.
- 57 Theresa Hitchens, *US-Sino relations in Space: From "War of Words" to Cold War in Space*, 3 CHINA SECURITY 12, 23 (2007).
- 58 *China Confirms Satellite Downed*, BBC NEWS REPORT (Jan. 23, 2007), <http://news.bbc.co.uk/2/hi/asia-pacific/6289519.stm>
- 59 See Outer Space Treaty, *supra* note 7, at art. IX.
- 60 *Id.*
- 61 *Id.*
- 62 *Id.*
- 63 *Id.* See also *The Space Security Index 2007* at 6 (Waterlo, Canada: Project Ploughshares, 2007) at 6. 2007).
- 64 Frank Moring, *China ASAT Test Called Worst Single Debris Event Ever*, AVIATION WEEK AND SPACE TECHNOLOGY (Feb. 11, 2007), http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=space&id=news/aw021207p2.xml&headline=China%20Asat%20Test%20Called%20Worst%20Single%20Debris%20Event%20Ever
- 65 *Id.*

- 66 See BBC NEWS REPORT, *supra* note 58.
- 67 Michael Gordon & David Cloud, *US Knew of China's Missile Test, but Kept Silent*, NEW YORK TIMES (Apr. 23, 2007).
- 68 *Judge Won't Bar Test Firing at Satellite, Expected Today*, NEW YORK TIMES A8 (Sept. 13, 1985).
- 69 AUST, *supra* note 11, at 243.
- 70 Hitchens, *supra* note 57, at 23.
- 71 See Kelso, *supra* note 3; *China's ASAT Test Will Intensify US-Chinese Standoff*, *supra* note 2; Peter Siegal & James Gertzang, *Chinese Missile Strikes Satellite*, THE L.A. TIMES, Jan. 19, 2007, <http://www.latimes.com/news/nationworld/world/la-fg-satellite19jan19,0,3917551.story?coll=la-homeeadlines>%20and%20Technology%20News%20Daily%20>; and Joseph Kahn, *China Confirms Space Test; Denies Intent to Intimidate*, THE NEW YORK TIMES (Jan. 24, 2007), <http://www.nytimes.com/2007/01/24/world/asia/24china.html?emc=eta1>
- 72 Moring, *supra* note 64
- 73 Vlastic, *supra* note 50, at 517.
- 74 Paul Harris, *US warns out-of-control spy satellite is plunging to Earth*, THE OBSERVER, Jan. 27, 2008, www.guardian.co.uk.
- 75 See DoD News Briefing, *supra* note 5
- 76 *Id.*
- 77 *Id.*
- 78 *Id.*
- 79 See Outer Space Treaty, *supra* note 7, at art. XI. See also the Convention on the Registration of Objects Launched into Outer Space, 28 U.S.T. 695, 1023 U.N.T.S. 15.
- 80 Kris DeRago, *Military confirms destruction of satellite*, UNIVERSITY WIRE (Feb. 25, 2008).
- 81 See Outer Space Treaty, *supra* note 7, at art. IX.
- 82 *Id.*
- 83 *Id.*
- 84 Christopher M. Petras, "Space Force Alpha:" *Military Use of the International Space Station and the Concept of "Peaceful Purposes"*, 53 A.F.L. REV. 135, 155 (2002)
- 85 See DoD News Briefing, *supra* note 5.
- 86 Vlastic, *supra* note 50.
- 87 See UN Charter arts. 33-38.

8

International Charter on Space and Major Disasters Accession in the Layout of National Political and Legal Regimes

*Daniël Konrad T. Link**

The article summarizes the provisions of the charter which aims at providing a unified system of space data acquisition and delivery to governments and non-government organizations of those countries which are often affected by natural disasters especially undeveloped countries. The Charter is a source for effective implementation of basic principles of space law, and requires a better legal regime of Earth Observation (EO). Article 4.1 of the charter is a significant clause imposing responsibility on member states to undertake technical and juridical analysis for sharing and free exchange of information and data. Article 5.4 of the charter conveys that no legal action shall be initiated against the state parties in the event of bodily injury, damage or financial loss arising from the execution or

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non-execution of charter activities. The article states that the SBDA (The Brazilian Society of Air and Space Law) recommends Brazil to become a member of the charter to extend its space related activities and services to the benefit of mankind, as part of its space policy.

"The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters"¹ anywhere in the world.

This system was initiated by the European and French space agencies (ESA and CNES), with the Canadian Space Agency (CSA) signing on October 20th, 2000. It was followed by NOAA, CONAE, JAXA and mor² recently having the Chinese space agency (CNSA) joining as a member.

"Each member agency commits resources to support the provisions of the Charter and thus is helping³ to mitigate the effects of disasters on human life and property",⁴ being member's contribution "essentially in the form of space data [and necessary human resource], and no funds are exchanged".⁵ Article 3.1 of the Charter stipulates that "the parties shall develop their cooperation on a voluntary basis, no funds being exchanged between them".⁶

Charter Operations (Figure 1):⁷

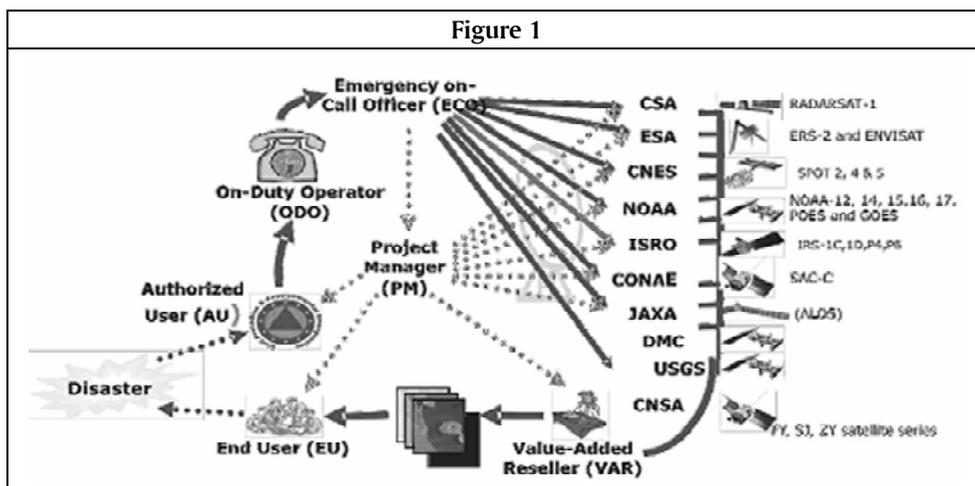


Table 1	
Event/Location	Project Manager
Hurricane, Texas – USA September 12th 2008	Center for Space Research, University of Texas at Austin
Cyclone, Yangon – Myanmar May 04th 2008	UNOSAT
Oil Spill, Norway (Noth Sea) December 12 2007	European Maritime Safety Agency
Earthquake, Afghanistan April 03 2007	USGS
Floods, South of France September 06 2005	ESA
Fires, Coimbra-Portugal, Agugst 23 2005	DLR

Where Disaster means a "situation of great distress involving loss of human life or large-scale damage to property, caused by a natural phenomenon, such as cyclone, tornado, earthquake, volcanic eruption, flood or forest fire, or by a technological accident, such as pollution by hydrocarbons, toxic or radioactive substances;"⁸ Authorized User (AU) is "a civil protection, rescue, defense or security body from the country of a Charter member"⁹; On-Duty-Operator as a "centralized 24 hour/day call-receiving unit",¹⁰ taken care by ESA/ESRIN in Frascati, Italy;¹¹ Emergency on-Call Officer (ECO) is a function that "rotates among partner agencies on a weekly basis";¹² Project Manager in his turn "is designated by the Executive Secretariat according to location, type of disaster and expertise"¹³

Few examples of PM's designated in recent past events (Table 1):¹⁴

The International Charter on Space and Major Disasters is "a good example of a concrete implementation of key principles of space law, but simultaneously its operation invokes the need for a more comprehensive legal regime of earth observation (EO)".¹⁵

Among the key principles implemented important to briefly mention: "for the benefit and in the interest of all countries"¹⁶ "should contribute to promoting and fostering international cooperation on an equitable and mutually acceptable basis",¹⁷ "remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries",¹⁸ "remote sensing shall promote the protection of mankind from natural disasters",¹⁹ "in order to maximize the

availability of benefits from remote sensing activities",²⁰ "capable of averting any phenomenon harmful to the Earth's natural environment shall disclose such information to States concerned",²¹ "affected by natural disasters, or likely to be affected by impending natural disasters, shall transmit such data and information to States concerned as promptly as possible".²²

Furthermore, while analyzing the Charter's Article 4.1²³ conformity with Article XI²⁴ of the Outer Space Treaty, again it is very visible the Treaty's implementation. Plus reinforcement of important binding and non-binding regulations, such as Article IV²⁵ of the Convention on Registration of Objects Launched into Outer Space and UN GA Resolution 62/101 of December 2007.²⁶

Nevertheless, certainly, this same Article 4.²⁷ of the International Major Disasters Charter is a key item which, willing to be a Member, National Policy responsible members (in example of States) shall undertake technical and juridical analysis to define the extent limit between "free exchanges of information" and sharing risk of "sensitive"²⁸ potential competitiveness enhancing information".²⁹ Especially if curiously one seeks to fully interpret the nature of USA political will practical decision³⁰ to accomplish accession with NOAA and USGS.

In same line, possible to include in this analysis scope, is the risk and fragility of sharing information which easily translates the State technological limits – giving open conscious opportunity to others States know the innovation level needed to conduce "unseen" operations, higher risk of system attack³¹ exposure,³² or to commercially offer systems which far exceed the competitors known proposals.

To be analyzed though, is not whether this concern affects political decisions in a time when all major space actors reaffirm the importance for international cooperation and the peaceful uses of outer space. But on how^{33,34} to get involved protecting³⁵ their own wealth,³⁶ with the continued overall growth in the global commercial space industry, with regional tensions being "significant driver of military space acquisitions",³⁷ and with the increasing importance of commercial sector achievements in developing space systems for civil and military purposes.

Taking into special consideration that to adhere to the Charter, one "agrees to contribute to the commitments made by the parties under Article IV",³⁸ contribution of the parties "by constructing a database of disaster management 'know-how' in the form of preparing scenarios for which satellites can be used to respond to the different types of disasters and the post-activation reports indicating the overall assessment of the whole activation process – including problems and findings."³⁹ The Charter parties, though, shall ensure that associated bodies⁴⁰ "use the supplied information only for the purposes defined with the Secretariat".⁴¹

Plus, few questions arise from a legal aspects interpretation on Article 5.4 6th item: "confirm that no legal action will be taken against the parties in the event of bodily injury, damage or financial loss arising from the execution or non-execution of activities, services or supplies arising out of the Charter". For example, and in the case of data misinterpretation leading to wrong logistic decisions (of routing trucks, cargo, helicopters, human resources); temporarily lack of communication in remote areas which may lead in unnecessary efforts or life losses due not accomplishment of rescue and emergency procedures;⁴² or leading to "wrong instructions for evacuation given to the crisis victims resulting in more casualties."⁴³ The analysis point here is to know in which extent this may harm the right of the people that could rely on better political-economical arrangements⁴⁴ (State-to-State international agreements "on reasonable cost terms"),⁴⁵ more individualized care (through a relationship, more prepared for local features and characteristics)⁴⁶ and with a responsibility and liability set for the good professional operation of the service, plus for the good of the people. Worthy to mention is the current doctrine understanding that after close examination "under the Charter, one can construe that there exists obligation between crisis victims and partner agencies and therefore, Good Samaritan law does not apply".⁴⁷ Furthermore, "it raises a question within the Charter operation as to whether or not free provision of services is sufficient to justify the waiver of liability."⁴⁸ Additionally, for or against private operators included as associated bodies for example, can "to bring legal action on a national level"⁴⁹ be a possibility?

Due Charter's⁵⁰ flexibility,⁵¹ driving force conformity with Hyogo's Framework for Action 2005 -2015 Strategic Goals⁵² and integration with UNSPIDER,⁵³ in an easier way States optimistically willing to contribute, can find the mission format suitable to undertake.

Cooperating, socio-economic benefits and political achievements⁵⁴ can be well perceived. Especially when ambitious global level integration is managed⁵⁵ with respect to the State's wealth, interests and political projection.

Opportunities to increase importance in this arena are enabled by the need to work with future issues.⁵⁶ Plus, life cost saved through relief, humanist principles and best endeavours in a linked act, should always speak louder argument than budget costs or rivalries.

With consideration to the herein mentioned understanding and with the very suitable recommendations from SBDA⁵⁷ (Associação Brasileira de Direito Aeronáutico e Espacial) for Brazil to become a member of the International Charter on Space and Major Disasters, strengthening vision and willingness to maintain and enhance constant measures in favor of mankind's benefit, peaceful purpose, humanist principles and special needs of developing and least developed countries, devote Brazil to participate with cooperation and operation, as part of its own Space Policy adding this one more initiative, among many others that show Brazil's international transparency and peaceful cooperation.

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Endnotes

- 1 "through authorized users"; Bessis, J.-L., 2004. p1.
- 2 Having UNOOSA as a Cooperating Body since 1st July 2003. Being able thus to request activations of the charter. Full Charter Members list at http://www.disasterscharter.org/participants_e.html; Plus, "the cooperative work with the UN organizations again allowed Charter coverage in situations where the Charter mechanism may not be known." *International Charter Space & Major Disasters, Executive Secretariat, 6th Annual Report, January-December 2006.*
- 3 Article 6.2 International Charter on Space and Major Disasters: "new accession must, in particular: – bring a significant contribution by the acceding party to the intervention capacity required for the purposes of the Charter".
- 4 BESSIS, J., p1.
- 5 BEQUINON and all, p1.
- 6 Remembering that a commitment to bear its share of the common costs is required for any new accession – Article 6.2 International Charter on Space and Major Disasters. One shall ask how to prevent from astronomical exceeding expected budget previously uncertain common costs. And if these common costs in certain year, due a major disaster event and the voluntary will to relief, take considerable unbearable percentage of a Country space program budget?
- 7 HUSSON, A., p8.
- 8 Article I International Charter on Space and Major Disasters – Definitions.
- 9 www.disasterscharter.org/activate_e.html; access on September 6th 2008.
- 10 BEQUINON and all, p1.
- 11 Address: Via Galilei Galileo I-00044 Frascati (RM), Italy.
- 12 And "An important prerequisite for total operation integration of a member agency is its ability to deliver the ECO function". BEQUINON and all, p1.
- 13 "PM is qualified in data ordering, handling and application; PM ensure the data sent corresponds to what the user expect; PM assists the user throughout the process. PM writes up a final operation report". HUSSON, A., p11.
- 14 See all Charter Activations and respective Project Manager details at: www.disasterscharter.org/new_e.html;
- 15 ITO, A., p1.
- 16 Article I, 1967 OST.
- 17 §3, Annex; UN GA Resolution 51/22.
- 18 Principle II; UN GA Resolution 41/65.

- 19 Principle XI; UN GA Resolution 41/65.
- 20 Principle VI; UN GA Resolution 41/65.
- 21 Principle X; UN GA Resolution 41/65.
- 22 Principle XI; UN GA Resolution 41/65.
- 23 Shall maintain list of available space facilities, including the following details: mission characteristics, orbital characteristics, operational condition, programming procedure, products and services provided by ground systems.
- 24 The States Parties "agree 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 such activities".
- 25 "the following information concerning each space object carried on its registry: (a) Name of launching State or States; (b) An appropriate designator of the space object or its registration number; (c) Date and territory or location of launch; (d) Basic orbital parameters, including: (i) Nodal period, (ii) Inclination, (iii) Apogee, (iv) Perigee; (e) General function of the space object.
- 26 Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects. Special attention to item 2. (b) – "Consideration should be given to the furnishing of additional appropriate information to the Secretary General on the following areas: (i) The geostationary orbit location, where appropriate; (ii) Any change of status in operations (inter alia, when a space object is no longer functional); (iii) The approximate date of decay or re-entry, if States are capable of verifying that information; (iv) The date and physical conditions of moving a space object to a disposal orbit; (v) Web links to official information on space objects;
- 27 Added by same Charter Article 4.2, second paragraph – "Once these new methods (or technologies) have been identified and validated by the design authorities and associated bodies, they may, with the Board's approval, be subjected to pre-operational implementation testing."
- 28 "The most important argument against cooperation is the possibility of the transfer of sensitive technology." POLLPETER, K. p44.
- 29 Information which can give an extra competitive edge or leading position to a State, or method / technology which propitiates a State to, with reduced costs, better compete in world-level market.
- 30 "We would like to emphasize a key feature in this strategy: that the US pursue cooperative international arrangements. Traditionally the American national security apparatus has strenuously avoided international involvement in space and information endeavors. This is due in large part to the fact that these technologies

have been at the heart of our intelligence collection activities and were considered too sensitive to share." WORDEN, S. and RANDALL C., p1.

- 31 "Elements of space systems will be targets of information attack operations, to include computer network operations." The US Army's CCP, p13.
- 32 "Ground segments and communications links remain the most vulnerable components of space systems, susceptible to attack by conventional military means, computer hacking, and electronic jamming." Trend 7.1: Space Security 2008; Project Ploughshares.
- 33 "Patents are thus becoming a preferred weapon to help to obtain or defend market share, or to procure revenues from someone else's market share." Example of given patent (range of protection): for the "Comsat Maneuver", patent granted, "concerns a method to prolong a satellite's useful life by letting it drift from its nominal position, thus conserving precious fuel and extending the period during which the satellite is at least approximately at its nominal position". SMITH, Bradford Lee. p5. Small example of competitiveness extra edge advantages: "Arabsat Awards COMSAT Systems Division \$1.2M to Employ 'Comsat Maneuver'".
- 34 A good example pointing to this concern: "Sensitive or advanced remote sensing data are only approved for export on the basis of government-to-government agreements which include end-use and retransfer assurances that protect US-controlled technical data and broader national security issues" – BROWNING, R., HARRIS R. p3.
- 35 Good example with this approach is the German Satellite Data Security Act – SatDSiG which has an entire section (Section 17) to define about Sensivity check (including data obtained and form of processing used).
- 36 "Generally, however, all national data policies and law share the same fundamental principles. They make data available for scientific, social, and economic benefit but restrict access to some data for national security reasons". MOSTESHAR, S. p6.
- 37 Trend 5.2: Space Security 2008. p18.
- 38 Article 6.1, second paragraph; International Charter on Space and Major Disasters.
- 39 ITO, A., p4.
- 40 Article I International Charter on Space and Major Disasters – Definition of associated bodies: "means the rescue and civil protection, defense and security bodies or other services referred to in Articles 5.2 and 5.3"; Article 5.2: "an institution or service responsible for rescue and civil protection, defense and security under the authority of a State whose jurisdiction covers an agency or operator that is a party to the Charter".
- 41 Article 5.4 International Charter on Space and Major Disasters.

- 42 Including fail in connecting disaster zone to the outside world and eminent further risks.
- 43 ITO, A. p5.
- 44 "In order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom." Principle XIII. UN GA Resolution 41/65.
- 45 Principle XII. UN GA Resolution 41/65.
- 46 Pre-event high resolution satellite data, detailed ground information, better knowledge of local awareness, better sensitive information protection, historical atlas of disasters and main concerns, strong and developed relationship with serviced Nation bodies, others random methods (with ground team, unmanned aerial vehicle, different categories tests and databases and others) to better construct maps and monitor geo and climate characteristics among others.
- 47 ITO, A., p7.
- 48 ITO, A., p8.
- 49 "A possible solution is to bring legal action on a national level."; "In a country where a comprehensive national space law is in force". KERREST, A., p3.
- 50 "as a contribution to the management of crisis arising from natural or technological disasters". Article II International Charter on Space and Major Disasters.
- 51 Considering Article 7.1 of the International Charter on Space and Major Disasters "The possibility of pursuing the mission in a modified form shall be examined by the parties", "the party intending to withdraw shall endeavour to maintain continuity of its current contribution." And same Charter Article 3.4 "The authorities and bodies concerned in a country affected by a disaster (beneficiary bodies) should request the intervention of the parties either directly through the rescue and civil protection, defense and security bodies of the country to which one of the parties belongs or of a State belonging to international organizations that are parties to the Charter (associated bodies) or where appropriate via a cooperating body acting in partnership with an associated body."
- 52 With the international acknowledgment for efforts, the more effective integration of disaster risk considerations into sustainable development policies, strengthening of institutions and emergency preparedness, response and recovery programmes among others.
- 53 United Nations Platform for Space-based Information for Disaster Management and Emergency Response. As a "coordinating entity that brought together the disaster management and the geospatial communities." Supporting the full disaster management cycle; global measures, ensure the harmonization of the various initiatives, access to information, regional and country profiles and capacity building as remarkable key features.

- 54 Optimisation of resources (both financial and technical), access to new technologies, access to new industry's niche; handle major relationships - good example is the CSA cooperation with ESA; political showcase – as one extra measure in political relations for political achievements, continuity in a National image constructing will show reaction driving capability and excellency on Disaster response, institutional and professional capacity development, new and effective methods created and consolidated in the use of Earth Observation and Disaster Management among others.
- 55 Respecting the layout of the State political and legal regimes.
- 56 Harmonization of platforms, differentiate map products according to the needs, continually produce damage assessment maps, compatible community standards, technological and budget achievement for Future Imaginary Architecture, frequency of observations with multiple satellite types, confrontation between the derivative products of space originated data and ground measures, necessary high resolution data among others.
- 57 Brazilian Society for Air and Space Law – www.sbda.org.br

GNSS as a Multi-Disciplinary Tool for Africa's Development

*R Wonnacott**

Although primarily designed for positioning applications, Global Navigation Satellite Systems (GNSS), which currently included the Global Positioning System (GPS) and the Global'naya Navigatsionaya Sputnikoyaya Sistem (GLONASS), have developed into a multidisciplinary tools for navigation geodesy, surveying, atmospheric science, disaster management and so on. Any regional or cross border development programmes in Africa which are based on geospatial information can only succeed if they are based on a modern uniform co-ordinate reference frame which is consistent with an international global reference frame. The Africa Reference Frame (AFREF) project is a geodetic project designed to unify the co-ordinate reference frames of Africa and is based on network of permanent GNSS stations. The presentation will briefly describe the AFREF project and its progress to date as well its importance for the provision of uniform geospatial information. Examples from Africa will also be presented in which GNSS data from a

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network of permanent GNSS base stations can be used for geophysical applications, weather forecasting, climate monitoring space weather monitoring and disaster mitigation.

Introduction

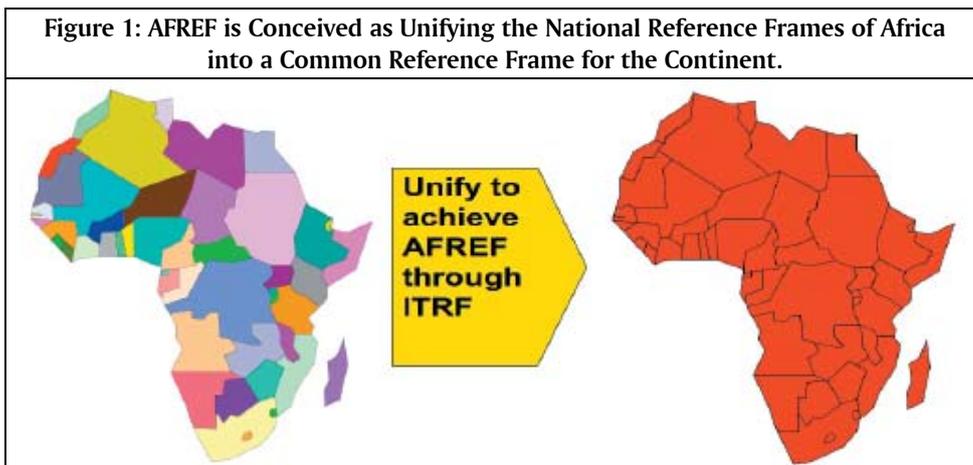
With the launch of the first unmanned satellite, Sputnik, by Russia in 1957, it was perhaps inevitable that the minds of scientists and space engineers would turn to solving the problem of providing an all-weather global navigation system based on satellite technology. Once the Russians had launched Sputnik it became important to the USA to be able to track the satellite's progress and to compute an orbit for it. The technique used was based on the Doppler shift of the received satellite signals. This principle was used to develop the first global navigation satellite system which became known as the US Navy Navigation Satellite System or Transit as it was often called. The system was released to civil society in 1967 and was used by both military and civilian navigators, geodesists and surveyors. Subsequent to the introduction of Transit, the concept of the Global Positioning System (GPS) was developed in 1973 and the first GPS satellite was launched in 1978. However, it was not until 1993 that the system became fully operational with a constellation of 24 satellites. Since then we have seen the Russian Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS) launched, the first of the European Galileo system satellites launched late in 2006 and, most recently, the first of a planned constellation of 30 Chinese navigation satellites launched in 2007. Collectively, all these satellite-based navigation systems have become known as Global Navigation Satellite Systems or GNSS. Although primarily designed as navigational tools, the applications of GNSS go beyond navigation and the signals have been used successfully for applications in atmospheric science, geophysics, timing and hazard mitigation.

Fundamentals of Modern GNSS

All modern GNSS share some common fundamental principles:

- All are satellite-based using or designed to use Medium Earth Orbiting (MEO) satellites;

- All use, or plan to use, radio frequencies in the L-band range of about 1176MHz to 1615MHz;
- All use some form of time transfer as a fundamental of the observations and hence rely on very stable clocks in the satellites to produce both the time and signal frequency;
- At the above frequencies all systems are or will be, largely independent of weather conditions;
- All systems are, or are planned to be, global in coverage with 24-hour availability;
- All systems use a three-dimensional geocentric coordinate reference system from which three-dimensional co-ordinates can be determined of points on the Earth's surface;
- All signals are affected by variations in atmospheric conditions as the medium through which they pass which, although a nuisance factor for positioning, has been used effectively for atmospheric science research and applications;
- Depending on user equipment, site selection, site occupation time and processing procedures, all systems are capable of achieving position accuracies of between a few tens of metres and less than one centimetre; and
- User equipment is relatively inexpensive, ranging from about USD 100 to about USD 25000.



At present, access to the GPS and GLONASS signals is free of charge to users but it is unclear what policies regarding signal access to any new systems will be implemented.

GNSS as a Positioning Tool in Africa

One of the main long term objectives of the New Partnership for Africa's Development (NEPAD) is "to eradicate poverty in Africa and to place African countries, both individually and collectively, on a path of sustainable growth and development and thus halt the marginalisation of Africa in the globalisation process."¹ NEPAD was developed by African leaders and is based on national and regional priorities and development plans for the continent's renewal. One of the priority areas is a focus "on the provision of essential regional public goods (such as transport, energy, water, ICT, disease eradication, environmental preservation, and provision of regional research capacity), as well as the promotion of intra-African trade and investments. The focus will be on rationalising the institutional framework for economic integration, by identifying common projects compatible with integrated country and regional development programmes, and on the harmonisation of economic and investment policies and practices." Any meaningful regional development programmes will require maps and other geographic information products for effective planning and efficient implementation. As a result of the importance of geographic information, the science and technology platform of NEPAD includes an objective to "promote cross-border co-operation and connectivity" and an action to "establish regional co-operation on product standards development and dissemination, and on geographic information systems."²

The fundamental point of departure for any project, application, service or product which is reliant on some form of geo-referencing, must be a uniform and reliable coordinate reference system. Geographic information services and products provide the link between all activities and the places or locations where those activities take place. One does not build a house without a foundation or secure frame. Most countries have developed co-ordinate reference systems and frames which are used for national surveying, mapping, remote sensing, Geographical Information Systems (GIS) and development programmes. Although these systems are in existence in many countries, the state of repair and extent of their applications varies considerably.

There are over 50 countries in Africa all of which are considered as developing nations and each with its own difficulties and challenges. Each of these countries has their own co-ordinate reference system and frame. Additionally, there are some countries that have more than one system each based on a different datum. A number of the former British colonies in Southern and East Africa adopted the Cape Datum co-ordinate system based on the Clarke 1880 spheroid but even these countries have different realisations of what, in name, is the same thing.

Although there remain a number of areas of conflict within Africa, there are also a number of regions where peace has been restored. With the restoration of peace has come the resurgence of development of these regions. The need to coordinate planning and development efforts within countries and across national borders in line with the ideals of NEPAD has become paramount and cannot be achieved successfully if the fundamental point of departure for these planning projects, i.e. the co-ordinate reference frame, is not uniform and of an appropriate modern standard (Windhoek Declaration, 2002).

The African Geodetic Reference Frame (AFREF) is conceived, therefore, as a unified geodetic reference frame for Africa. It will be the fundamental basis for the national three-dimensional reference networks fully consistent and homogeneous with the International Terrestrial Reference Frame (ITRF). When fully implemented, it will consist of a network of continuous, permanent GPS stations such that a user anywhere in Africa would have free access to and would be, at most, 1000 km from such stations. Full implementation will include a unified vertical datum and support for efforts to establish a precise African geoid, in concert with the African Geoid project activities.³

Apart from being fundamental to all infrastructure, planning and development projects, AFREF and the network of permanent GPS base stations upon which it will be based, has vast potential for the promotion of geodesy and surveying, geo-information, earth and atmospheric science, disaster mitigation, the monitoring of crop and vegetation distribution and animal migration patterns. The implementation of AFREF and its applications will provide a major platform for the enhancement of skills and skills transfer in these sciences and further some of the objectives and actions of the NEPAD science and technology platform.

It has been estimated that 59% of all disasters in Africa are hydro-meteorological in nature which are essentially either droughts or floods. A network of permanent GNSS base stations distributed evenly throughout Africa will have the potential to provide continuous estimates of the amount of water vapour in the atmosphere for the enhancement of either climate monitoring or weather forecasting models and applications. Other disaster mitigation applications that will benefit from the establishment of the AFREF permanent GNSS base stations will be the monitoring of volcanic and seismic activity and as a contributing observation technique for tsunami early warnings.

If one looks at the global network of permanent geodetic observing systems, it is clear that a large gap exists in Africa in the coverage of such observing stations. Apart from the benefits to Africa and its development, a network of permanent GNSS base stations will close the gap in the global network of observing stations and contribute to the aims and objectives of the International Association of Geodesy's (IAG) Global Geodetic Observing System (GGOS) which is a contributing project to the Global Earth Observing System of Systems (GEOSS).

Progress with AFREF

Since the Global Spatial Data Infrastructure meeting held in Cape Town in March 2000, where the need for a unified reference frame for Africa was first expressed, many meetings and workshops have been held to deal with AFREF either directly or indirectly. Currently, there are nearly 25 countries throughout Africa that have expressed interest in AFREF while the number of international organisations with interest in AFREF has also increased since the project was first proposed.

Perhaps the first meeting or workshop since the completion of the African Doppler Survey (ADOS) dedicated to the unification of reference frames in Africa was held in Tunisia in May 2000. This workshop was attended by 6 North African countries and was largely of an exploratory nature to find ways and means of unifying datums in the region.⁴

A similar, but unrelated meeting dedicated to AFREF, was held in Cape Town in March 2001 as part of the Conference of Southern African Surveyors (CONSAS). The purpose of this meeting was largely to try to gauge the level of interest in the project. Representatives attending the meeting were mainly from the National Mapping Organisations of Southern African countries as well as representatives from the IAG, IGS and EUREF. The consensus of opinion from

attendees was that the project should go ahead and that the IAG should be the lead international organisation to give AFREF the necessary technical support. It was also recognised that AFREF must include both the horizontal and vertical components of a unified continental reference frame similar to EUREF. It was also recognised at this meeting that the logistics of undertaking such a project involving the more than 50 African countries simultaneously would probably result in failure and that it should be organised on a regional basis. This concept has now become one of the fundamentals of the current organisational structure of AFREF.

The IAG was formally approached to support AFREF and to endorse the project at the European Geophysical Society (EGS) General Assembly in Nice in April 2001. At the EGS meeting in April the following year, 2002, the wheels were set in motion within IAG to establish a formal structure within however, there were also a number of stations that had been established using the IGS guidelines but were not recognised IGS stations. As an example South Africa had established a network of 36 stations from which data was being made the Environment (AARSE) in Nairobi in October 2004. The general organisational structure of the working group is given in Figure 2.

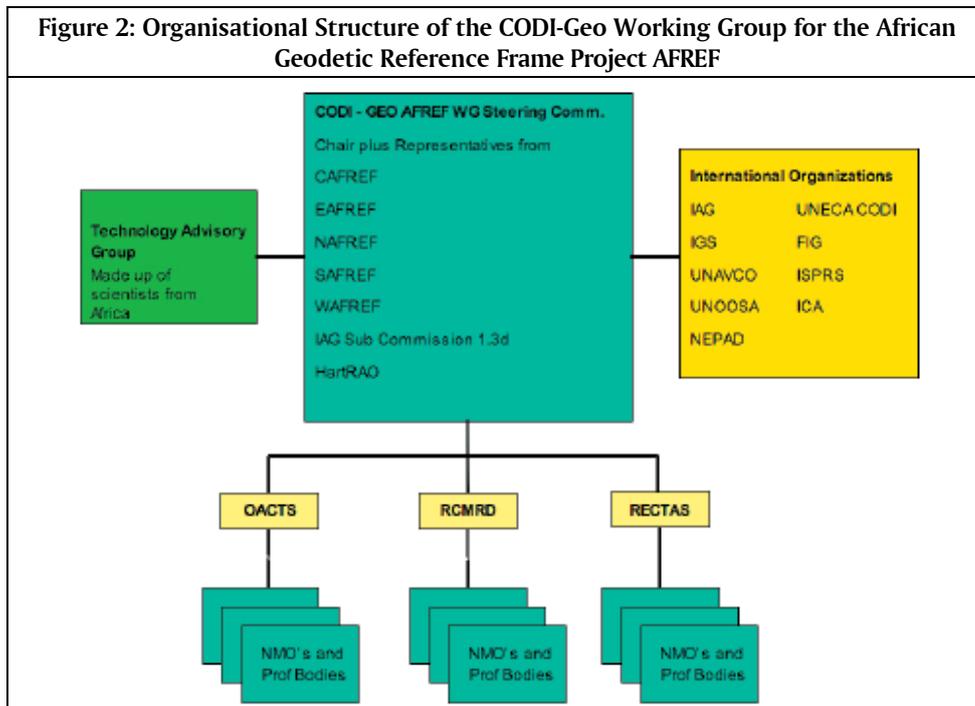
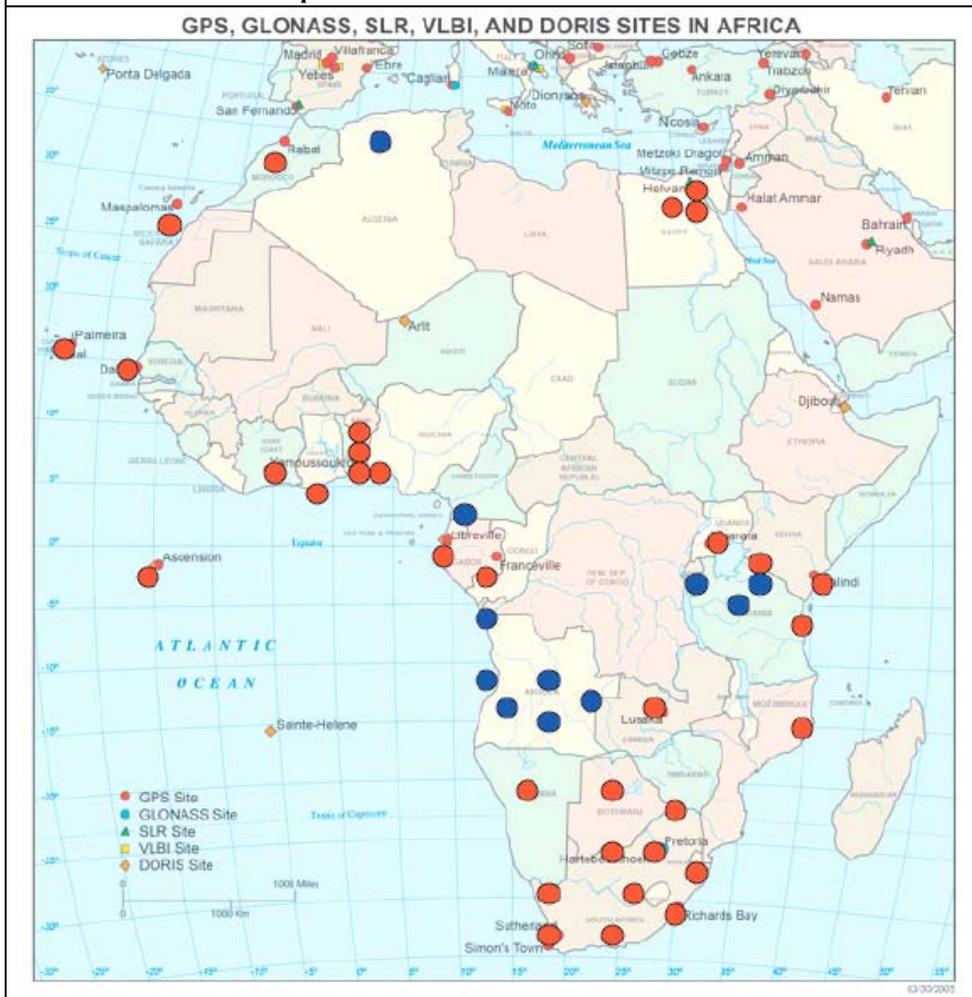


Figure 3: Red dots indicate established stations. Blue dots indicate planned stations. The information shown here is not to be regarded as definitive but merely as an indication of the increased density of permanent GNSS base stations. For clarity only a representative sample of stations installed is shown such as in Benin (7 stations) and South Africa (43 stations). There may be other countries in which stations have been installed or are planned for installation of which the author is unaware.



The importance of the regional centres cannot be underplayed as collectively they already represent a reasonably high percentage of African countries. They have an important role to play in the "regional" aspect of AFREF and are better equipped to communicate and liaise with their member countries. Starting from

the North, l'Organisation Africaine de Cartographie et, de Teledetection (OACT) largely represents the Arab-speaking countries of that region, while in West Africa, the Regional Centre for Training in Aerospace Surveys (RECTAS) represents both French- and English- speaking West African countries. The Regional Centre for Mapping of Resources for Development (RCMRD) represents a reasonably large number of East and Southern African countries.

Perhaps the most important role players in the project are the National Mapping Organisations as these are going to be responsible for the implementation of all phases of the project from the installation and operation of GPS base stations right through to the final conversion to ITRF of the National reference frames for which they are responsible. Even once the conversion is complete, historical data based on previous systems will also have to be converted where necessary. This is particularly the case of cadastral records for taxation purposes and to ensure the continuity of security of title and the preservation of legacy data.

The Hartebeesthoek Radio Astronomy Observatory (Hart-RAO) in South Africa also has an important role to play in AFREF as it is the only facility in Africa that is a regional data centre for the IGS and it is therefore natural that all data generated by the permanent GPS base stations should be archived at HartRAO. This, however, does not exclude the regional centres from archiving data from their respective regions. HartRAO is also important in that it is one of very few facilities globally where VLBI, SLR, GPS and DORIS observing facilities are all co-located on the same site.

Apart from two meetings supported by the International Federation of Surveyors (FIG) in Cairo, Egypt in April 2005 and in Accra, Ghana in March 2006, two purely technical workshops were held, one in Cape Town, South Africa, in July 2006 and the second in Nairobi, Kenya, in August 2007.

These two workshops were attended by members of NMO's who would be responsible for the implementation, operation and maintenance of permanent GNSS base stations and the processing of data as a part of the AFREF project. The most recent AFREF meeting was held in Nigeria in September 2007 for all Nigerian stakeholders in the project.

The Present Situation

Prior to 2005 there were approximately 15 permanent GNSS base stations in Africa that had been established in accordance with IGS guidelines and that were regularly forwarding data to the IGS for archiving. Having said this, however, there were also a number of stations that had been established using the IGS guidelines but were not recognised IGS stations. As an example, South Africa had established a network of 36 stations from which data was being made available freely to users both inside South Africa and outside the country. At the same time some oil and mining companies had set up their own stations but for internal use only.

Since 2005 the number of permanent GNSS base stations has increased considerably with an even greater number being planned for installation. About 22 countries are currently involved in activities that will lead to the realisation of AFREF. Such activities include the establishment of permanent GNSS base stations and the estimation of the relationship between old existing coordinate reference frames. Whilst this is most encouraging, it also highlights the difficulty being experienced with the monitoring of progress with projects, as a number of stations are being installed in the name of AFREF but for reasons other than those of the project. At the same time, whereas two of the primary objectives of the project are to involve the NMO's at all stages of the project and to ensure the transfer of technology to NMO personnel, this is not always happening.

Conclusion

GNSS has proven to be a very useful and universal tool which can be used for numerous applications other than positioning and navigation. The equipment required to use the data for conventional surveying and mapping operations for the infrastructure development projects in Africa is inexpensive compared to major development project costs.

The African Reference Frame project, AFREF, will rely heavily on GNSS for all levels of positioning from high level geodetic operations all the way to simple GIS applications, all of which must be based on the uniform International Terrestrial Reference Frame. While it has taken some time to show progress with AFREF, the project is rapidly gaining momentum.

Endnotes

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Intellectual Property in Outer Space: International Law, National Jurisdiction, and Exclusive Rights in Geospatial Data and Databases[†]

*Lee Ann W. Lockridge**

This article argues that the international law of outer space, although it emphasizes the res communis, does not conflict with the assertion of private rights in intellectual property developed from or related to outer space activity. The article also addresses another scholar's concern that a conflict is brewing between the EU Database Directive and US copyright law with respect to the legal status of outer-space-derived data. Without arguing for the application of any particular substantive rights in space-related intangibles, the article analyzes the current status of copyright and database rights under the international law of outer space and the choice-of-law principles that may be used to support enforcement of the various substantive rights deemed desirable by individual nations. It concludes that national laws implementing the Database Directive, even without an express

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territorial limitation within those laws, should not be applied to reach extraterritorial conduct, at least when that conduct occurs within another nation's territory. If unauthorized use of geospatial data or other intellectual property occurs in outer space, however, there appears to be a limited void within the standard choice-of-law doctrine of intellectual property, which relies on a presumption of territorial prescriptive jurisdiction. Therefore, regardless of the substance of the relevant national laws, whether related to data, copyright, or patent, there is a risk of incoherency in the application of intellectual property rights to outer space activity if no steps are taken to further mold jurisdictional law related to outer space.

I. Introduction

The international law of outer space emphasizes nondiscriminatory access to outer space as between nations, as well as the absence of national sovereign rights in outer space, including the moon and other celestial bodies.¹ International intellectual property law, on the other hand, emphasizes private rights over public access.² The international law of outer space prohibits territorial claims to sovereignty in outer space. International intellectual property law operates under the assumption that each nation's laws apply territorially. Moreover, national laws protecting intellectual property derived from and utilized in outer space vary; in the case of data rights, the European approach radically departs from much of the rest of the world. Do these divergences lead to inexorable conflict?

In her article, *How on Earth Terrestrial Laws Can Protect Geospatial Data*, Professor Julie Cromer presents two models for protecting geospatial databases and their underlying geospatial data, meaning data pertaining to geographic characteristics and boundaries, both of natural and man-made Earth-bound features.³ She contributes to the literature of outer space law by drawing attention to a divergence in treatment of what may be the most valuable form of intangible right currently generated in outer space ventures, namely geospatial

and other outer-space-derived data. Her focus is on geospatial data collected via satellite-borne systems, much of which data is presented in mapped or photographic form.

Professor Cromer applies both copyright law, using United States copyright law as the demonstrative example,⁴ and the *sui generis* European Union Database Directive (the "Database Directive") to geospatial data and databases.⁵ She exposes some of the theoretical weakness in using a copyright regime to protect the underlying photographic or mapped data, most particularly with respect to fixation and fair use,⁶ but also the lack of clear originality and authorship of the resulting work.⁷ She also suggests the possibility that geospatial data might not fall within the protection of the Database Directive due to the low investment in organization of the data (as compared to the high investment in data gathering).⁸ Professor Cromer reminds us that US copyright law may find its ultimate strength with respect to data protection not in traditional copyright but in the newer anti-circumvention provisions, which could be used to prevent access to legally unprotected data as long as the data are contained in a copyrightable database to which technological access-control measures have been applied.⁹

Following her presentation of the copyright and *sui generis* models of protection, Professor Cromer suggests, for our consideration, two international divergences that may raise legal conflicts in the treatment of geospatial data as intellectual property, both of which I address here. She proposes a conflict between *any* assertion of exclusive intellectual property rights in outer-space-derived geospatial data (including via copyright or data protection) and the overarching international legal principle applied to outer space, namely, *res communis*. She does note that the Outer Space Treaty "does not necessarily preclude intellectual property; its effect instead depends entirely upon the interpreter's viewpoint."¹⁰

I conclude that the international law of outer space most certainly does not preclude intellectual property.¹¹ In fact, one significant multinational agreement focused upon investigation in outer space specifically provides for intellectual property.¹² The fact that there is no true conflict between the international law of outer-space activity and private rights in outer-space-derived data does not

mean, of course, that all such data *should* be protected by exclusive rights as a matter of sound scientific and legal policy. Instead, it may mean that the affected communities should begin a conversation about the scope of exclusive rights currently available and whether that scope should be expanded or constricted.

Cromer also asks whether there is a conflict between the treatment of geospatial data under the Database Directive¹³ (or other similar *sui generis* data protection regimes) and the treatment of geospatial data under United States copyright law¹⁴ (or other jurisdictions without a *sui generis* data right).¹⁵ She notes that “[b]ecause recognition of the Database Directive may be contrary to the policy interests of the United States, it would [be] surprising if a US court determined that the Directive should be interpreted or enforced,” thus acknowledging that this may be a policy conflict more than a true legal conflict.¹⁶ More concerning with respect to transnational conflicts and the jurisdictional reach of national laws is Cromer’s suggestion that a US court could apply the Database Directive to find liability for appropriation of data occurring from within the US (but presumably affecting an interest within the EU).¹⁷

I analyze the propriety of transnational application of data-protection laws in light of the traditional principles governing international intellectual property disputes. I conclude that any such application of a foreign data law to conduct occurring in the US would be, quite simply, incorrect and unsupported.¹⁸ The ability of one nation’s substantive copyright or database law to impose liability for actions done in another nation is certainly a minority view in the international community. Further, such an idea is contrary to the territorial principle generally underlying intellectual property law in most nations. As a result, while I agree with Professor Cromer that there is a divergence of policy between the EU and the US in terms of treatment of factual data underlying a database, I do not find any real likelihood of a genuine conflict between their laws with respect to protection of geospatial data when unauthorized use occurs on Earth.

If unauthorized use of geospatial data or other intellectual property occurs in outer space, however, there appears to be a void within the standard choice-of-law doctrine of intellectual property, which relies on a presumption of territorial prescriptive jurisdiction. As set forth below, regardless of the substance of the

relevant laws, if we do nothing to further mold jurisdictional law in this area, there is a risk of incoherency in the application of intellectual property rights to outer-space activity.

I do not argue here in favor of any particular substantive rights in space-related intangible property such as geospatial data, databases or other copyright-protected works, or inventions. Instead, I analyze the current status of copyright and database rights under the international law of outer space and the choice-of-law principles that may be used to support enforcement of the various substantive rights deemed desirable by individual nations. I conclude that national laws implementing the Database Directive, even without an express territorial limitation within those laws, should not be applied to reach extraterritorial conduct, at least when that conduct occurs within another nation's territory. Jurisdictional issues will remain important to the community of space-related producers and users of intangible information and works under any scheme of substantive law unless and until further international agreement is reached to alter jurisdictional principles in the outer-space environment or in transnational intellectual property disputes.

II. Outer Space Inclusivity versus Data Right Exclusivity

Analyzing the Outer Space Treaty under traditional principles of international law demonstrates the absence of a real, extant conflict between the international law of space and private rights in outer-space-derived data. Professor Cromer asks us to consider whether otherwise valid data and database rights are invalid as applied to geospatial data gathered from outer space, in light of the *res communis* status of outer space under relevant international treaties.¹⁹ She leaves the question open to discussion. In my view, however, the only truly open question is not whether exclusive data rights conflict with current international law, but instead whether exclusive data rights conflict with the goals and policies that motivated the creation of international outer-space law.

In order to determine whether any legal conflict exists, we must first determine what position international law takes with respect to data or information gathered from outer space.²⁰ More generally, we can discern the status of

intellectual property rights within the international law of outer space and then apply that categorical status to the specific case of rights in data derived from outer space.

Before moving into an examination of the relevant international law, it is worthwhile to recall Professor Kali Murray's reminder, in her article *Of Gardens and Streets: A Differentiated Model of Property in International and National Space Law*, that "property" is not merely three-dimensional, territorial property, whether on Earth or in space.²¹ As a result, settling the issue of property rights in outer space is not simply a matter of denying their existence by disclaiming national claims to the three-dimensional space *qua* territorial space.²² Instead, as Professor Murray argues, we must consider the differentiated aspects of property in order to construct a comprehensive and cohesive theory of what "property" exists or does not exist with respect to outer space and with respect to the indicia and fruits of human efforts in outer space.²³ These indicia and fruits include vehicles or other objects launched into space, remote sensing data gathered in space, and inventions practiced in space. She urges us to consider not only the model of territorial property but also personal chattel (whether moveable or fixed real chattel) and intangible property (including patentable inventions and copyrightable works).

As I demonstrate below, the relevant international law does not specifically address intellectual property. As a result, recalling and applying the differentiation between types of property rights is crucial to distilling the status of intellectual property under relevant international law.

A. International Law Governing Outer Space

Although international law governing outer space addresses, and rejects, national claims to three-dimensional outer space *qua* territorial space, no accepted source of international law governing outer space precludes intellectual property claims related to or derived from the exploration of outer space. The Statute of the International Court of Justice states that the Court will apply the following international law: (1) international treaties, (2) international custom, (3) widely accepted general legal principles, and (4) as a supplement, judicial decisions and the writings of highly qualified scholars.²⁴ Noted international legal scholar Ian Brownlie, among others, notes that while the statute applies

specifically to the International Court of Justice (the "ICJ"), and does not actually refer to "sources" of international law, it is generally regarded as a comprehensive list of the sources of international law and states international tribunal practice as it existed at the time of formation of the ICJ.²⁵ As such, these four sources would indicate the propriety under international law of a nation's allowing exclusive capture of rights in geospatial data gathered from outer space, if any international law on the issue exists. My examination of these sources and the literature leads me to the conclusion that treaties and international custom arising from treaties form the extent of available international law on intellectual property rights in outer space.²⁶

Relevant treaty sources are themselves limited. The Outer Space Treaty and the Moon Treaty provide little explicit guidance for exploring the issue, as neither precludes or even specifically addresses intellectual property rights in or derived from outer space. The specific obligations of the US and other signatories to the Outer Space Treaty to one another with respect to exclusive rights in outer space derive from Articles I, II and IX.²⁷ Examining the relevant language makes clear that while outer space is not to be claimed as territorial property,²⁸ and while outer space exploration and investigation are to remain free for all with cooperation and without discrimination,²⁹ there is no language in the treaty that provides any real guidance on the issue of intangible intellectual property rights, including geospatial data rights.³⁰

Article I focuses on access for purposes of exploration and on freedom of scientific investigation: "The exploration and use of outer space...shall be carried out for the benefit and in the interest of all countries.... Outer space shall be free for exploration and use by all States.... There shall be freedom of scientific investigation...."³¹ Cooperation is encouraged in Article I as well as in Article IX: "States shall facilitate and encourage international co-operation [outer space scientific] investigation,"³² and "In the exploration and use of outer space...States...shall be guided by the principle of co-operation and mutual assistance."³³ These goals do not inherently conflict with the existence of intellectual property rights. Article II prohibits the appropriation of outer space as sovereign territory, a prohibition focused on a real-property-rights analogy rather than an intangible-property-rights analogy: "Outer space...is not subject to

national appropriation by claim of sovereignty, by means of use of occupation, or by any other means."³⁴ As between signatories to the Outer Space Treaty, then, no specific or general obligation exists with respect to intellectual property rights, nor is there any evidence of international custom.

The Moon Treaty, which has not gained many adherents, also addresses claims to outer space without covering intangible property rights.³⁵ Although the treaty has been in force since 1984, it has only 11 signatories and thus is best used merely as a secondary reference point in seeking international custom on the issue of intellectual property rights.

Articles 4, 6, and 11 of the Moon Treaty address property and exploitation rights to the moon.³⁶ Article 11 states in particular that neither the "surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property."³⁷ The relevant provisions throughout the treaty point to freedom of investigation and exploration on the moon,³⁸ absence of national appropriation of the moon,³⁹ and the surface, subsurface, and natural resources of the moon.⁴⁰ Reference to national appropriation and the surface and subsurface of the moon clearly implicate real-property analogies, as does the term "natural resources." "Natural resources" do not include information or intellectual property rights under any standard definition of the term. In sum, the Moon Treaty fails to address intellectual property or other intangible rights, much like the Outer Space Treaty.

At the time the Moon Treaty was drafted, intellectual property rights had been for many years discussed and included in formal international agreements, including provisions considering the differing economic and developmental stages of various nations.⁴¹ In light of the then-contemporaneous focus on developmental inequity in intellectual property rights, the failure of the Moon Treaty, which did include at least nominal consideration for developing nations, to address intellectual property rights indicates that no international consensus, and thus certainly no international customary law, existed at that time with respect to outer-space-derived intellectual property rights.

Other international agreements regarding the exploration and use of outer space include the Convention on Registration of Objects Launched into Outer Space (1975),⁴² which is an expansion upon Article VIII of the Outer Space

Treaty; the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (1968),⁴³ which augments Articles V and VIII of the Outer Space Treaty; and the Convention on International Liability for Damage Caused by Space Objects (1972),⁴⁴ which adds to Article VII of the Outer Space Treaty. None contains any provision directly applicable to the question of intangible intellectual property rights, including rights in outer-space-derived data.

It is thus clear that the Outer Space Treaty, the Moon Treaty, and the other broad international agreements regarding outer space exploration and exploitation do not contain any specific binding obligation between signatory nations as to outer-space-derived intellectual property rights, including data rights. The absence of specific obligations does not conclude the analysis of international treaties: treaties and agreements demonstrating a pattern in the same form can evidence international custom, another recognized source of international law.⁴⁵ As such, the agreements might theoretically provide evidence of a more general international custom that could be applied to the issue of exclusive intellectual property rights.

The pattern found here, however, is in a form indicating only that the three-dimensional airspace of outer space and any real-property-like surfaces, subsurfaces, and resources are not to be claimed as sovereign territory or as nationally exclusive resources in the way that nations claim terrestrial surface and subsurface territory and resources and the airspace above the terrestrial surfaces. Moreover, space objects may be, and may even be required to be, claimed as "territory" of a sort by the nation of registration.⁴⁶ There is simply no pattern with respect to intangible, intellectual property rights. As a result, I conclude that neither the Outer Space Treaty nor the Moon Treaty, nor any other broad international treaty, evidences any international custom to restrain or preclude intellectual property rights related to outer space activity, including data rights.

A limited-scope, yet highly relevant multinational agreement to which the United States and European Union space agencies are parties is the intergovernmental agreement concerning the International Space Station (the Space Station Agreement).⁴⁷ The Space Station Agreement is the agreement undergirding the operation of the international space station, which is, in rough

terms, a joint venture of the United States, Russia, Canada, Japan, and the European Union. And that agreement arguably *encourages* claims of intellectual property rights related to outer space investigation and experimentation. It provides in detail for protection of data and other intellectual property rights within the environment of the international space station.⁴⁸

As to patent rights, Article 21 of the Space Station Agreement could hardly be clearer in its anticipation and approval of national laws providing for both creation and infringement of patent rights within the international space station environment. And although it is more explicitly focused on patent rights,⁴⁹ with no express mention of copyright, the agreement certainly addresses trade secret and data rights. For instance, Article 6(6) implies that “data resulting from the conduct of activities in or on the Space Station” may be owned by the agency conducting those activities,⁵⁰ while Article 12 requires “respect” for “proprietary rights in and confidentiality of appropriately marked data.”⁵¹

As between Space Station partners, there is certainly acknowledgment of and agreement upon the possibility of both creation and infringement of intellectual rights in outer space. In addition, the territorial basis of intellectual property rights⁵² survives in outer space under Article 21(2), which states that “for purposes of intellectual property law, an activity occurring in or on a Space Station flight element shall be deemed to have occurred only in the territory of the Partner State of that element’s registry.” This provision constructively extends a Partner State’s territory for intellectual property purposes. By doing so it acknowledges both the validity of intellectual property rights in outer space and the continued acceptance of territoriality as the primary jurisdictional basis for the prescriptive reach of a nation’s intellectual property laws.

B. International Law of Intellectual Property

The cornerstone of modern international intellectual property law is the TRIPS Agreement.⁵³ The TRIPS Agreement, one of the three major substantive agreements required of all members of the World Trade Organization,⁵⁴ provides an overarching framework of international intellectual property obligations, including copyright, trademark, patent and trade secret. By incorporating the substantive provisions of both the Berne Convention and the Paris Convention, the TRIPS Agreement has both eclipsed and reinforced those

conventions, which had previously been the preeminent intellectual property treaties. The TRIPS Agreement broadened international treaty coverage by adding trade secrets to the subject matter to be protected. In addition, it required countries to extend copyright protection to computer programs and compilations of data, which the Berne Convention arguably did not cover.

If the members of the World Trade Organization had any specific obligation to one another with respect to intangible rights in outer-space-derived information, creations, or inventions, one would expect it to have been addressed within the TRIPS Agreement. That agreement dates only from 1994, well after the concerned states were aware of potential applicability (or inapplicability) of intellectual property rights in outer space.⁵⁵ The absence of any mention of outer-space-derived intellectual property in the TRIPS Agreement suggests, if it does not conclusively demonstrate, that there is no international obligation either to include those rights within or to exclude those rights from national intellectual property laws of general applicability.

C. Application of International Law to Geospatial Data Rights

With no international law to control outer-space-derived intellectual property rights, as to geospatial data, I contend that each country is free to choose for itself whether to recognize legal rights in such data. Ownership of an intangible right in an expression or embodiment of geospatial data, as long as the legal protection provided does not preclude legal independent creation by others, does not offend the cooperation and non-discriminatory access principles of space law because such intangible rights are non-rivalrous. Even if one entity claims exclusive data rights, the same geospatial data or other outer-space-derived information remains available for others to capture, on a nondiscriminatory basis. The danger existing in such protection may be in the protection potentially available through copyright law, rather than in the data right set out in the Database Directive. This is so because the Database Directive provides that only extraction or utilization of data from a protected database gives rise to liability, while in copyright law, although independent creation is non-infringing, that independent creation may be difficult to prove if an inference of access may be made.

Concerns regarding the functional capacity of developing nations to gather geospatial or other outer-space-derived data are valid, and if developing nations

do not have the functional capacity to gather the data, non-discriminatory access to outer space is cold comfort.⁵⁶ In light of the absence of an international obligation to protect private rights in factual data (as opposed to databases as original compilations),⁵⁷ on the other hand, nations who do not wish to allow exclusive rights in data to be enforced within their territories can simply choose to exclude factual data from copyright protection. Professor Cromer's article correctly notes that the element of originality, i.e. creativity, underlying certain tangible expressions or embodiments of geospatial data is either weak or nonexistent, including when considered either as a photograph or a map.⁵⁸ As a result, any nation, including a developing one, has a valid argument for excluding geospatial data and any non-original embodiments of that data, including unenhanced mapped or photographic data, from national copyright protection.⁵⁹ This exclusion would not ensure access to the data gathered by other nations and their nationals, of course, but neither would denying database copyright or data rights as a matter of international law. Databases and data can be protected through contract and trade secret law, and these protections may even be more commonly used today than other legal protection. Contract and trade secret are more detrimental to developing nation access than data or copyright protection.⁶⁰

In sum, despite the overarching ideal of freedom for all in the exploration and use of outer space, outer-space-derived data remain subject to national protection. Nothing in current international law poses an impediment to national laws allowing for the creation and application of intellectual property rights in the outer space environment. National protection may incentivize advances in the capture and use of such data. On the other hand, the application of national intellectual property laws to outer-space-derived data may not be optimal for all who are interested in outer space, including developing nations. Identifying a normative means or level of protection is beyond the scope of these comments. If the international community wants the law of outer space to prohibit the application of national intellectual property laws to outer-space-derived data, it cannot rely on existing treaties or current international custom.

III. Jurisdictional Issues in Transnational Data Disputes

As set forth in the introduction, Professor Cromer suggests that a US court could apply a European national law implementing the Database Directive to find a US

actor liable for actions taken within the US to extract or reutilize geospatial data contained within a database owned by an EU national.⁶¹ I disagree. Current intellectual property choice-of-law and jurisdictional principles generally result in the application of the law of the nation in which the unauthorized use occurred. Accordingly, it seems highly unlikely that a US court would ever have occasion to apply a national law implementing the Database Directive to activities occurring in the US. Similarly, it would violate a basic principle of international intellectual property law for a court within the EU to apply a European national database law to US activities, regardless of the nature of the data.

This inquiry raises, however, an important issue that has not yet been squarely addressed by the space law community: the extreme difficulty of applying traditional intellectual property choice-of-law principles, based on territoriality, to conduct occurring in outer space, particularly where the conduct is relatively unmoored to other Earth-based conduct. Allegedly infringing conduct occurring in outer space raises a true jurisdictional conundrum that eludes traditional analysis within intellectual property law.

A. Territorial Limitations of Intellectual Property Laws

In international civil law, the basic jurisdictional principle is that of territoriality, meaning a national government has legislative or prescriptive competence within the geographic scope of its territory.⁶² The territoriality principle is not absolute, particularly when transnational activities are involved, but at root it remains the backdrop of international lawmaking and dispute resolution.

The effects doctrine, whereby a nation asserts prescriptive jurisdiction over extraterritorial activities causing a significant deleterious effect within the nation's territory, modifies the territoriality doctrine. The effects doctrine is not a true departure from territoriality, however, since it governs extraterritorial conduct by reference to significant intra-territorial effects. Thus the effects doctrine departs from and yet simultaneously reinforces the limited territorial legitimacy of the exercise of a sovereign's prescriptive power.⁶³

The primary use of the effects doctrine within the US has been to expand the prescriptive reach of national laws in the area of antitrust law. US antitrust law has been applied for more than fifty years to conduct occurring abroad that

causes a substantial effect within the US.⁶⁴ At one time other nations resisted this extraterritorial application of US domestic law, finding it to be a breach of comity.⁶⁵ Recently, however, other countries have also begun to apply certain of their laws against anticompetitive activities in an extraterritorial manner. Notably, the European Court of Justice, without expressly utilizing the “effects doctrine,” has ruled that EU regulations may be applied to anticompetitive conduct having a significant deleterious effect within the EU’s common market.⁶⁶ And although a limited extension of the effects doctrine can be found in trademark law, a species of unfair competition law,⁶⁷ use of the effects doctrine to expand the prescriptive reach of domestic law has largely been limited to the field of antitrust and competition law in both the US and the EU.

The second common basis of prescriptive jurisdiction for both lawmaking and legal enforcement is the nationality principle, which relies on the nationality of the actor.⁶⁸ Nationality can be an important adjunct to territoriality when conduct occurs in a territory that is *res communis*, such as outer space, or for which the territoriality principle is otherwise inapplicable, such as Antarctica.⁶⁹ Other than this embellishment and the effects-doctrine adjunct to the territoriality principle, domestic civil laws, such as intellectual property laws, do not typically purport to prescribe extraterritorial conduct.⁷⁰

Deciding which country’s law applies to particular conduct is an exercise in analyzing the extent of prescriptive jurisdiction for national laws governing the conduct in question. Most countries apply territoriality as the primary, if not exclusive, basis for their prescriptive jurisdiction for intellectual property infringement.⁷¹ Accordingly, territorial boundaries determine the choice of law in judicial enforcement of all major proprietary categories within intellectual property⁷² in most countries.⁷³ This emphasis on territoriality means that in almost all instances, the law of the nation in which the unauthorized use of intellectual property occurred is the law that will be applied to judge whether the use infringed the asserted intellectual property right.⁷⁴

With respect to copyright, the Berne Convention and the TRIPS Agreement provide for the independence of national rights: “the extent of protection, as well as the means of redress afforded to the author to protect his rights, shall be governed exclusively by the laws of the country where protection is claimed.”⁷⁵

Under the national treatment principle of Berne and TRIPS, domestic laws may not discriminate against non-nationals domiciled in a treaty party with respect to works protected under the treaties.⁷⁶ Neither the mandate of national treatment nor the reference to “laws of the country where protection is claimed,” nor any other provision of Berne or TRIPS expressly provides for application of territoriality in choice-of-law determinations. As set forth above, however, territoriality has long been the basis of prescriptive jurisdiction in intellectual property for most nations.⁷⁷ Accordingly, these Berne Convention and TRIPS Agreement provisions are generally applied in such a way that the law of the nation in which the unauthorized use of a work occurred is the law chosen to determine the existence of copyright protection for the work as well as the infringing or non-infringing nature of the unauthorized use.⁷⁸ Courts do not reference the domicile of the owner of the copyrighted work in choosing the law to apply to allegedly infringing activity. Each nation’s copyright laws only extend to the borders of the nation. The territorial limitation of intellectual property laws leads to some difficulty, but not impossibility, in applying the laws to conduct that crosses territorial boundaries.

B. Extraterritorial Extensions of US Intellectual Property Laws

When extraterritorial conduct is tied strongly to additional or supporting activity within the territory of a particular nation, courts may elect to extend that nation’s intellectual property laws to include the entirety of the conduct, even though some elements of the activity are extraterritorial. For instance, in patent law, US courts have occasionally held that a system patented in the US may be infringed, in certain circumstances, even when not all elements of the claimed system are located in the US.

In *Decca Ltd., v. United States*,⁷⁹ the court determined that a patented radio navigation system was used within the US despite the fact that one segment of the system was located in Norway, on the logic that “although the Norwegian station is located on Norwegian soil, a navigator employing signals from that station is, in fact, ‘using’ that station and such use occurs wherever the signals are received and used in the manner claimed.”⁸⁰ In *NTP, Inc., v. Research in Motion, Ltd.*,⁸¹ the Federal Circuit held that a claimed system is used, for purposes of patent infringement, where the “system as a whole is put into service, i.e., the place where control of the system is exercised and beneficial use of the

system obtained. . . . RIM's customers located within the United States controlled the transmission of the originated information and also benefited from such an exchange of information. Thus, the location of the Relay in Canada did not, as a matter of law, preclude infringement of the asserted system claims in this case."⁸² In *Microsoft v. AT&T*, on the other hand, the US Supreme Court emphasized the territorial nature of a US patent right.⁸³ It ruled that Microsoft's shipment of a master disk of software to a foreign country did not infringe AT&T's US patent even though the software, if installed on a computer in the US, had the potential to infringe the patent, and even though Microsoft had shipped the copy of the software abroad for the specific purpose of installing it on computers, which made the situation a plausible candidate for the application of the Patent Act's limited exception to strict territoriality.⁸⁴

Section 105 of the Patent Act provides expressly for application of US patent law to infringing activity occurring on a space object under the jurisdiction or control of the United States.⁸⁵ As a result, the question of applying US patent law in outer space has already been decided with respect to unauthorized use of an invention patented in the US on a US-registered space object, regardless of whether that use is connected to other use of the invention within US territory.⁸⁶ Like the Space Station Agreement, Section 105 constructively extends US territory to include US-registered space objects, so that the territorially bounded law will apply to activities on or in those space objects. Patent law, despite being territorially limited, has thus accommodated certain limited modifications to deal with cross-border activity, including outer space activity.

US copyright law's territorial emphasis has also been open to adjustment in light of cross-border activity. In *Los Angeles News Serv. v. Reuters TV Int'l*, the Ninth Circuit ruled that proof of a predicate infringing copy made in the US, which made possible the infringing activity abroad, enabled the court to award damages based on compensation for both the domestic infringing activity and the foreign infringing activity.⁸⁷ Even when the Ninth Circuit heard a subsequent appeal in that case and backpedaled somewhat, it continued to allow recovery of the infringer's profits resulting from the extraterritorial infringement although it disallowed the plaintiff's actual damages resulting from that infringement to the extent that the damages exceeded the infringer's profits.⁸⁸ These adjustments, however, are limited. In *Subafilms, Ltd., v. MGM-Pathe Communications Co.*,⁸⁹ when allegedly infringing activities occurred solely extraterritorially, the Ninth

Circuit denied relief, under US copyright law, to a plaintiff claiming infringement in the US solely on the basis of the defendant's authorization of those extraterritorial activities from within the US.⁹⁰

C. Extension of Copyright Law to Outer-Space Activity

Without a predicate act of infringement within US territory, it would seem unlikely that a US court would extend US copyright protection to unauthorized uses of copyright-protected works in outer space, unless the court were willing to engage in a bit of territorial fiction *and* the unauthorized use occurred on a US-registered space object. The court would need to determine that the territorial jurisdiction of US copyright law could extend to the US-registered object by virtue of its registration, a determination that constructively extends US territory. If the unauthorized use of the work were to occur exclusively on a foreign-registered object, however, I predict that a court would be unlikely to extend US copyright law to that activity, even if that court were inclined to engage in the "territorial fiction." It would be more likely that a court willing to find that a space object is an extension of national territory on Earth would choose to apply the law of the foreign country in which the object had been registered. Without resort to the registry system, constructive territorial extensions to include space objects would know no bounds, a result greatly at odds with the territorial limitation of US and foreign copyright law.

The use of "territorial fiction" to include US-registered space objects within the reach of US law would be uncharted territory for a court ruling on a copyright matter. As a result, an express extension of US copyright protection to US-registered space objects may be needed, much like the extension provided by Section 105 of the Patent Act. Without that statutory authority, a US court may be reluctant to find that unauthorized use of a copyright-protected work on a US-registered space object, unconnected to unauthorized use on US territory, would constitute infringement of the US copyright in the work.

IV. Jurisdictional Analysis of Database and Data Rights

In order to apply the traditional territorial jurisdictional principle of intellectual property law to database and data rights, the nature of those rights should be compared to the more familiar intellectual property rights in order to determine

whether the traditional approach is appropriate or whether a modification such as the effects doctrine should be applied. Without an international consensus on the proper approach to choice-of-law questions related to a *sui generis* data or database right, the only logical analysis proceeds by way of carefully considered comparison.

A. The Nature of Data Rights for Purposes of Choice of Law

Is European protection of data rights truly analogous to intellectual property protection such that choice-of-law principles drawn from traditional intellectual property law, rather than antitrust or unfair competition law, provide appropriate guidance? The Database Directive contains two different modes of protection: one obligates extension of copyright protection to databases “which, by reason of the selection and arrangement of their contents, constitute the author’s own intellectual creation,”⁹¹ and the other obligates the creation of a *sui generis* right “to prevent extraction and/or re-utilization of the whole or of a substantial part . . . of the contents” of a database in which “a substantial investment in either the obtaining, verification or presentations of the contents” has been made.⁹² The first protection is not novel. Copyright protection of a database with original selection and arrangement is one of the obligations of a WTO member under the TRIPS Agreement.⁹³ As a result, protection of databases as a whole, rather than protection of contents, would not often give rise to a real conflict of policy reflected in different nations’ substantive laws.

The *sui generis* right, on the other hand, provides broader protection than US or European copyright laws as applied to facts and other data contained within a database. Inclusion of database contents within the scope of protected subject matter is where national laws within the EU, under the Database Directive, diverge from US law and the laws of a number of other nations.⁹⁴ Properly analyzing the choice-of-law issue presented by the divergence requires a determination of whether the *sui generis* data right is more akin to competition law or copyright. As discussed above in Part II.A., in certain areas of competition law, most particularly in antitrust law but also in some trademark-based unfair competition cases, the effects doctrine has been used to modify the application of strict territoriality in prescriptive jurisdiction. If the data right is analogized to the right to prevent unfairly competitive or anticompetitive conduct, that comparison

might lead to use of the effects doctrine to modify strict territoriality and to reach extraterritorial conduct alleged to have significant deleterious effect within the territory. If the data right is more akin to copyright, however, the territorial choice-of-law principles dominant within copyright should prevail.

The European data right, wherein facts within certain databases gain limited exclusive rights, clearly contrasts with the unprotected status of factual data under US copyright law. No judicial decisionmaker could miss the comparison, or the distinction. In its landmark case of *Feist Publications, Inc., v. Rural Telephone Service Co.*,⁹⁵ the Supreme Court stressed that the lack of copyright protection for facts is fundamental to the policies underlying US copyright law and that the Copyright Act means exactly what it says when it excludes the facts in a compilation from the copyright protection extended to the compilation.⁹⁶ In fact, the Court held that exclusion of protection for factual information has a Constitutional dimension.⁹⁷ As a result, databases containing factual data are protected as compilations under US copyright law, with that protection limited only to the originality, if any, in the selection and arrangement of the factual data within the database.

By analyzing US law alone, noting the deep links between non-protection of facts and copyright protection of expression, a court should view the European data right as an adjunct to European copyright law, and not a separate right against unfair competition. As such, when faced with a claim based on action taken within the US to extract or reutilize geospatial data contained within a database, a US court should utilize its traditional territorial choice-of-law principle to determine which nation's copyright (and allied) laws would apply to the unauthorized use. It should choose US law and find infringement only if the use of the geospatial data or database constitutes copyright infringement under the US Copyright Act.

Were the US court to dig deeper into the classification and nature of the data right within either the Database Directive or European national laws, I contend that it would still reach the same conclusion. Although the Database Directive separates the *sui generis* data right from the copyright in the database as a compilation, the EU still classifies the data right as one "related" to copyright.⁹⁸ Many EU member states have codified the data right with national copyright law, rather than placing the data right with other provisions providing rights against

unfair competition.⁹⁹ The right is still treated by those nations as a *sui generis* right, however, in order to prevent the right from becoming subject to the obligation of national treatment within the Berne Convention and the TRIPS Agreement.¹⁰⁰

The nature of the data right also more closely parallels copyright than unfair competition. The term of the protection of data against extraction or reutilization is time-limited, as is copyright, with the term set forth specifically in the relevant statute. The rights within unfair competition and trade secret law, on the other hand, are measured by propriety of conduct and resulting damage, whenever it may occur. These actions are not typically limited to a term of years. Moreover, both copyright law and the data right set forth specified acts that are deemed wrongful,¹⁰¹ while unfair competition law does not specify particular wrongful acts. This leaves the meaning of "unfair" to be defined in each case. The Paris Convention defines unfair competition as "[a]ny act of competition contrary to honest practices in industrial or commercial matters."¹⁰² Similarly, section 43(a) of the Lanham Act, the US federal trademark and unfair competition law, provides in part: "Any person who ... uses in commerce any word ... or device ... [or any] false or misleading description of fact, which ... is likely to cause confusion, or to cause mistake, or to deceive ... shall be liable in a civil action by any person who believes that he ... is likely to be damaged by such act."¹⁰³ In unfair competition laws the propriety of conduct and resulting damage, rather than specific actions, are the keys to liability. In a number of ways, then, the European data right finds its structural parallel in copyright rather than unfair competition law.

Even with further review of the Database Directive and the relevant European national database law, therefore, a US court should determine that the characteristics of a data-rights claim make that claim more like a copyright claim than an unfair competition claim. With copyright as the model, the court should then conclude that a territorial choice-of-law analysis is appropriate for the data right. That analysis would lead to the conclusion that the data right provided by a European nation's law is enforceable only against activity occurring within that European nation, or perhaps within another EU nation, in light of the harmonization of data laws under the Database Directive. Extraterritorial conduct, such as US activity, would not be included. Thus, when presented with a

claim based on action taken within the US to extract or reutilize geospatial data contained within a database, a US court should apply US copyright law, not a European national data rights law.

Further, a European national court should do the same, maintaining the traditional territorial principle.¹⁰⁴ The law of the forum understandably possesses a strong magnetism in transnational disputes, particularly when a national policy is, or appears to be, at stake. Comity, on the other hand, would counsel against such an approach without a thorough analysis. If the law of the place of use were to be set aside, the legitimacy of local uses would become unpredictable, damaging the public interest accommodated through those laws. As a European copyright choice-of-law scholar has argued, maintaining the law of the nation of use as the governing law for existence, duration, and scope of copyright is necessary and vital for maintaining the balance struck in each nation between the interests of creators and the interests of the public.¹⁰⁵ Because public and private economic interests in the database industry motivated the addition of data protection to EU law,¹⁰⁶ a court in the EU should acknowledge that balance was struck only within the EU and not for the whole world. With that acknowledgement made, even a European national court should resist the urge to apply the law of the forum to conduct outside the EU. Instead, the court should restrict the data right's prescriptive reach only to conduct occurring within the EU, leaving US and other extraterritorial conduct outside the scope of the European data right.

B. Application of Territorial Choice of Law to Outer-Space-Derived Data Rights

1. Databases Created in and Data Derived from Outer Space

The Database Directive expressly restricts the availability of the *sui generis* data right to "databases whose makers or rightholders are nationals of a Member State or who have their habitual residence in the territory of the Community," in addition to databases owned by certain EU-based companies and firms.¹⁰⁷ The Database Directive does not, however, restrict protection based on the location where the database was created or from where the contents derive. Creating a database in outer space or including outer-space-derived data should not, therefore, restrict an EU national's ability to obtain data rights.

In copyright, either the author's nationality or country of habitual residence, or the nation of first publication, provides a point of attachment for protection under the Berne Convention or the TRIPS Agreement.¹⁰⁸ Each treaty provides protection under the doctrine of national treatment, meaning each member nation to those international agreements will provide authors of Berne or TRIPS-protected works with the same substantive rights as authors who are nationals of the member states.¹⁰⁹ Location of fixation or creation, as contrasted with location of publication, does not play a role in determining existence of protection for the work under the Berne Convention, the TRIPS Agreement, or the laws of most nations. Thus, as to the existence or creation of copyrightable works, including databases and mapped or photographic geospatial data, the addition of outer space as a location for creation and fixation of works creates no serious international jurisdictional dilemma. Because the existence of both copyright and *sui generis* data protection depends largely on nationality, rather than location of creation or fixation, the non-existence of national territory in outer space is no impediment to copyright and related-rights protection of outer-space-derived data, including data protection under the Database Directive.¹¹⁰

2. Unauthorized Use of Outer-Space-Derived Data on Earth

Regardless of the location of creation, derivation, fixation, or publication of the data or database, when the location of unauthorized use is on Earth no new problems should arise. Transnational copyright disputes have already challenged territorial jurisdictional and choice-of-law precepts. While courts have generally refused to apply US copyright law to foreign activity,¹¹¹ they have shown some willingness to provide a remedy for foreign infringement in cases where foreign and US infringing activities are linked.¹¹² But when foreign activity is not linked to domestic infringing acts, the courts have ruled that the foreign activity should be governed by foreign copyright law.¹¹³ And as I argue in Part III above, the same territorial jurisdictional analysis should apply to the European data right when unauthorized use is on Earth. With respect to unauthorized use of works protected by the data right or copyright, however, outer space as a location for the unauthorized use may pose additional challenges.

3. Unauthorized Use of Outer-Space-Derived Data in Outer Space

Unauthorized use of outer-space-derived data in outer space could occur on a registered space object, including an object that has been fixed to a celestial

body. The focus on territoriality within intellectual property's jurisdictional and choice-of-law analyses does not create a true conflict with outer-space international law or policy insofar as infringement occurs on a space object for which national registration is made,¹¹⁴ a conclusion that is bolstered by the language of the Space Station Agreement, discussed in Part II.A. above.¹¹⁵

Unauthorized use of intellectual property could also occur, perhaps in the future, outside a space object, such as the interception of a data stream being sent from a space object to Earth. It is also conceivable that unauthorized use could occur on the non-sovereign territory of a celestial body such as another planet or the Moon, and yet not occur in or on a space object. Extending the laws of any one nation to activity occurring on a celestial body outside a registered space object could begin to infringe upon the declaration within the Outer Space Treaty that no celestial body may be claimed as the sovereign territory of any nation. Without a territorial claim, or the constructive extension of territoriality provided by registration, the jurisdictional principles governing international choice of law within intellectual property will be upset. If extraction or reutilization of data occurs within outer space but not in or on a registered space object, traditional jurisdictional principles provide little guidance. In the same way, current analysis provides no answer in a situation where a database owner alleges copyright infringement based on outer space activity not on or in a space object.

The real jurisdictional conundrum at the intersection of outer-space-derived data rights and activities in outer space arises, then, when considering not creation in or derivation from outer space,¹¹⁶ but instead utilization, extraction, appropriation, or other unauthorized activity in outer space. With systems of copyright and data rights that are domestically enforceable, to what domestic legal system does an aggrieved data or database owner look for recourse with respect to unauthorized uses in outer space? The difficulty in territorially locating an infringement is not exclusive to outer space – in fact, satellite broadcast signals and internet-based transmissions have already challenged jurisdictional analyses within intellectual property and other areas of the law. In the case of terrestrially based human activity conducted via satellite or internet, however, there is still an actor and his unauthorized activity, closely linked to the non-territorial activity, located within at least one national territory. As such, territoriality can still be of use in choosing the law to apply to the activity, although it may not be entirely satisfactory.¹¹⁷ With interception or utilization by

an actor not terrestrially located or linked at the time of interception or utilization, however, such as might occur on a celestial body, using territoriality as the basis for jurisdiction would become difficult or impossible.

V. Conclusion

Professor Cromer has demonstrated that copyright and data rights can be applied to protect geospatial data gathered remotely from outer space. I have argued above that national laws providing for these exclusive rights do not violate any international treaty or custom. In addition, I have argued that current choice-of-law principles suffice to address the utilization on Earth of outer-space-derived data and databases as well as most uses of such data and databases in or on space objects, regardless of the presence of those objects within space or on another celestial body. Although workable and consistent, however, reference to registration of space objects as the basis for choice of law may prove undesirable as a normative matter. The possibility of non-object-based use of data and databases in outer space also poses serious difficulty for the territorial basis of jurisdiction and choice of law.

Foreign litigation may be inconvenient for the owner of an intellectual property right that has been used without authorization in outer space by a person or entity over which the owner's domestic courts do not have personal jurisdiction, but that inconvenience is present today in light of the ease of cross-border infringement. Similarly, the intellectual and practical difficulty of a domestic court's application of a foreign nation's laws to unauthorized uses occurring in that foreign nation does not seem a sufficient reason to alter the established norm of territorial application of intellectual property laws.¹¹⁸ There have been numerous calls for change in the territorial principle currently governing copyright choice of law, even without the added complication of the outer-space environment. One recommendation calls for courts to consider the laws and policies of various nations in connection with transnational copyright disputes,¹¹⁹ and another argues that copyright infringement should be located in the US if planning and preparation for the infringement take place in the US, even if infringing copies are never made here.¹²⁰

If the space-research producing and using communities feel strongly that uniform substantive law and predictability are paramount in their field, change

may be in order. Professor Cromer's paper has demonstrated divergent approaches to geospatial data protection, and I have argued, in turn, that under current jurisdictional principles multiple national laws should be applied in the case of multinational unauthorized use of geospatial and other outer-space-derived data. If the affected communities desire a different approach to choice of law or jurisdiction for normative reasons, they can and should take affirmative action to mold the law at this relatively early stage in the exploration and utilization of the outer space environment. If action is taken now, those communities could conceivably install a sound, cohesive framework for space-related and space-derived information and creations, which framework should attend to jurisdictional conflicts arising from the *res communis* status of outer space as well as substantive rights. Even when laws are relatively uniform, such as within the economic rights of copyright, national variation in procedures and remedial judicial powers may exist and may greatly affect outcomes if jurisdictional matters are not addressed. Addressing substantive rights related to space-derived intellectual property would be insufficient. With outer space being, by definition, extraterritorial to all nations, an international legal regime governing intellectual property rights in outer-space-derived information and creations could be useless if it did not carefully consider jurisdictional issues, choice of law, and choice of forum. Whether and how a cooperative system of territorial national rights can effectively function in the non-territorial zone of outer space continues to warrant serious consideration.

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Endnotes

- † This article was originally published as Comment: *Intellectual Property in Outer Space: International Law, National Jurisdiction, and Exclusive Rights in Geospatial Data*, 32 J. SPACE L. 319 (2006). It has been updated for this 2010 republication.
- 1 See generally Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 UST. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].
- 2 Compare, for example, TRIPS Agreement Articles 9-12 & 14 (setting forth a broad scope of rights in copyrighted works) with Article 13 (allowing nations to create exceptions from copyright protection but only when the exceptions excuse "certain special cases which do not conflict with a normal exploitation of the work."). See Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, THE LEGAL TEXTS: THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS 320 (1999), 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994) [hereinafter TRIPS Agreement].
- 3 Julie D. Cromer, *How on Earth Terrestrial Laws Can Protect Geospatial Data*, 32 J. SPACE L. 253 (2006).
- 4 Although Prof. Cromer uses US copyright law to illustrate the question of copyrightability, it is important to note that in many respects, the result will be the same or similar in many other jurisdictions, because the basic nature of a copyright-protected work, particularly the requirements of originality and fixation and the exclusion of underlying ideas or facts, does not vary greatly from nation to nation within the Berne Convention or the WTO. See generally TRIPS Agreement, *supra* note 2, and Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, revised July 24, 1971, S. TREATY DOC. NO. 27, 828 U.N.T.S. 221 (1986) [hereinafter Berne Convention]; Berne Convention Implementation Act, Public Law 100-568, 102 Stat. 2853, 1161 U.N.T.S. 30 (1988).
- 5 Cromer, *supra* note 3.
- 6 *Id.* at 275-81.
- 7 *Id.* at 270-74.
- 8 *Id.* at 282-84.
- 9 *Id.* at 274-75.
- 10 *Id.* at 262.
- 11 See *infra* Part II.
- 12 See *infra* Part II.A.
- 13 Council Directive 96/9/EC, 1996 (L 77 1996-03-27, pp 20-28) (of the European Parliament and of the Council of 11 March 1996 On the Legal Protection of Databases) [hereinafter Database Directive].

- 14 See 17 U.S.C. § 102(b) (2006); *Feist Publ'ns, Inc., v. Rural Tel. Serv. Co.*, 499 US 340 (1991).
- 15 The absence of a data right under a *sui generis* or other legal regime does not exclude data from all forms of legal protection. "Self-help" forms of legal protection for data continue to exist in all economically developed jurisdictions, including contract and trade secret. Such legal protection requires something more from the person asserting exclusive rights than preparation or collection of data or organization of a database. Legally enforceable rights only arise after implementation of reasonably effective secrecy measures or formation of a contract obligating the non-owning party with respect to the data.
- 16 Cromer, *supra* note 3, at 285-87.
- 17 *Id.* at 286-87.
- 18 See *infra* Part III.
- 19 Professor Cromer does not, of course, suggest that the EU's decision to protect data as such is an invalid exercise of the EU's legislative powers, but only that as to outer-space-derived data it may violate the international law of space.
- 20 I focus my analysis on geospatial and other data gathered from equipment located in outer space, which I term generally data "derived" from outer space, rather than on data gathered from Earth regarding outer space itself because geospatial data gathered from outer-space-bound equipment is the focus of Professor Cromer's article.
- 21 Kali N. Murray, *Of Gardens and Streets: A Differentiated Model of Property in International and National Space Law*, 32 J. SPACE L. 361 (2006).
- 22 See Outer Space Treaty, *supra* note 1, at art. II ("Outer space, including the moon and other celestial bodies, is not subject to national appropriation by the claim of sovereignty, by means of use or occupation, or by any other means.").
- 23 Murray, *supra* note 21.
- 24 Statute of the International Court of Justice, June 26, 1945, art. 34(1), 59 Stat. 1031, 30 YEAR BOOK OF THE UNITED NATIONS 1052 (1976). The statute provides that the Court will apply:
 - a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting States;
 - b. international custom, as evidence of a general practice accepted as law;
 - c. the general principles of law recognized by civilized nations; and
 - d. subject to the provisions of Article 59 [providing that Court decisions are not binding except as to the parties and in the particular case], judicial decisions

and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of the rules of law.

Id.

- 25 IAN BROWNLIE, *PRINCIPLES OF PUBLIC INTERNATIONAL LAW* 5 (7th ed. 2008). See also ANTHONY AUST, *HANDBOOK OF INTERNATIONAL LAW* 5-6 (2005).
- 26 The first source of international law, namely international conventions or treaties, must be carefully considered: Brownlie cautions that international conventions, agreed upon as they are by only the contracting States, while clearly a source of obligations between individual states, are “not primarily a source of rules of general application, although treaties may provide evidence of the formation of custom.” BROWNLIE, *supra* note 25, at 5. Non-treaty-derived international customary rules arise from the practice of states, when the practice is accompanied by state understanding of the practice as obligatory. See *id.* at 6-12; AUST, *supra* note 25, at 6-7. The “general principles of law” referred to in part (c) of article 34(1) of the ICJ statute are those principles of domestic law that may be applied to relations between nations. See generally BROWNLIE, *supra* note 25, at 16-18; AUST, *supra* note 25, at 8-9. This is generally not substantive law, but instead procedural or evidentiary rules, or other concepts such as good faith or estoppel. See BROWNLIE, *supra* 25, at 16-17 (rules of procedure and evidence); AUST, *supra* note 25, at 9 (good faith and estoppel). Due to the limited nature of these “general principles” within international law, they are inapplicable to the issue at hand. Similarly, because there are currently no relevant international judicial decisions and scant attention paid to outer-space intellectual property issues within the “teachings of the most highly qualified publicists of the various nations,” the sources of international law with respect to outer-space-derived intellectual property and data are limited.
- 27 Articles I, II, and IX of the Outer Space Treaty provide:

Article I

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

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.

There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.

Article II

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.

Article IX

In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.

Outer Space Treaty, *supra* note 1, at arts. I, II, & IX.

28 *Id.* at arts. I & II.

29 *Id.* at arts. I & IX.

30 See Dan Burk, *Application of United States Patent Law to Commercial Activity in Outer Space*, 6 SANTA CLARA COMPUTER & HIGH TECH L.J. 295, 314 (1991) (“[T]he Outer Space Treaty is not explicit about the applicability of this principle [of international policy against national territoriality in outer space] to intellectual property discoveries in outer space, as opposed to real property discoveries in outer space.”).

31 Outer Space Treaty, *supra* note 1, at art. I.

32 *Id.* at art. I.

33 *Id.* at art. IX.

34 *Id.* at art. II. As Professor Cromer acknowledges, this language “does not necessarily preclude intellectual property.” Cromer, *supra* note 3, at 262.

35 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, May 12, 1979, 1363 U.N.T.S. 21 [hereinafter Moon Treaty] (Participants: Austria, Chile, France, Guatemala, India, Morocco, the Netherlands, the Netherlands Antilles, the Philippines, Peru, Romania, and Uruguay).

36 The relevant portions of Articles 4, 6, & 11 of the Moon Treaty provide:

Article 4

1. The exploration and use of the moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. . . .

Article 6

1. There shall be freedom of scientific investigation on the moon by all States Parties without discrimination of any kind, on the basis of equality and in accordance with international law.

Article 11

1. The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement and in particular in paragraph 5 of this article.
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.
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 foregoing provisions are without prejudice to the international regime referred to in paragraph 5 of this article.
4. States Parties have the right to exploration and use of the moon without discrimination of any kind, on a basis of equality and in accordance with international law and the terms of this Agreement.
5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. This provision shall be implemented in accordance with article 18 of this Agreement.
6. In order to facilitate the establishment of the international regime referred to in paragraph 5 of this article, States Parties shall 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 any natural resources they may discover on the moon.
7. The main purposes of the international regime to be established shall include:
 - 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 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.

Id. at arts. 4, 6, & 11.

37 *Id.* at art. 11(3).

38 See *id.* at arts. 6 & 11(4).

39 See *id.* at art. 11(2).

40 See *id.* at art. 11(3).

41 The Moon Treaty, completed in 1979, found its current form just eight years after the 1971 Acts of the Berne and Universal Copyright Conventions attempted to quell concerns of developing nations by allowing those nations to adjust certain copyright protections in light of a nation's stage of development. See, e.g., PAUL GOLDSTEIN, INTERNATIONAL COPYRIGHT §§ 2.1.2.2.A and 5.5.1.6.C (2001) (referencing the Berne Convention, *supra* note 4, and the Universal Copyright Convention, 25 U.S.T. 1341, T.I.A.S. 7868, (1971 Paris Text), Appendix Declaration Relating to Article XVII).

42 Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 [hereinafter the Registration Convention].

43 Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, April 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119.

44 Convention on International Liability for Damage Caused by Space Objects, March 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 187.

45 See BROWNLIE, *supra* note 25, at 3-8.

46 See Registration Convention, *supra* note 42, at art. 2; Outer Space Treaty, *supra* note 1, at art. VIII.

47 Agreement among the Government of Canada, Government of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, 1998 U.S.T. LEXIS 212 [hereinafter Space Station Agreement].

48 Articles 6, 12, and 21 of the Space Station Agreement provide in relevant part:

Article 6

Ownership of Elements and Equipment:

1. [The space agency of each participating country] shall own the elements listed in the Annex that they respectively provide, except as otherwise provided for in this

Agreement. The Partners, acting through their Cooperating Agencies, shall notify each other regarding the ownership of any equipment in or on the Space Station.

6. The ownership or registration of elements or the ownership of equipment shall in no way be deemed to be an indication of ownership of material or data resulting from the conduct of activities in or on the Space Station.

Article 12

Transportation:

4. Each Partner shall respect the proprietary rights in and the confidentiality of appropriately marked data and goods to be transported on its space transportation system.

Article 21

Intellectual Property:

1. For the purposes of this Agreement, "intellectual property" is understood to have the meaning of Article 2 of the Convention Establishing the World Intellectual Property Organization, done at Stockholm on 14 July 1967.
2. Subject to the provisions of this Article, for purposes of intellectual property law, an activity occurring in or on a Space Station flight element shall be deemed to have occurred only in the territory of the Partner State of that element's registry, except that for ESA-registered elements any European Partner State may deem the activity to have occurred within its territory. For avoidance of doubt, participation by a Partner State, its Cooperating Agency, or its related entities in an activity occurring in or on any other Partner's Space Station flight element shall not in and of itself alter or affect the jurisdiction over such activity provided for in the previous sentence.
3. In respect of an invention made in or on any Space Station flight element by a person who is not its national or resident, a Partner State shall not apply its laws concerning secrecy of inventions so as to prevent the filing of a patent application (for example, by imposing a delay or requiring prior authorization) in any other Partner State that provides for the protection of the secrecy of patent applications containing information that is classified or otherwise protected for national security purposes.
4. Where a person or entity owns intellectual property which is protected in more than one European Partner State, that person or entity may not recover in more than one such State for the same act of infringement of the same rights in such intellectual property which occurs in or on an ESA-registered element.

.....

6. The temporary presence in the territory of a Partner State of any articles, including the components of a flight element, in transit between any place on Earth and any flight element of the Space Station registered by another Partner State or ESA shall not in itself form the basis for any proceedings in the first Partner State for patent infringement.

Id. at arts. 6, 12, & 21. The Convention referenced in Art. 21(1) of the Space Station Agreement includes within intellectual property:

- literary, artistic and scientific works,
- performance of performing artists, phonograms, and broadcasts,
- inventions in all fields of human endeavor,
- scientific discoveries,
- industrial designs,
- trademarks, service marks, and commercial names and designations,
- protection against unfair competition, and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

Convention Establishing the World Intellectual Property Organization (WIPO) art. 2, July 14, 1967 and amended on September 28, 1979, 828 U.N.T.S. 3.

49 *Id.* at art. 21(3).

50 *Id.* at art. 6(6).

51 *Id.* at art. 12.

52 See *infra* Part III.A.

53 See *generally* TRIPS Agreement, *supra* note 2.

54 The World Trade Organization's current membership stands at 153 nations (following the accessions of Cape Verde and Ukraine in 2008). See list of WTO Members, http://www.wto.int/english/thewto_e/whatis_e/tif_e/org6_e.htm (last visited July 22, 2009). At the time the TRIPS Agreement came into effect in January 1995, it had around 75 adherents (although adherence to TRIPS was subject to different transition periods for different countries before full compliance with all provisions was required).

55 In fact, the United States added section 105, governing inventions in outer space, to the Patent Act only four years before the TRIPS Agreement was concluded in 1994. See Pub. L. No. 101-580, 104 Stat. 2863 (1990). In addition, the first multinational agreement regarding the planned international space station was concluded in 1988.

- 56 Without the capacity to gather the data anew and without the right to demand access to the data as gathered by others, developing nations might wonder what had become of the benefit and interest of developing nations that had at least been given lip service in the Outer Space Treaty. See Outer Space Treaty, *supra* note 1, at arts. I, & IX. See also Moon Treaty, *supra* note 35, at arts. 4 & 11(7).
- 57 See TRIPS Agreement, *supra* note 2, at art. 10(2): "Compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations shall be protected as such. Such protection, which shall not extend to the data or material itself, shall be without prejudice to any copyright subsisting in the data or material itself."
- 58 See Cromer, *supra* note 3, at 270-74.
- 59 For example, the US clearly excludes facts from copyright protection, see *Feist Publ'ns, Inc., v. Rural Tel. Serv. Co.*, 499 US 340 (1991), and I am unaware of any complaint that such exclusion violates any international obligation.
- 60 Accord Leo P. Malagar & Marlo Apalisok Magdoza-Malagar, *International Law of Outer Space and the Protection of Intellectual Property Rights*, 17 B.U. INT'L J. 311, 349 (1999) ("The lack of [an intellectual property rights regime for space activities] impedes the efficient international cooperation among states and other entities engaged in space research. . . . [Intellectual property] protection likewise 'encourages the publication, distribution, and disclosure of the creation to the public, rather than keeping it secret'" (quoting Albert Trampusch, *Importance of Intellectual Property Rights for Space Activities in General*, in PROCEEDINGS OF THE FIRST ECSL/SPANISH CENTRE FOR SPACE LAW WORKSHOP ON INTELLECTUAL PROPERTY RIGHTS IN OUTER SPACE 15 (1993)).
- 61 In this article I leave questions of personal jurisdiction largely to the side, focusing instead on the proper prescriptive reach of a nation's substantive intellectual property laws and the related choice of law analysis. In doing so, particularly with respect to the proposition that a US court might choose to apply the Database Directive to conduct occurring in the US, I limit my discussion to conduct by an actor whose appropriation or other unauthorized use of data occurs through actions wholly outside the territorial confines of the EU.
- 62 See BROWNLIE, *supra* note 25, at 300. Brownlie reviews six bases for criminal jurisdiction in particular, and then notes that there are no important differences between criminal and civil jurisdiction with respect to extraterritorial application of a state's law. *Id.* at 310-11.
- a. *The territorial principle.* The principle that the courts of the place where the crime is committed may exercise jurisdiction . . . [is] a single application of the essential territoriality of the sovereignty, the sum of legal competences, which a state has. . . .

- b. *The nationality principle.* Nationality, as a mark of allegiance and an aspect of sovereignty, is also generally recognized as a basis for jurisdiction over extra-territorial acts. . . . [M]any states place limitations on the nationality principle and it is often confined to serious offences. In any event nationality provides a necessary criterion in such cases as the commission of criminal acts in locations such as Antarctica, where the 'territorial' criterion is inappropriate.
- c. *The passive nationality principle.* According to this principle aliens may be punished for acts abroad harmful to nationals of the forum. . . . [C]ertain of its applications fall under the principles of protection and universality considered below. . . .
- d. *The protective or security principle.* Nearly all states assume jurisdiction over aliens for acts done abroad which affect the security of the state, a concept which takes in a variety of political offences, but is not necessarily confined to political acts. Currency, immigration, and economic offences are frequently punished. . . . In so far as the protective principle rests on the protection of concrete interests, it is sensible enough: however, it is obvious that the interpretation of the concept of protection may vary widely.
- e. *The universality principle.* A considerable number of states have adopted, usually with limitations, a principle allowing jurisdiction over acts of non-nationals where the circumstances, including the nature of the crime, justify the repression of some types of crime as a matter of international public policy. Instances are . . . crimes by stateless persons in areas not subject to the jurisdiction of any state, i.e., a *res nullis* or *res communis*. Anglo-American opinion is hostile to the general principle involved. . . .
- f. *Crimes under international law.* It is now generally accepted that breaches of the laws of war, and especially of the Hague convention of 1907 and the Geneva Convention of 1949, may be punished by any state which obtains custody of persons suspected of responsibility. This is often expressed as an acceptance of the principle of universality, but this is not strictly correct, since what is punished is the breach of international law; and the case is thus different from the punishment, under national law, of acts in respect of which international law gives a liberty to all states to punish, but does not itself declare criminal.

Id. at 300-07 (internal citations omitted). See also RESTATEMENT (THIRD) OF THE FOREIGN RELATIONS LAW OF THE UNITED STATES §§ 402, 404 (1986) (characterizing the four bases of jurisdiction as territoriality, nationality, protective, and universality). The nature of the passive personality, protective, universality, and crimes under international law principles as set forth above makes clear that these principles have no relevance to intellectual property laws. Accord Glenn H. Reynolds, *Legislative Comment: The Patents in Space Act*, 3 HARV. J.L. & TECH. 13, 18 (1990).

63 See Harold G. Maier, *Jurisdictional Rules in Customary International Law*, in EXTRATERRITORIAL JURISDICTION IN THEORY AND PRACTICE 65-66 (Karl M. Meessen ed., Kluwer Law Int'l 1996) ("Although the presumed limitation of governmental authority

to a nation's territorial boundaries flows from the historic concept of the modern nation state, the proposition that a state may on occasion exercise authority over events beyond its borders also flows, paradoxically, from the principle that the interests of the people that make up the state's population are territorially defined.")

- 64 See *United States v. Aluminum Co., of America*, 148 F.2d 416, 444 (2d Cir. 1945); see also *Hartford Fire Ins. Co., v. California*, 509 US 764, 796 (1993).
- 65 See BROWNLIE, *supra* note 25, at 309-10.
- 66 *Id.*; see also SYMEON C. SYMEONIDES, ET AL., *CONFLICT OF LAWS: AMERICAN, COMPARATIVE, INTERNATIONAL: CASES AND MATERIALS* 554-555 (2d ed. 2003) (noting that German antitrust law expressly extends its jurisdiction to "all restraints on competition that have effect within the [German] territory . . . even if they are caused outside of this territory," and that Article 81 of the Treaty of Rome, an EU treaty, regulates activities that "have as their object or effect the prevention, restriction, or distortion of competition within the [European Union].")
- 67 Some domestic courts, in limited situations, are willing to adjudicate claims related to extraterritorial conduct when that conduct affects a trademark interest within the domestic territory. For example, in *Steele v. Bulova Watch Co.*, 344 US 280 (1952), the US Supreme Court held that US trademark laws could, in certain circumstances, be applied to reach conduct occurring in foreign nations. It relied on many factors, however, not solely on the "effect" of the defendant's commerce within the US. In addition to the effect of defendant's conduct on plaintiff Bulova's trade reputation in the US through the confusion of US customers, the Court discussed the Lanham Act's broad jurisdictional grant including all commerce between the US and foreign nations, the defendant's US citizenship, defendant's purchases of component parts within the US, and the fact that defendant's goods had ultimately crossed the Mexican border into the US. It also stressed the fact that reaching defendant's conduct would not conflict with any rights established under foreign law.

The New York domicile of the owner of the infringed mark, and thus the possible "effect" of the infringement in New York, did not determine the outcome of the case. Confusion in the US formed the relevant effect – a logical analysis in light of the fact that trademark rights exist only in the jurisdiction or jurisdictions where consumer associations exist (or the mark has been registered), not where the mark owner is domiciled. Possible US confusion alone did not suffice.

A number of federal appellate decisions have followed *Bulova* in requiring more than a moderate effect in US commerce, and indeed more than a substantial effect, before exerting jurisdiction over extraterritorial acts alleged to infringe US trademarks. See, e.g., *Vanity Fair Mills, Inc., v. T. Eaton Co.*, 234 F.2d 633 (2d Cir. 1956); *Totalplan Corp., of Am. v. Colborne*, 14 F.3d 824 (2d Cir. 1984); see also *Ocean Garden, Inc., v. Marktrade Co.*, 953 F.2d 500 (9th Cir. 1991) (recognizing *Bulova* as well as applying an expanded analysis, which includes multiple factors relevant to the strength of the links to American foreign commerce compared to the

strength of links to other nations). *But see* *Sterling Drug, Inc. v. Bayer AG*, 14 F.3d 733 (2d Cir. 1994) (emphasizing substantial effects in US commerce rather than the more extensive analysis drawn from *Bulova and Vanity Fair*); *Am. Rice, Inc., v. Producers Rice Mill, Inc.*, 518 F.3d 321, 327-28 (5th Cir. 2008) (requiring no particular level of effect on United States commerce and instead stating the considerations for extraterritorial application of the Lanham Act as “the sufficiency of the contacts in this country and the interests of the United States, including ‘the citizenship of the defendant, the effect on United States commerce, and the existence of a conflict with foreign law.’” (quoting *Am. Rice, Inc., v. Arkansas Rice Growers Cooperative Ass’n*, 701 F.2d 408 (5th Cir. 1983))).

Similarly, a British court has relied on the existence of trademark goodwill within England, acts of a foreign defendant targeted toward English consumers, and damage within England to the goodwill of plaintiffs before finding that the plaintiffs had stated a valid cause of action under English trademark law. See *Mecklermedia Corp., v. DC Congress GmbH*, [1998] Ch. 40 (1997). The location of plaintiffs’ goodwill and thus the location of harm to that goodwill, rather than plaintiffs’ domicile, when coupled with the sending of targeted mailings by the foreign defendant to plaintiffs’ English customers, justified application of English trademark law to the admittedly extraterritorial activities of the foreign defendant.

- 68 See BROWNIE, *supra* note 25, at 303.
- 69 *Id.* at 304. See also *Space Station Agreement*, *supra* note 47, at art. 5 (utilizing the territoriality and nationality principles for determinations of jurisdiction and control within the group of Partner States).
- 70 See, e.g., *EEOC v. Arabian Am. Oil Co.*, 499 US 244, 248 (1991) (“Congress legislates against the backdrop of the presumption against extraterritoriality.”).
- 71 See, e.g., INTELLECTUAL PROPERTY: PRINCIPLES GOVERNING JURISDICTION, CHOICE OF LAW, AND JUDGMENTS IN TRANSNATIONAL DISPUTES 117-18 (2008) (taking territoriality as the basic principle of choice of law in intellectual property, with certain limited departures encouraged by the American Law Institute in cases of transnational infringement and litigation); International Association for the Protection of Intellectual Property (AIPPI), Summary Report from the Executive Committee Meeting in Lucerne, Switzerland 4 (Question Q174) (2003), <https://www.aippi.org/download/comitees/174/SR174English.pdf> [sic “comitees”] (summarizing reports from 39 national and regional groups with respect to jurisdiction in intellectual property matters and reporting that aside from the Chinese, Colombian and Bulgarian reporting groups, “The Groups in their majority believed that the applicable law for judging the basis of the litigation is the law of the country where the infringement took place.”); see also AIPPI, Report Q174 in the name of the French Group 6-7, 27 (2003), <https://www.aippi.org/download/comitees/174/GR174france.pdf> [sic “comitees”] (stating that for copyright (or author’s rights) the tribunal will apply the law of the country in which the infringing act is committed and that for industrial

property (e.g., patents and trademarks), the French choice of law similarly conforms to the principle of territoriality); AIPPI, Report Q174 in the name of the Italian Group 3 (2003), <https://www.aippi.org/download/comitees/174/GR174italy.pdf> [sic "comitees"] (reporting that the law of the place of alleged infringement is to be applied to determine the legality or illegality of the acts in question); AIPPI, Report Q174 in the name of the U.K. Group 2 (2003) <https://www.aippi.org/download/comitees/174/GR174uk.pdf> [sic "comitees"] (noting that infringement must take place within the UK in order for the UK copyright statutes to apply); AIPPI, Report Q174 in the name of the Spanish Group 5 (2003), <https://www.aippi.org/download/comitees/174/GR174spain.pdf> (concluding that the law of the country in which the infringing acts take place is the appropriate law to judge the existence of infringement); AIPPI, Report Q174 in the name of the Canadian Group 3, <https://www.aippi.org/download/comitees/174/GR174canada.pdf> [sic "comitees"] (stating that *lex loci delicti* would be applied by a Canadian court to judge alleged infringement abroad, with the caveat at page 1 that most such actions would likely be declined on the basis of *forum non conveniens*). The Canadian Group also reported that some Canadian courts have allowed the recovery of all damages resulting from infringement of a Canadian intellectual property right, even when some of those damages accrued with respect to sales of an infringing product abroad.

72 *I.e.*, copyright, patent, trademark, and trade secret.

73 The recent Principles adopted and promulgated by the American Law Institute (ALI) regarding jurisdiction and choice of law in transnational intellectual property disputes include a provision that separates unfair competition actions from other intellectual property actions for purposes of choice of law. See INTELLECTUAL PROPERTY, *supra* note 71, at 122-24, § 301. The unfair-competition provision recommends that the "law applicable to a noncontractual obligation arising out of an act of unfair competition is the law of each State in which direct and substantial damage results or is likely to result, irrespective of the State or States in which the act giving rise to the damage occurred." *Id.* at 122, § 301(2). The choice-of-law provision for other, non-registered intellectual property rights, including copyright, is recommended to be "the law of each State for which protection is sought." *Id.* at 122, § 301(1)(b). The choice-of-law provision for registered rights, such as patent and registered trademark rights, is stated in the Principles to be "the law of each State of registration." *Id.* at 122, § 301(1)(a).

The ALI's recommended application of the effects doctrine to apply to private unfair competition actions (rather than only antitrust law) is significant and, if adopted widely, could affect the analysis herein if the data right is considered to be a right against unfair competition rather than a right related to copyright. The Comments to section 301 of the Principles note that the characterization of trade secrets and of certain non-copyright-protected databases varies from country to country, with some characterizing the claims as intellectual property claims and other grouping the

claims with unfair competition. See *id.* at 124, § 301 comment g. A country's characterization of the data right as unfair competition would, under the Principles, change the choice of law from the law of the location of use to the law of the location in which damage is likely to occur, which would likely be the home nation of the database owner.

On the other hand, the Principles limit the effects doctrine with respect to unfair competition actions to those acts causing "direct and substantial damage" within the State whose law would be applied. See *id.* at 122, § 301(2). Not all damage from database misappropriation would rise to the level of "direct and substantial damage." In addition, the Comments to the Principles imply that competition between the parties must occur in the state whose law is applied, even if certain actions of the defendant do not occur within that state. See *id.* at 124, § 301 comment g ("The Principles recognize that acts in one State may affect competition in another location. In such cases, the law of the place where competition is taking place should accordingly apply."). See also *id.*, illustration to comment g. As such, even this proposed unfair competition choice-of-law principle would not affect the situation where Y, the owner of a database right, is located in Country A, and an unauthorized use by Z occurs in Country B, with no acts by Z taking place in Country A, including no competition by Z with Y in Country A. In that scenario, the Comment, despite its broad language, appears to contemplate that only Country B's law would apply to Z's activity, even if financial effects were felt by Y within Country A (such as a lowered foreign income stream).

- 74 For an illustration of the territorial limitations of a patent right under United States law, see *Microsoft Corp., v. AT&T Corp.*, 550 US 437, 441-44 (2007) (stating that "it is the general rule under United States patent law that no infringement [of a US patent] occurs when a patented product is made and sold in another country," and that, other than the section 271(f) exception regarding supply of components from the US for combination abroad, "[o]ur patent system makes no claim to extraterritorial effect").
- 75 Berne Convention, *supra* note 4, at art. 5.2; TRIPS Agreement, *supra* note 2, at art. 9(1) (incorporating Articles 1-21 of the Berne Convention).
- 76 See Berne Convention, *supra* note 4, at art. 5.1; TRIPS Agreement, *supra* note 2, at art. 3.
- 77 See, e.g., sources cited *supra* note 71.
- 78 See Graeme W. Austin, *Domestic Laws and Foreign Rights: Choice of Law in Transnational Copyright Infringement Litigation*, 23 COLUM.-VLA J.L. & ARTS 1, 24-25 (1999).
- 79 *Decca Ltd., v. United States*, 544 F.2d 1070 (Ct. Cl. 1976).
- 80 *Id.* at 1083.

81 *NTP, Inc., v. Research in Motion, Ltd.*, 418 F.3d 1282 (Fed. Cir. 2005).

82 *Id.* at 1317.

83 *Microsoft Corp., v. AT&T Corp.*, 550 US 437 (2007).

84 See *id.* at 442:

Plausible arguments can be made for and against extending § 271(f) to the conduct charged in this case as infringing AT&T's patent. Recognizing that § 271(f) is an exception to the general rule that our patent law does not apply extraterritorially, we resist giving the language in which Congress cast § 271(f) an expansive interpretation. Our decision leaves to Congress' informed judgment any adjustment of § 271(f) it deems necessary or proper.

The Section 271(f) exceptions to strictly territorial limitations on the US patent right provide:

1. Whoever without authority supplies or causes to be supplied in or from the United States all or a substantial portion of the components of a patented invention, where such components are uncombined in whole or in part, in such manner as to actively induce the combination of such components outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.
2. Whoever without authority supplies or causes to be supplied in or from the United States any component of a patented invention that is especially made or especially adapted for use in the invention and not a staple article or commodity of commerce suitable for substantial noninfringing use, where such component is uncombined in whole or in part, knowing that such component is so made or adapted and intending that such component will be combined outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.

35 U.S.C. § 271(f) (2006).

85 See 35 U.S.C. § 105 (2006). Under the Registration Convention, such space objects would likely include all space objects on the US registry, although the Convention refers to "jurisdiction and control" rather than "jurisdiction or control." Registration Convention, *supra* note 42. In addition, Section 105 provides that if an international agreement with the registry state so provides, a space object registered by a foreign state may also be treated as US territory for purposes of US patent law.

86 Interestingly, the legislative history indicates Congress's view that section 105 was a clarification, rather than a change, of the law. See GLENN H. REYNOLDS & ROBERT P. MERGES, *OUTER SPACE: PROBLEMS OF LAW AND POLICY* 346 (2d ed. 1997) (excerpting Senate Report 101-266, 1990).

- 87 *Los Angeles News Serv. v. Reuters TV Int'l*, 149 F.3d 987 (9th Cir. 1998); see also *Update Art, Inc., v. Modiin Publishing, Ltd.*, 843 F.2d 67 (2d Cir. 1988).
- 88 See *Los Angeles News Serv. v. Reuters TV Int'l*, 340 F.3d 926 (9th Cir. 2003).
- 89 *Subafilms, Ltd., v. MGM-Pathe Communications Co.*, 24 F.3d 1088 (9th Cir. 1994).
- 90 See *id.* at 1090; accord *Update Art*, 843 F.2d at 73.
- 91 Database Directive, *supra* note 13, at art. 3(1).
- 92 *Id.* at art. 7(1).
- 93 TRIPS Agreement, *supra* note 2, at art. 10(2).
- 94 This is not to say that US and other national laws provide no protection for any non-copyrightable database contents: on the contrary, trade secret law could be used to protect the contents of an undisclosed database, or the parties could contract for nondisclosure or non-extraction of the contents of the database as part of the consideration for initial disclosure of a database.
- 95 *Feist Publ'ns, Inc., v. Rural Tel. Serv. Co.*, 499 US 340 (1991).
- 96 *Id.* at 360.
- 97 *Id.* at 346-47.
- 98 For example, copyright protection for databases and the *sui generis* right to prevent unauthorized extraction and reutilization of data appear in the same directive. That directive is listed on the EU's website as one covering "copyright and related rights." See European Union Website, http://europa.eu/legislation_summaries/internal_market/businesses/intellectual_property/index_en.htm (last visited July 22, 2009).
- 99 See, e.g., § 87 UrhG (implementing in German statutory copyright law the *sui generis* data right required by the Database Directive).
- 100 This setting aside of an otherwise copyright-related right as *sui generis* in a way that eliminates international copyright treaty obligations is not uncommon. The United States added protection for semiconductor chip design to its law in 1984. Despite the similarities of that protection to copyright law and its codification in Title 17 of the United States Code with the Copyright Act, it was implemented as a *sui generis* right (rather than a copyright-based right for which the term was shorter, or some other distinction). See 17 U.S.C. §§ 901-914 (2006). By setting the right apart from copyright, the US took the position that it was not obligated to provide national treatment to foreign nationals with respect to the right. This parallels the limitation in the Database Directive that excludes from *sui generis* protection any database not made or owned by EU nationals or habitual residents, or by companies or firms organized and based in the EU. See Database Directive, *supra* note 13. With the nationality limitation in the Directive and the Berne Convention obligation of national treatment for copyright, it is important for EU nations to characterize the right as *sui generis* within the national law.

- 101 See, e.g., 17 U.S.C. § 106 (2006); Database Directive, *supra* note 13, at arts. 7, 8, & 9. For a characterization of copyright law as law that is delineated in terms of specific rights and that does not govern propriety of conduct and resulting damage in the way that tort law does, see Austin, *supra* note 78, at 20-21 (“The nature of the property that comprises a copyright is delineated by the laws that create the right and which render wrongful a range of specified actions when they are performed without the copyright owner’s authorization.” (emphasis added)). The European data right is consistent with Austin’s characterization of copyright in that it renders wrongful a range of specified actions, rather than relying on propriety of conduct and resulting damage.
- 102 Paris Convention for the Protection of Industrial Property, as last revised at the Stockholm Revision Conference July 14, 1967, 21 U.S.T. 1583, 828 U.N.T.S. 303 art. 10bis [hereinafter Paris Convention].
- 103 15 U.S.C. § 1125(a) (2006).
- 104 Not all national courts may be willing to apply foreign intellectual property law, preferring (or feeling required) instead to dismiss the case either for lack of subject-matter jurisdiction or under the discretionary common law doctrine of *forum non conveniens*. See sources cited *supra* note 71 and *infra* note 118 (discussing jurisdictional concerns); see also *Boosey & Hawkes Music Publishers v. Walt Disney Co.*, 145 F.3d 481, 491-92 (2d Cir. 1998) (discussing the appropriate application of *forum non conveniens* with respect to claims based on foreign copyright infringement); *London Film Productions, Ltd., v. Intercontinental Communications, Inc.*, 580 F. Supp. 47, 50 (S.D.N.Y. 1984) (same). Claims under foreign (non-forum) patent and trademark law have traditionally fallen outside the jurisdiction of national courts, while a foreign copyright claim has instead been considered by some courts to be a “transitory” cause of action, *i.e.*, one that can be adjudicated in a national court. See, e.g., *Boosey & Hawkes*, 145 F.3d at 491-92 (finding foreign copyright claims to be capable of adjudication in a US court); *London Film*, 580 F. Supp. at 50 (same); *cf. Voda v. Cordis Corp.*, 476 F.3d 887 (Fed. Cir. 2007) (reversing a district court’s discretionary acceptance of supplemental jurisdiction over foreign patent infringement claims, even where the district court had original federal question jurisdiction over the US patent infringement claims and the foreign law claims all arose from patents issued through a Patent Cooperation Treaty application that was based upon the United States patent application that resulted in the US patent claims). For a well-reasoned argument supporting the ability of a US court to adjudicate a claim based on foreign patent law in certain circumstances, by using supplemental jurisdiction, see Judge Newman’s dissent in *Voda v. Cordis*. *Voda*, 476 F.3d at 905-17.
- 105 MIREILLE M.M. VAN ECHOU, CHOICE OF LAW IN COPYRIGHT AND RELATED RIGHTS: ALTERNATIVES TO THE LEX PROTECTIONIS 226 (2003).

- 106 See Database Directive, *supra* note 13, at recitals 11 & 12; DG Internal Market and Services Working Paper: First Evaluation of Directive 96/9/EC on the legal protection of databases 2.2-2.4 (Dec. 12, 2005), available at http://ec.europa.eu/internal_market/copyright/docs/databases/evaluation_report_en.pdf.
- 107 Database Directive, *supra* note 13, at art. 11.
- 108 See Berne Convention, *supra* note 4, at art. 3; TRIPS Agreement, *supra* note 2, at art. 9(1) (incorporating Articles 1-21 of the Berne Convention).
- 109 See Berne Convention, *supra* note 4, at art. 5.1; TRIPS Agreement, *supra* note 2, at art. 3(1) (expressly providing for national treatment) & art. 9(1) (incorporating Articles 1-21 of the Berne Convention).
- 110 Similarly, eligibility for patent and trademark protection in the international arena relies largely on the nationality of the owner and the owner's proper registration of rights, rather than the location of creation of the subject matter of the right. The TRIPS Agreement and Article 2 of the Paris Convention obligate signatories to provide national treatment to nationals of all signatory nations with respect to patent and trademark rights. See TRIPS Agreement, *supra* note 2, at art. 3(1); Paris Convention, *supra* note 102. In the law of most, if not all, countries, the physical location of the inventor at the time of invention does not create any serious impediment to patentability in that country (although certain US rules discriminate against foreign knowledge or use in favor of knowledge or use in the United States for purposes of evaluating possible bars to patentability, see 35 U.S.C. § 102(a) & (b) (2006), and against foreign inventive activity in favor of domestic activity, such as when the claims of two inventors to the same invention conflict in the context of an interference, see 35 U.S.C. 102(g) (2006)). Trade secrets form part of the spectrum of intellectual property protected under TRIPS, see TRIPS Agreement, *supra* note 2, at art. 39, and the national treatment principle within TRIPS also applies to trade secret rights.
- 111 See, e.g., *Subafilms, Ltd., v. MGM-Pathe Communications Co.*, 24 F.3d 1088, 1090 (9th Cir. 1994); accord *Litecubes, LLC v. Northern Light Prods., Inc.*, 523 F.3d 1353, 1366-67 (Fed. Cir. 2008); *Omega S.A. v. Costco Wholesale Corp.*, 541 F.3d 982, 988 (9th Cir. 2008); *Update Art, Inc., v. Modiin Publishing, Ltd.*, 843 F.2d 67, 73 (2d Cir. 1988).
- 112 See, e.g., *Los Angeles News Serv. v. Reuters TV Int'l*, 340 F.3d 926 (9th Cir. 2003); *Los Angeles News Serv. v. Reuters TV Int'l*, 149 F.3d 987 (9th Cir. 1998); *Update Art, Inc., v. Modiin Publishing, Ltd.*, 843 F.2d 67 (2d Cir. 1988).
- 113 See, e.g., *Subafilms, Ltd., V. MGM-Pathe Communications Co.*, 24 F.3d 1088, 1090 (9th Cir. 1994) (refusing to apply US copyright law to foreign acts or to find authorization of those acts from within the US to infringe US rights). See also *Boosey & Hawkes Music Publishers v. Walt Disney Co.*, 145 F.3d 481, 491-92 (2d Cir. 1998) (reversing dismissal of and remanding for trial a plaintiff's claims under foreign copyright law where those claims were based on allegedly infringing foreign

activities); *London Film Productions, Ltd., v. Intercontinental Communications, Inc.*, 580 F. Supp. 47 (S.D.N.Y. 1984) (accepting jurisdiction of claims under foreign copyright law where those claims were based on allegedly infringing foreign activities). Not all courts may be willing, however, to consider copyright or other intellectual property claims to be a transitory causes of action appropriate for adjudication in a foreign court. See *supra* note 104.

- 114 Dan Burk appears to agree with this proposition. See Burk, *supra* note 30, at 316. (“Under a ‘free space’ reading of the international space treaties, it appears that the United States may validly assert jurisdiction over United States flag spacecraft and United States nationals. The determination must still be made whether Congress has in fact asserted such jurisdiction.”).
- 115 Even without national registration of a space object, a similar jurisdictional analysis could occur, although there is the distinct possibility that an unregistered space object could possess attributes of crew, construction, launch, and control that would lead to possible jurisdiction under the laws of multiple nations.
- 116 See *supra* Part IV.B.1.
- 117 Graeme Dinwoodie, for example, has concluded that “The façade of copyright rules based upon territoriality needs to be stripped away, and a new approach constructed. Some uncertainty is an inevitable, but worthwhile, short-term cost.” Graeme B. Dinwoodie, *A New Copyright Order: Why National Courts Should Create Global Norms*, 149 U. PA. L. REV. 469, 573 (2000).
- 118 There may, however, be an issue as to subject-matter jurisdictional competency of national courts. See William Patry, *Choice of Law and International Copyright*, 48 AM. J. COMP. L. 383, 468-469 (2000) (agreeing that US copyright law is strictly territorial but arguing that a US federal court has no subject matter jurisdiction over a claim of infringement under foreign copyright law); Austin, *supra* note 78, at 29 (arguing in favor of a US court’s application of foreign copyright law to foreign infringing activities although noting that “[t]he authority for the availability of subject matter jurisdiction over infringement of foreign copyright laws is somewhat thin.”). This issue does not arise in the outer-space environment alone; any application by a domestic court of another nation’s intellectual-property laws could raise this concern. Jane Ginsburg has noted that if there is complete diversity, as would be the case with a US defendant and a foreign plaintiff (and assuming the requisite amount is indeed in controversy), a federal court would have jurisdiction over the foreign copyright infringement claim. See Jane C. Ginsburg, *Extraterritoriality and Multiterritoriality in Copyright Infringement*, 37 VA. J. INT’L L. 587, 601 (1997). She also argues that even if there is incomplete diversity between the parties, if a federal court has initially retained jurisdiction over a case as the result of its original jurisdiction over a good-faith US copyright claim, it should retain the case even if the US claim is dismissed and only foreign copyright claims remain, on the basis of supplemental jurisdiction. *Id.* at 602.

In the patent area, as opposed to copyright, the Federal Circuit recently reversed an exercise of discretionary supplemental jurisdiction over foreign patent claims related to the US patent claims over which the district court was exercising original jurisdiction, although it noted that federal courts have, at least in theory, the power to exercise supplemental jurisdiction over claims arising under either foreign patents or foreign laws. See *Voda v. Cordis Corp.*, 476 F.3d 887, 893-97 (Fed. Cir. 2007). The court based its decision not on the potential power to exercise supplemental jurisdiction, but the propriety of such an exercise in light of concerns about comity, judicial economy, convenience, and fairness. *Id.* at 900-04. Judge Newman issued a lengthy and strenuous dissent arguing in favor of the exercise of supplemental jurisdiction. *Id.* at 905-17 (Newman, J., dissenting).

- 119 See Dinwoodie, *supra* note 117, at 543 (“proposing a “substantive law” approach to international copyright disputes, wherein a court “would consider whether the international dimension implicated policies of other states or the international copyright system, and develop (and apply) a substantive rule of copyright law that best effectuates this range of policies”).
- 120 See Ginsburg, *supra* note 118, at 599 (arguing that the difficulty of physically locating where an infringing copy is made counsels in favor of moving away from strictly applying territoriality to infringing acts, and stating that “[i]t makes more sense to identify the place where the plan to engage in unauthorized dissemination was devised, and then to consider the application of that country’s law.”).

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Outer Space: Science and Law

Snapshot

Advances in space science and technology are driven by international cooperation in the exploration and use of outer space. This needs more specific and detailed rules to govern new activities. After the launch of sputnik by Soviet Union in 1957, the curiosity to further explore the outer space has increased among the international community. Space technology has introduced new opportunities in the study of environment and various earth's processes. Spatial Information Technology has advanced into a significant branch of subject supporting different fields relating to land and water resource management, disaster mitigation and management, flood zoning, earth quake warning, tsunami alerts, environment, medical, distance education, coastal engineering, global navigation satellite system (GNSS) and global positioning system (GPS). Modern military operations extensively depend on space technology, communications and data relating to vital military installations. The purpose of space programs is to strengthen the international legal regime governing outer space activities, and help the developed and the developing nations in utilizing the benefits of space science and technology for their economic and social development.

In the light of the above debate this edited book presents some research insights into various benefits and advantages the space science and technology provides to the global community. It is hoped that this book will be found interesting and useful by research scholars, scientists, students, legal practitioners, policymakers, government organizations, non-government organizations, attorneys, and academicians.