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FOREWORD

THE EVOLVING EARTH – SPACE RELATIONSHIP IN SPACE LAW

Joanne Irene Gabrynowicz[*]

Since the last issue of the JOURNAL OF SPACE LAW, the world has experienced a number of devastating natural disasters; from Pakistan and India where they suffered a horrendous, tragic earthquake to the United States where four states experienced the wrath of hurricanes *Katrina* and *Rita*. Other, less well-known disasters included volcanic eruptions in Comoros and Salvador; flooding, heavy rains and/or landslides in Central America, the south of France, Romania, Senegal, and Switzerland.[1] Satellites played an important role in observing and responding to all of these. For Earth observations and the world, decades-long attempts to integrate Earth observations on a global scale were raised to a whole new, historic level. Earth observations history was made when, for the first time, the United States activated the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural

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[1] Disasters Charter, *Homepage, available* http://www.disasterscharter.org/ (last visited Jan. 18, 2006).

or Technological Disasters[2] in response to hurricane *Katrina*. The U.S. activation of the Disasters Charter benefited the U.S. and significantly advanced the Charter's evolution. By activating the Charter on its own behalf, the U.S. joins Austria, Canada, France, Germany, Italy, Russia, Sweden, Switzerland and other developed and/or space faring nations that have also activated it. Together, they have demonstrated that in the face of Nature's worst, well-organized assets create a whole that is greater than the sum of its parts, benefiting both developed and developing nations.

Appropriately, this issue of the JOURNAL OF SPACE LAW has a number of timely articles relevant to the recent natural disasters and Earth observation activities. Masami Onoda, an internationally recognized expert on Japanese remote sensing law and policy considers a particular type of international agreement and offers, "Satellite Earth Observation as 'Systematic Observation' in Multilateral Environmental Treaties". Two internationally-recognized experts on Brazilian remote sensing law and policy, José Monserrat Filho and Álvaro Fabrício dos Santos describe the Chinese-Brazilian Protocol on Distribution of Chinese-Brazilian Earth Resources Satellite (CBERS) Products and make available an English translation of the Protocol. Focusing on the concept of cooperation in international space law, Chukeat Noichim also addresses Earth observations as they relate to sustainability in his article, "International Cooperation for Sustainable Space Development". Ruwantissa Abeyratne both expands and narrows the consideration of the law of satellites in his article, "Satellite Distribution in Meteorological Forecasts for Air Navigation". Dr. Abeyratne expands the inquiry by addressing the law of both Earth observations satellites and communications satellites but he then narrows the analysis to the law's specific application to forecasts for air navigation.

Some of the many other aspects of space law are also well represented in this edition of the JOURNAL OF SPACE LAW. The

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[2] Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters, Oct. 20, 2000 [hereinafter the Disasters Charter], *at* http://www.disasterscharter.org/charter_e.html (last visited Jan. 18, 2006).

continuing issues raised by missile defense is addressed by Steven A. Mirmina in his article, "The Ballistic Missile Defense System and its Effects on the Outer Space Environment" while Glenn Harlan Reynolds looks to the possible future of space law in his commentary, "Space Law in its Second Half-Century". Stephen E. Doyle, an experienced space law practitioner, offers the students of space law pragmatic advice in his practice note, "Preparing Written Briefs for International Law Competitions: A Primer".

The volume contains information on some current space law activities including a meeting report by the Secretary of the International Institute of Space Law, Tanja Masson-Zwaan and a review of the book, *Making Space Happen: Private Space Ventures and the Visionaries Behind Them* by Paula Berinstein and reviewed by Diane Howard. Finally, a comprehensive space law bibliography complied by law students Keishunna Randall and Katrina Sandifer since the last issue of the JOURNAL OF SPACE LAW is provided. It contains the latest space law case developments, recent publications, law journal articles, comments and notes, books, agreements and United States' legislation.

CALL FOR PAPERS

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Volume 32, Issue 1

The National Remote Sensing and Space Law Center of the University of Mississippi School of Law is delighted to announce that it will publish Volume 32, Issue 1 of the *JOURNAL OF SPACE LAW* as a special issue dedicated to the legal aspects of The Vision for Space Exploration announced by the U.S. President on January 14, 2004. The Vision focuses on landing humans on the moon before the end of the next decade and paving the way for eventual journeys to Mars and beyond. Papers addressing all aspects of international and national space law are welcome.

Authors are invited to submit manuscripts, and accompanying abstracts, for review and possible publication in the *JOURNAL OF SPACE LAW*. Submission of manuscripts and abstracts via email is preferred. Please email manuscripts and accompanying abstracts in Microsoft Word or WordPerfect to jsl@olemiss.edu.

Or, alternatively, a hardcopy of the manuscript and abstract, along with a computer diskette containing them in Microsoft Word or WordPerfect format may be sent to:

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To be considered for the next issue, submissions should be received on or before May 1, 2006. The *JOURNAL OF SPACE LAW* will continue to accept and review submissions on an on-going basis.

SATELLITE DISTRIBUTION IN METEOROLOGICAL FORECASTS FOR AIR NAVIGATION

Ruwantissa Abeyratne[*]

I. INTRODUCTION

The information super-highway and rivers of communication created by modern technology and exponentially growing commercial activity are converging[1] quickly in an incipient century. We have reached an era when a cellular telephone has the facility to take photographs and transmit them to a computer screen which is thousands of miles away. The International Telecommunications Network (Internet), arguably one of the most intriguing corollaries to telecommunications advancement, has successfully amalgamated technology and commerce to provide the modern world with endless opportunities as well as disconcerting challenges.[2] The era of modern telecommunications has come of age and looks as though it will grow old gracefully and productively.

The exponential advancement of telecommunications technology, when translated into aeronautical language, involves fundamental but significant considerations. For there to be a sustainable and viable global air transport system, aircraft must be able to take off and land safely. When this basic need is viewed within the context of air transport, which, from a fledgling industry in 1945 which carried nine million people, has

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[*] Dr. Abeyratne, who is a senior official at the International Civil Aviation Organization, is a member of the Space Law Committee of the International Law Association. He has written this article in his personal capacity.

[1] "Convergence" is generally considered as the overlapping of communications conduit systems (transmission networks) and content (information, programming). *See* International Telecommunications Union, Regulatory Implications of Telecommunications, *The Changing Role of Government in an Era of Telecom Regulation*, at 8 (Geneva, Dec. 11-13, 1996).

[2] *See* Ram Jakhu, *Challenges in Regulating Satellite Telecommunications in the Early 21st Century*, 28 ANNALS OF AIR & SPACE L. 281-309 (2003) (detailing challenges in the field of satellite communications).

turned into a behemoth carrying an estimated 1.8 billion people when the year 2004 ended,[3] it becomes evident that the need to carry people and goods safely and quickly has never been more compelling. The increasing demand on finite resources such as land used for accommodating airports, coupled with the ever-increasing congestion in airspace, calls for more efficient use of the air space and land within the overall parameters of safety. Such optimal use will bring more constraints on aircraft operating in adverse weather conditions such as strong winds, cross winds and thunderstorms. These weather conditions bring to bear the compelling need to implement better and improved landing systems and more precision overall flying. In this perspective, satellite navigation systems have shown us the significant value of telecommunications for air navigation, particularly from a meteorological perspective.[4]

The objective of meteorological service for international air navigation is to contribute toward the safety, regularity and efficiency of international air navigation.[5] This objective is achieved by supplying users such as operators, flight crew members, air traffic service units, search and rescue units, airport management units and others concerned with necessary meteorological information.[6] The genesis of aviation meteorology goes back to the early 1930s when techniques introduced by the Norwegian school were making significant inroads into meteorological forecasting and assessment. This trend continued in the decade to follow when the *Radiosonde* was introduced as a weather sensing device in the basic upper-air network in Europe, the United States and other parts of the world, making

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[3] International Civil Aviation Organization (ICAO), Press Release, PIO 17/04, Decisions of the 35th ICAO Assembly High Point of 60th Anniversary Year, Year End Message from the President of the Council of the International Civil Aviation Organization. Dr. Kotaite remarks that today's air transport industry includes nearly 900 scheduled air carriers operating about 21,000 aircraft, in addition to some 22,000 business aircraft and many more owned by private pilots. *Id.*

[4] *See* Neil Gordon, *The Future Evolution of Aeronautical Meteorological Services*, 44 (4) WMO BULL. 328, 329 (1995).

[5] Convention on International Civil Aviation, Dec. 7, 1944, 15 UNTS 295, UKTS 8 [hereinafter Chicago Convention], Annex 3, Meteorological Service for International Air Navigation, Standard No. 2.1.1 [hereinafter Annex 3].

[6] Annex 3, *supra* note 5, at 2.1.2.

obsolete the more costly and limited aircraft sounding in use at the time.[7] The *Radiosonde* was particularly efficient in providing meteorological services around the world the capability to assist aircraft flying at higher altitudes through its capacity for routine upper air analysis. The numerical weather forecasts produced by the *Radiosonde* were a great improvement on the predictions of the earlier decade. In the 1950s the numerical weather predictions in broad-scale synoptic analysis and prediction of weather and upper winds were considered a further step in tropospheric meteorology. This trend was followed in April 1960 by the introduction of the first TIROS weather satellite, which was a seminal event providing a whole new dimension to the techniques of aeronautical meteorology. Many more proactive steps were taken in the years to follow, such as computer generated forecasting in pre-flight planning of winds and temperatures aloft. These were followed by such far reaching technology as Doppler weather radar systems, with capabilities of new readings every two minutes, which could scan the lower levels of the atmosphere for micro-bursts, precipitation intensity, wind shifts and gust fronts. They also enabled meteorologists to observe inner movements of storms, plot their probable paths and detect tornados and hail storms.

A. The Communications Satellite

Aeronautical meteorology has evolved significantly since its incipient days seven decades ago, to the era of the communications satellite. The communications satellite, being an active repeater, receives signals from an Earth station and amplifies such signals to enable them to be re-transmitted to one or more Earth stations. The communications equipment in the satellite is comprised of numerous transponders capable of amplifying radio signals in certain frequency bands. The key function of the satellite is amplification, since it is required to amplify weak signals from an Earth station (made weak during transmission up to the satellite) and retransmit it at a new higher power level

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[7] Charles H. Sprinkle & Gordon D. Cartwright, *A Historical Perspective of Aeronautical Meteorology,* 44 (4) WMO BULL. 325, 326 (1995).

to Earth. Since the signal from the satellite may also get weaker in transmission to Earth, the receiving Earth station must also have the capability of amplifying the signal being received from outer space through the satellite.[8]

There were several communications satellites put into use commencing in the early 1970s. In 1973, the ITU Plenipotentiary Conference addressed the matter of regulating communications through satellites for the first time. The steady evolution of regulation which followed resulted in the 1992 Geneva Convention which established that there should be proper and appropriate allocation of bands of the radio frequency spectrum and the allotment of radio frequencies assignments and orbital positions in the geostationary satellite orbit in order to avoid harmful interference between radio stations of different countries and that efforts should be coordinated in order to eliminate harmful interference between radio stations of different countries and to improve the use of the radio frequency spectrum and the GSO for radio communication services. ITU members have also undertaken use of radio frequencies and the GSO rationally, in order to preserve the finite resources they represent.

It is particularly significant that, in 1995, the United Nations, in an effort to safeguard the interests of the developing countries, recommended that when a developed country and a developing country have equal claims to access to the same orbital position, or neighboring positions, or when a country which has already had access and a country which has not yet had access have equal claims, preference would be given to the developing country or to the country which has not yet had access.

It is difficult to think of any technology that has had a more profound influence on human society in recent times than satellite technology. It has touched the economic, social, political and cultural lives of nations across the globe, making telecommunications the only sustainable link between earth and space, whilst ensuring that communications between the two and be-

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[8] GARY D. GORDON & WALTER L. MORGAN, PRINCIPLES OF COMMUNICATIONS SATELLITES 6-7 (John Wiley and Sons, eds., 1993).

tween any two areas on Earth are possible.[9] Telecommunications satellites[10] use radio frequencies for their transmission, especially in the geostationary equatorial orbit.[11] The geostationary orbit is the established standard for the function of most communications satellites. Presently, there are hundreds of satellites following each other in geostationary orbit. Therefore, it is indisputable that, being a most important resource of telecommunication, geosynchronous satellites must not be jeopardized by obstacles such as space debris, overcrowding of orbit and deliberate destruction. Geosynchronous satellites offer global coverage through communications links offered by a largely privatized industry.[12]

One of the beneficiaries of satellite communications is undoubtedly air navigation, primarily through the Satellite Distribution System (SADIS)[13] which provides information on forecasts of en-route meteorological conditions[14] in digital form ob-

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[9] *See* Richard E. Butler, *Satellite Communications: Regulatory Framework and Applications For Development*, 3 SPACE COMM. BROADCASTING 103, 108 (1985).

[10] Modern communications satellites receive, amplify, and retransmit information back to Earth, providing television, telefax, telephone, radio and digital data links around the world.

[11] Geosynchronous orbit occurs when the satellite orbits at the same speed as the earth spins, keeping the satellite in a fixed position above earth. In a geosynchronous orbit, the satellite motion, being synchronized with that of Earth, has the same 24 hour period as the Earth's rotation. Most communications satellites maintain the orbital inclination within a few tenths of a degree of the equator. This type of orbit enables uninterrupted communication links between ground stations. The Syncom 4 communications satellite, which was launched from the space shuttle Discovery, follows a geosynchronous orbit.

[12] Notable among the privatized entities is Intelsat Ltd., which, through its 25 geosynchronous satellites, offers global internet, video, corporate network and telephonic services to some 200 nations. *See* Jakhu, *supra* note 2, at 287. Deployment and operation of communications satellites on a commercial basis began with the founding of the Communications Satellite Corporation (COMSAT) in 1963. When the International Telecommunications Satellite Organization (INTELSAT) was formed in 1964, COMSAT became the U.S. member. INTELSAT is based in Washington, D.C. and owned by more than 120 nations.

[13] There is also the aeronautical public correspondence system, a relatively new communications system in air navigation providing communications facilities on board to passengers that enable them to access the internet, email and telephone services.

[14] The meteorological information to be provided comprises forecasts of global upper wind; upper air temperature; upper air humidity; direction, speed and height of maximum wind; tropopause height temperature; and significant weather phenomena. The word "tropopause" relates to the Troposphere, which is the lowest layer of the Earth's atmosphere and site of all weather on the Earth. The troposphere is bounded on the top

tained through satellites. SADIS offers a comprehensive, intensified and integrated worldwide uniform system of weather information derived from satellites as they affect air navigation.

Aviation weather hazards are a critical factor in aviation safety, and meteorological satellites prove to be an invaluable tool in making available imagery, in addition to digital information, that offers analysis and short-range prediction. These hazards range from fog and stratus, jet stream winds, clear air turbulence, mountain waves, volcanic ash plumes, dust and smoke, en-route icing and convective storms.[15] In order to make optimum use of satellite technology, air navigation systems have to be able to receive satellite imagery and other digital information. The first significant step toward this end was the establishment of the World Area Forecast System (WAFS). This ICAO[16] initiative, conceived in 1982,[17] was created with a view to providing both States and the air transport industry, particularly the airlines, with standardized, superior quality forecasts concerning meteorological facts required for pre flight planning. WAFS evolved to become an efficient provider of important weather forecasts including upper wind behavior and temperature forecasts, all of which were relayed to the airline operator in digital grid-point form.[18] The second significant initiative was

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by a layer of air called the tropopause, which separates the troposphere from the stratosphere and on the bottom by the surface of the Earth.

[15] For more information on weather hazards in air navigation, *see* Gary P. Ellrod, *Satellite Images Provide Valuable Information Supplement to the Aviation Meteorologist,* 55 (2) ICAO J. 6-10, 26 (2000).

[16] The International Civil Aviation Organization, with a current membership of 188 Contracting States, was created as the specialized agency of the United Nations responsible for the regulation of international civil aviation upon the signing by 52 signatory States to the Convention on International Civil Aviation. Chicago Convention, *supra* note 5. Article 43 of the Chicago Convention establishes ICAO and Article 44 sets out the objectives of the Organization as being the development of the principles and techniques of air navigation and fostering of the planning and development of international air transport. *Id.* at art. 43.

[17] WAFS was an ICAO system established by the Communication/Meteorology Divisional Meeting of ICAO (COM/MET/82) in Montreal in 1982.

[18] *See* Sava Cernava, *World Area Forecast System Is On Threshold Of Final Phase Of Implementation,* 50 (8) ICAO J. 4-5 (1995).

the ICAO Future Air Navigation System (FANS).[19] The goals of FANS were: the worldwide coverage of air navigation communications - including remote, off-shore and oceanic areas - from very low to very high altitudes; the achievement of digital data interchange between air and ground systems, permitting the full capabilities of both to be exploited; and, a navigation and approach service for those runways and other landing areas not required and to have precision aids such as micro wave landing systems (MLS).[20] The FANS programme was assisted by the International Maritime Satellite Organization (INMARSAT), which offered its satellite facilities for aircraft communications worldwide.[21] FANS evolved both technologically and politically to embrace a wider spectrum of aeronautical telecommunications and is now called Communication, Navigation, Surveillance/Air Traffic Management Systems (CNS/ATM).[22] Contrary to appearance, however, this is no mere acronymic achievement. CNS/ATM systems worked well with the currently used Instrument Landing System (ILS) and are even more effective with the futuristic Microwave Landing System (MLS) for aircraft. While consolidating a new system of satellite technology,

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[19] For a detailed account of FANS *see* Ruwantissa Abeyratne, *Legal and Economic Aspects of FANS, in* LEGAL AND REGULATORY ISSUES IN INTERNATIONAL AVIATION 103-24 (Ruwantissa Abeyratne, ed., Transnational Publishers, Inc. 1996).

[20] *The FANS Report,* AERONAUTICAL SATELLITE NEWS, Sept. 1988, at 4. The Microwave Landing System (MLS) is an integral part of Global Positioning Systems (GPS), which provides useful data on aircraft velocity. This facility is not available from the Instrument Landing System (ILS). Further, the linear accuracy of MLS is relatively constant over the approach path, as against the sometimes erratic feature of the ILS. *See FAA to Demonstrate GPS Landing Potential,* AVIATION WEEK AND SPACE TECHNOLOGY, May 10, 1993, at 33.

[21] An agreement of co-operation was signed by ICAO and INMARSAT on June 27, 1989, which, while recognising that ICAO has the exclusive competence to establish SARPS in the field of aeronautical communications and that INMARSAT has the technical competence to offer aeronautical mobile-satellite communication services in support of air traffic services, established close co-operation *inter alia* between the two organizations. The agreement entered in to force on October 20, 1989. The Secretariats of ICAO and INMARSAT have also signed a Memorandum of Understanding in March 1985 concerning co-operation in respect of safety of aircraft operations to and from ships and other marine vehicles and of aeronautical and maritime search and rescue (SAR) activities. *See* Memorandum of Understanding Between ICAO and INMARSAT, Mar. 1985, ICAO Agreement - Reg. No. 329, 16/1/86.

[22] *See* Ruwantissa Abeyratne, *State Liability for the Global Navigation Satellite System, in* AVIATION TRENDS IN THE NEW MILLENNIUM 313-16 (Ruwantissa Abeyratne ed., Ashgate 2000).

the systems extract communication data from satellites from a system called Global Navigation Satellite Systems (GNSS) where communications from a vertical distance of fifteen miles is made possible, giving an instant solution to both the fuel consumption problem of aircraft and the airport congestion problem.[23]

Another positive feature of the CNS/ATM system is its support for more flexible monitoring of aircraft. The required navigation performance capability (RNPC) which is an integral feature of CNS/ATM systems would, together with RADAR surveillance, offer more flexibility and security to aircraft in navigation.[24] CNS makes optimal use of satellite technology and the advantages it offers through reliable high-speed data link communications to minimize the dependance of aircraft on preceding technology, while ATM revolutionized air traffic management by obviating less sophisticated control techniques.[25] From a regulatory perspective, there is a provision in the Chicago Convention regularising the carriage on board of necessary satellite signal receiving equipment. Article 30 of the Convention provides that aircraft of each Contracting State may, in or over the territory of other Contracting States, carry radio transmitting apparatus provided a licence to install and operate such apparatus is issued by appropriate authorities of the State of registry[26] of the aircraft. It also provides that the use of radio

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[23] For a discussion on the airport congestion problem *see* Ruwantissa Abeyratne, *The Challenge of Airports and Planning Laws,* 23 (2) ENVTL. POL'Y & L. 79-86 (1993). *See also* Charles D. LaFond, *ICAO Looks To Space,* AIR TRANSPORT WORLD, Dec. 1991, at 96.

[24] *Global Plan for Communications, Navigation and Surveillance,* AVIONICS, Oct. 1988, at 9-12.

[25] John F. White, *Aeronautical Meteorology and the International Air Transport Association (IATA),* 44 (4) WMO BULL. 335-39 (1995).

[26] Article 17 of the Chicago Convention stipulates that aircraft have the nationality of the state in which they are registered. Chicago Convention, *supra* note 5, at art. 17. Article 18 qualifies that an aircraft cannot be validly registered in more than one State, but its registration may be changed from one State to another. *Id.* at art. 18. A more recent development, Article 83 *bis,* provides that notwithstanding the provisions of Article 30 *inter alia*, when an aircraft registered in a Contracting State is operated pursuant to an agreement for the lease, charter or interchange of the aircraft or similar arrangement by an operator who has his principal place of business or, if he has no such place of business, his permanent residence in another Contracting State, the State of registry may, by agreement with such other State, transfer to it all or part of its func-

transmitting apparatus in the territory of the Contracting State whose territory is flown over shall be in accordance with the regulations as prescribed by that State. Article 30 is followed by the provision that radio transmitting apparatus may be used only by members of the flight crew who are provided with a special license for the purpose, issued by the appropriate authorities of the State in which the aircraft is registered.

II. SATELLITE DISTRIBUTION SYSTEM FOR INFORMATION RELATING TO AIR NAVIGATION (SADIS)

There are three INTELSAT satellites providing services for air navigation purposes. Of the three satellite services, two are provided by the Washington system, called International Satellite Communications System (ISCS) provided by the United States, distributing WAFC Washington products over the Americas, the Pacific and Asia. WAFC also provides a satellite service out of London over Europe, most of Asia, Africa and the Indian Ocean region and Western Australia. It is called the Satellite Distribution System (SADIS), and it acts as a pre-flight meteorological planning tool and backs up ISCS and *vice versa*.[27] SADIS products are only passed on by WAFC London to users who have acquired authorised access from the relevant ICAO meteorological authority in the relevant ICAO Contracting State. SADIS provides relevant operational meteorological information (OPMET); high quality charts for international flights; user friendly and reliable receiving and display systems; timely information; expeditious transfer of data; information on global winds and temperatures; and reliable back up service.[28]

SADIS is an operational system dedicated primarily to aeronautical meteorological information in line with ICAO worldwide provisions. WAFS forecasts and OPMET information

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tions and duties as State of Registry in respect of that aircraft. In such an instance, the original State of registry will be relieved of responsibility in respect of the functions and duties so transferred.

[27] *See* John Charlesworh, *Satellite Distribution and Broadcast of World Area Forecast System Products: An ICAO Communication System*, 44 (4) WMO BULL. 351, 352 (1995).

[28] *Id.* at 352.

are disseminated without conflict or delay caused by the dissemination of non-operational data. As an ICAO system forming part of the AFS, it has been designed to meet the worldwide Standards and Recommended Practices (SARPS) promulgated in ICAO Annex 3 — *Meteorological Service for International Air Navigation* and Annex 10 — *Aeronautical Telecommunications*. The United Kingdom has been invited by ICAO to implement SADIS in accordance with ICAO specifications for the system. Contractual agreements exist between the United Kingdom Met Office and commercial service providers for the operation and maintenance of the SADIS service. As a consequence, WAFC London manages the day-to-day operational control of the system in direct contact with the commercial service providers. Also, WAFC London ensures that the data required by all users is delivered via SADIS in accordance with ICAO provisions. In addition, WAFC London liaises with the commercial service providers on matters related to the users' VSAT equipment and any problems experienced. This ensures full availability of the service and the largely error free transmission of all information required for pre-flight planning. WAFS GRIB[29] and BUFR[30] forecasts will be backed up, with WAFC London and WAFC Washington products being interchangeable.

SADIS provides a point to multi-point service on a 24-hour basis via satellite. Access to SADIS by an end-user will only be granted after authorization by each ICAO Contracting State concerned. The authorization will be based upon advice by the meteorological authority of the respective State as defined in Annex 3, Chapter 1, and Chapter 2, paragraph 2.1.4 and will be communicated to ICAO and also to the United Kingdom Met Office by the authorizing State itself. It is incumbent upon user States to arrange access to the satellite broadcasts for the reception of WAFS products and OPMET data, and to arrange for their national distribution, in line with the provisions of Annex

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[29] Digital Grid Point (GRIB) is a system which displays wind and temperature information generated from data. *See* ICAO SADIS Operations Group, *SADIS User Guide*, app. I (Data Processing Systems) (3rd ed., June 2004), *available at* http://www.icao.int/anb/sadisopsg/sug/ (last visited Nov. 15, 2005).

[30] Binary Universal Form for the Representation of meteorological data.

3, Section 2.1. In order for the authorities in the individual States to retain control over the national distribution, it is necessary to identify those users who are authorized to receive the SADIS broadcast directly.[31]

A mechanism for the recovery of the costs incurred by the SADIS Provider State has been developed.[32] The SADIS cost allocation and recovery scheme is based on mandatory participation by the SADIS user States and is administered by the SADIS Cost Recovery Administrative Group (SCRAG). States included in the United Nations list of Least Developed Countries (LDC) are exempt from the cost recovery scheme. The participating States will contribute towards the scheme in proportion to the number of IFR flights in their airspace and recover these contributions from the airspace users through en-route charges.

A. Legal and Regulatory Aspects

The umbrella of meteorological information provided *via* satellite, The World Area Forecast System (WAFS) whose products SADIS distributes, came into being with the ICAO Communications/Meteorology (COM/MET) Divisional meeting held concurrently with the Seventh Session of the WMO Commission for Aeronautical Meteorology (CAeM) in Montreal in 1982. The legal regime applicable to WAFS starts with the fundamental premise that outer space is the common heritage of mankind and that no State or individual can therefore claim *rights in rem* to any portion of outer space. This essentially means that space law is solely grounded on legal principles binding on the community of nations. Principles of public international law therefore play an exclusive part in the application of space law principles. The fundamental postulate of space law lies in the "common interest" principle which emerged as a result of the first specific Resolution on space law of the United Nations

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[31] *SADIS User Guide*, *supra* note 29, at 1-2.

[32] A discussion on the SADIS Cost Recovery Mechanism will follow.

General Assembly in 1958.[33] The "common interest" principle has since been incorporated in subsequent multilateral treaties, particularly the *Outer Space Treaty* of 1967, Article 1(1) which provides that "the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind".[34] At the 95th Plenary Meeting of its 41st Session, the United Nations General Assembly adopted Resolution A/RES/41/65, basing itself on the report of the Committee on Peaceful Uses of Outer Space (UNCOPUOS) resulting from its twenty ninth session.[35] The Resolution asserts that "[r]emote sensing activities shall be carried out for the benefit and in the interest of all countries, irrespective of the degree of their economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries".[36] Principle XI of the Resolution provides that "remote sensing shall promote the protection of mankind from natural disasters. To this end, States participating in remote sensing activities that have identified processed data and analysed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, are required to transmit such data and information to States concerned as promptly as possible."[37] From an aeronautical perspective, this resolution provides for the quick dissemination of information to States' authorities on such occurrences as the eruption of volcanoes resulting in volcanic ash hazards for aircraft, and serves as an effective global tool of communication. When tied in with Principle III of the Resolution, which provides that "remote sensing activities shall

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[33] UN. Questions on the Peaceful Use of Outer Space, G.A. Res. 1348, U.N. GAOR, 13th Sess., 792d plen. mtg., U.N. Doc. A/RES/1348 (1958).

[34] 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, 610 U.N.S.T. 205 (entered into force Oct. 10, 1967) [hereinafter the Outer Space Treaty].

[35] Principles Relating to Remote Sensing of the Earth from Outer Space, Dec. 3, 1986, G.A. Res. No 41/65, U.N. Doc. A/Res/41/65 (1986) [hereinafter UN Remote Sensing Principles].

[36] *Id.* at Principle II.

[37] *Id.* at Principle XI.

be conducted in accordance with international law, including the United Nations Charter" and other outer space treaties, "including the relevant instruments of the International Telecommunications Union,"[38] Principle XI assumes legal legitimacy and enforceability within the spectrum of public international law.

The role of the International Telecommunications Union (ITU) was significantly expanded by its assumed responsibility for radio requirements of satellite communications and networks. ITU recognized the need to ascribe radio frequencies for space purposes even before *Sputniks* 1 and 2, which were launched in October and November 1957, caused interference to ground based services. Although only limited measures were adopted to correct these technical faults by the Geneva Plenipotentiary Conference of ITU and the Administrative Radio Conference held just prior to it, a general revision of the Radio Regulations was made by ITU in 1979. In 1988, WARC-ORB-88[39] modified provisions regarding notification and coordination of the geosynchronous satellite system, which were calculated to obviate communication lapses between satellites and ground stations.

The World Meteorological Organization (WMO) is continuing to pay attention to the use of Earth satellites for meteorological observation. A report submitted by a Panel of Experts in March 1960 to the Executive Committee of WMO on the Atmosphere and Atmospheric Phenomena by means of Artificial Satellites recommended that WMO focus on the advantages of the use of meteorological data obtained through communications satellites. An earlier report had made the same suggestion, adding that WMO be actively involved in the promotion of the use of meteorological satellite data with a view to further facilitating the rapid dissemination of such data to the meteorological services and contribute to the use of data in meteorological diagnosis and prognosis.[40]

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[38] *Id.*

[39] ITU, Final Acts adopted by the Second Session of the World Administrative Radio Conference on the Use of the Geo-Stationary Satellite Orbit and the Planning of the Space Services Utilizing It (ORB-88) (1988).

[40] WMO EC - XII/Doc.29 (March 31, 1959), at 10.

The most fundamental legal issue that emerges from the "common heritage of mankind" principle in the context of communication satellites is sovereignty.[41] There is a dichotomy which brings to bear two opposing principles. While the Outer Space Treaty of 1967 guarantees the freedom to use outer space, it also admits the fact that such use will be for the benefit of all humankind. Practically, not every State is able to use outer space, leaving the more developed space faring nations to use outer space exclusively. This led to some anxiety on the part of developing nations who, in the past, were concerned that developed nations would occupy the best satellite positions to the exclusion of the former.[42] The ITU resolved this issue in sessions held between 1985 and 1988 in which every State was allocated a position within a particular slot on the geostationary orbit with radio frequencies allocated accordingly, regardless of whether such States were able to put a satellite into that position or not. However, this benefit was not accorded to international telecommunications satellite organizations which were required to act through ITU members in their communications activities.[43]

With regard to liability of the signal provider, responsibility of States for the provision of air navigation services in their territories is founded on principles contained in Article 28 of the Chicago Convention of 1944.[44] It must be noted that this is not

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[41] The principle of State sovereignty in airspace is embodied in Article 1 of the Chicago Convention which recognizes that every State has sovereignty over the air space above its territory, the latter being defined in Article 2 as land situated within and water adjacent to the State concerned. Chicago Convention, *supra* note 5, at arts. 1-2. As for rights over airspace over the high seas, Article 87 of the United Nations Convention on the Law of the Sea of 1982 awards freedom for the aircraft of all States to fly over the high seas. United Nations Convention on the Law of the Sea, opened for signature Dec. 10, 1982, art. 87, 1833 U.N.T.S. 397, 400 (entered into force Nov. 16, 1994).

[42] The earliest major expression of discontent among developing nations was the Declaration of Bogotá in 1976 where eight of the equatorial States claimed what amounted to sovereign rights over those parts of the geostationary orbit that lay above their territories. *See* Declaration of the First Meeting of Equatorial Countries, Dec. 3, 1976, reprinted in 2 MANUAL ON SPACE LAW 382-87 (Nandasiri Jasentuliyana & R. Lee eds., 1979) [hereinafter Bogotá Declaration].

[43] MILTON L. SMITH, INTERNATIONAL REGULATION OF SATELLITE COMMUNICATIONS 78 (McGraw 1990).

[44] Article 28 provides, *inter alia*, that Each Contracting States undertakes, so far as is practicable, to provide, in its territory, airports, radio services, meteorological services

an absolute obligation as the State is called upon to provide such services only in so far as it finds practicable to do so. In order to cover the possibility of a State not being able to provide adequate air navigation services, the Convention imposes an overall obligation on the Council of ICAO in Article 69 to the effect that the Council shall consult with a State which is not in a position to provide reasonably adequate air navigation services for the safe, regular, efficient and economical operations of aircraft. Such consultations will be with a view to finding means by which the situation may be remedied. Article 70 of the Chicago Convention even allows for a State to conclude an arrangement with the Council regarding the financing of air navigation facilities and the Council is given the option in Article 71 of agreeing to provide, man, maintain and administer such services at the request of a State. The ICAO Legal Committee, at its 27th Session in April 1992, had agreed that arrangements for satellite communications and surveillance should provide for the safety, availability and continuity of the provision of the required services and facilities at reasonable and stable prices and that pricing of services should not compromise safety.[45] The Committee also agreed that CNS/ATM systems should provide for: appropriate arrangements to be made for the establishment of liabilities; the capability of States to control all air operations within the airspace for which they are responsible; opportunity to be given to responsible air traffic services authorities for a designated control area to exercise control over information exchanges relating to air traffic in the area; participation of States and other users in planning services; accessibility of services to all users without discrimination; and, equitable attribution and distribution of costs of joint arrangements among participating States and users.[46]

Article VII of the Outer Space Treaty establishes liability of a State in pecuniary terms for damage caused by that State's

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and other air navigation facilities to facilitate international air navigation and to adopt and put into operation appropriate standard systems of communications procedure, codes, markings, signals, lighting and other operational practices and rules. Chicago Convention, *supra* note 5, at art. 28.

[45] LC/27-WP/7 (Feb. 27, 1990), at 2.

[46] *Id.*

activities in outer space.[47] It must be noted that Article VI of the Treaty makes it absolutely clear that there is a distinction in terms of liability between a State and its subjects. This is somewhat different from the usual practice of international law where, in instances in which individuals in authority negligently misuse such authority, the international community may proceed with attaching reprehensibility both to the individual as well as to the State concerned. Traditionally, at public international law, the law relating to international responsibility need not necessarily be bifurcated into individual and State responsibility in all circumstances. However, within national parameters, although a State which provides air navigation services under Article 28 of the Chicago Convention will be ultimately responsible, the international community might not be precluded from attaching responsibility to an agent of a State providing such services if deliberate intent or gross negligence can be attributed or imputed to such person.

Notwithstanding established principles of space law, the delicate issue of signals generated in outer space where activity is carried out for the benefit of all humankind, and used terrestrially within the airspace of countries, makes it particularly susceptible to consideration in an entirely different perspective from the usual principles of State responsibility. While satellite signal providers are deemed to provide the service gratuitously, thus making their intent seemingly impeccable, most States which use such services within their territories to assist aircraft navigation are doing so as far as practicable and only insofar as their knowledge and expertise permit them to comprehend the sophisticated and esoteric technology behind satellite communications. Therefore, within such a spectrum of activity the notion of State responsibility might inevitably be perceived in a

[47] This provision takes after a 1962 United Nations Resolution which provided that each State which launches or procures the launching of an object into outer space, and each State from whose territory or facility an object is launched, is internationally liable for damage to a foreign State or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space. G.A. Res. 1962 (XVIII), U.N. GAOR, 18th Sess., Supp. No. 15, U.N. Doc. A/5515 (1963).

different light, where both providers and users are moving toward a common goal of ensuring aviation safety.[48]

The ICAO Assembly, at its 29th Session, adopted Resolution A29-11 which recognized that the exploration and use of outer space for peaceful purposes "is of great interest to international civil aviation and affects matters falling within the Organization's competence under the terms of the Chicago Convention."[49] The Resolution further recognized that ICAO was responsible for developing the position of international civil aviation on all matters related to the study of questions involving the use of space technology for air navigation purposes, including the determination of international civil aviation's requirements in respect of the application of space technology. At the 35th Session of its Assembly, held in Montreal in September/October 2004, ICAO adopted Resolution A35-7, which recognized the primary objective of the Organization as well as that of Contracting States as being to ensure the safety of international civil aviation worldwide.[50] The Resolution pointed to the fact that, in accordance with Article 37 of the Convention on International Civil Aviation, each Contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulation, standards, procedures and organization in relation to aircraft, personnel, airports, airways and auxiliary services in all matters in which uniformity will facilitate and improve air navigation, adding that the improvement of the safety of international civil aviation on a worldwide basis requires the active collaboration of all stakeholders.

Resolution A35-7 urges all Contracting States to share with other Contracting States critical safety information which may have an impact on the safety of international air navigation and to facilitate access to all relevant safety information and encourages Contracting States to make full use of available safety

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[48] *See* Ruwantissa Abeyratne, *Vulnerability of International Air Transport Relying on the Global Positioning System: Liability Issues*, 9 (5) COMM. L. 164, 168 (2004).

[49] The Resolution also noted that the principles for the participation by ICAO in programmes for the exploration and use of outer space had been established at the 15th, 16th and 22nd sessions of the Assembly. ICAO Res. A29-11 (1992).

[50] ICAO Res. A35-7 (2004).

information when performing their safety oversight functions, including during inspections as provided for in Article 16[51] of the Convention.[52] It also directs the Council of ICAO to further develop practical means to facilitate the sharing of such safety information among Contracting States and offers a reminder of the need for surveillance of all aircraft operations, including foreign aircraft within their territory and to take appropriate action when necessary to preserve safety. One of the salient features of the resolution is its emphasis on the need for States to cooperate with each other both globally and regionally in promoting the safety of aviation and its request of the Council to implement a unified strategy based on the principles of increased transparency, cooperation and assistance, while fostering, where appropriate, partnership among States, users, air navigation service providers, industry, financial institutions and other stake holders.

The 35th Session of the ICAO Assembly also adopted Resolution A35-15, by which participating States recognized that ICAO is the only international organization in a position to effectively coordinate global CNS/ATM activities and that the ICAO CNS/ATM systems should be utilized to serve the interests and the objectives of civil aviation throughout the world.[53] The Resolution also recognized that Contracting States should have equal rights to benefit from global systems incorporated within the ICAO CNS/ATM systems. Referring to a statement of ICAO Policy on CNS/ATM Systems Implementation and Operation developed and adopted by the ICAO Council on March 9, 1994, the Assembly resolved that nothing should deprive a Contracting State from its right to benefit from the ICAO CNS/ATM systems or cause discrimination between provider and user States. Furthermore, the Assembly stated that States' sovereignty and borders should not be affected by the ICAO CNS/ATM systems implementation. The Resolution urged that

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[51] Article 16 provides that the appropriate authorities of each Contracting State shall have the right, without unreasonable delay, to search aircraft of other contracting States on landing or departure, and to inspect the certificates and other documents prescribed by the Chicago Convention.

[52] ICAO Resolution A35-7, *supra* note 50.

[53] ICAO Resolution A35-15 (2004).

provisions and guidance material relating to all aspects of the ICAO CNS/ATM systems should be sought and developed through the convening of adequate meetings, conferences, panels and workshops with the participation of Contracting States. It called upon Contracting States, the Planning and Implementation Regional Groups (PIRGs) and the aviation industry to use the ICAO Global ATM Operational Concept as the common framework to guide planning and implementation of CNS/ATM systems and to focus all such development work on the Global ATM Operational Concept, while urging the Council to ensure that ICAO develop the transition strategies, ATM requirements and SARPs necessary to support the implementation of a global ATM system and to continue considering without delay the economic, institutional, legal and strategic aspects related to the implementation of the ICAO CNS/ATM systems.

B. Economic Issues

On March 6, 2000, the Council of ICAO decided that, effective January 1, 2001, all States receiving the service provided by the Satellite distribution system for information relating to air navigation (SADIS) shall participate in the SADIS Cost Allocation and Recovery (SCAR) arrangement, thereby rendering null and void the already existing mechanism implemented through the *Agreement on the Voluntary Sharing of Costs of the Satellite Distribution System for Information relating to Air Navigation* as of that date. The new arrangement was given effect through the Agreement on the Sharing of Costs of the Satellite Distribution System for Information relating to Air Navigation (SADIS Agreement)[54] which provided *in limine* that the United Kingdom, as the provider State, shall provide, operate and maintain the SADIS and do so in conformity with all

[54] The objective of this Agreement is for the Parties to establish and administer a mechanism to share in an equitable and fair manner the costs of providing, operating and maintaining the SADIS as approved by the Council, the services of which are described in Annex I to the Agreement. The Agreement, and its Annexes which form an integral part thereof, entered into force on January 1, 2001. Agreement on the Sharing of Costs of the Satellite Distribution System for Information relating to Air Navigation, Jan. 1, 2001, *available at* www.icao.int/icao/en/atb/jf/scrag/agreement.pdf [hereinafter SADIS Agreement].

relevant ICAO standards and recommended practices and in accordance with relevant recommendations and decisions approved by the ICAO Council or other authorized ICAO body. Each Party receiving the SADIS service, including the United Kingdom, but excluding the Parties referred to under Article IV, is required to pay its share of the costs of providing, operating and maintaining the SADIS as attributable to it in accordance with Article XI.[55] The Agreement also provides that any Party receiving the SADIS service and which falls within the group of States defined by the United Nations as "least developed countries (LDCs)" shall, unless it chooses not to, be exempt from paying its share of the respective costs as long as it remains in that situation.

Article VI of the SADIS Agreement exempts parties to the Agreement from liability for any damages or losses, physical or financial, inflicted as the consequence of failures and/or omissions in the provision, operation and maintenance of the SADIS. Article IX provides that the costs to be shared among the Parties shall be the full costs to the United Kingdom of employing fully or in part the facilities and personnel listed in Annex II to the Agreement for the purpose of providing, operating and maintaining the SADIS, including depreciation of assets and cost of capital and an appropriate amount for administration.

The SCAR arrangement is administered by a group, the *SADIS Cost Recovery Administrative Group* (SCRAG), which assesses the annual cost-share attributable to each Party, including reassessments arising from new Parties adhering to the Agreement, and audits the costs of the SADIS provision and any related financial activities, including those incurred by the provider State and subject to cost sharing. The SCRAG is composed of one Party from the European Region nominated by the European Air Navigation Planning Group (EANPG), one Party from the AFI Region nominated by the AFI Planning and Implementation Regional Group (APIRG), one Party from the MID Region nominated by the MID Air Navigation Planning and Implementation Regional Group (MIDANPIRG) and one Party from the

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[55] *Id.* at art. III (2).

Asia Region nominated by the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG). An additional member has been nominated by the planning and implementation regional group for the region wherein Parties are located which in the aggregate are responsible for more than fifty per cent of the total current assessments. The representative from the Party so nominated shall be chairman of the SCRAG. If none of the regions includes Parties which in the aggregate are responsible for more than fifty per cent of the total current assessments, SCRAG shall elect its chairman from among its members. Only those Parties which participate in the SCAR arrangement are eligible to serve on the SCRAG. The United Kingdom, in its capacity as the SADIS provider State, participates in the SCRAG as an observer. Furthermore, the International Air Transport Association (IATA), as a representative of user interests, is invited to participate as an observer. The Chairman of the SADIS Operations Group (SADISOPSG) is invited to participate as an observer as needed to provide information on the technical efficacy of the SADIS services provided and on the inventory of the facilities and services falling under the SCAR arrangement. Each member Party of the SCRAG has one vote, and when voting is required, decisions by the Group are reached by simple majority; however, when the votes are equally divided, the Chairman's vote prevails.

The costs to be shared among the Parties are the full costs to the United Kingdom of employing fully or in part the facilities and personnel listed in Annex II to the Agreement for the purpose of providing, operating and maintaining the SADIS, including depreciation of assets and cost of capital and an appropriate amount for administration. Each Party as encompassed by Article III, paragraph 2, is assessed a share of the total costs of the SADIS arrangement in proportion to the total number of available tonne-kilometres (ATKs) in scheduled services (international and domestic) performed by air carriers based in the territory of the State of that Party. The share of each Party is calculated from the total number of ATKs performed by all air carriers based in the territory of the State of that Party as a percentage of the total number of such ATKs performed by all air carriers of all the Parties participating in

the arrangement. The total shared costs include the costs attributable to the Parties exempted from paying.

On or before November 1st of each year, the Secretary General of ICAO furnishes the SCRAG with the total number of ATKs performed in scheduled services (international and domestic) in the preceding calendar year by air carriers of each party based in the territory of the State of that Party. For example, the assessments for year *n* are calculated on the basis of the cost estimates for that year as approved by the SCRAG and ATKs as provided with regard to each Party by the Secretary General for year *n-2*. The cost basis for the assessments in year *n*, however, are first adjusted upwards or downwards as the case may be by the amount by which the total estimated costs for year *n-2* were below or above the approved actual costs for that year. Likewise the assessment of each Party is adjusted to take into account any difference between the amounts paid by it under this Agreement as advances for year *n-2* and its share as determined on the basis of actual ATKs and approved actual costs in year *n-2*. Any under-recovery of costs for year *n* arising from the failure of a Party to pay the SADIS cost share attributable to it for that year is added to the total SADIS costs to be shared for year *n+2*. Any subsequent remittance by the Party concerned to offset the consequential debt is deducted from the total costs to be shared for the year following that in which the remittance was received.

Article XII of the Agreement provides that the SCRAG communicates to the United Kingdom as the SADIS provider State on or before December 1st of each year the approved estimated assessments for each Party adjusted as provided for in Article XI and authorize their collection by the United Kingdom, which thereupon may proceed to issue the invoices to each Party for its respective assessment as adjusted. Failure by a Party receiving the SADIS service to pay its share of the costs of providing the service (other than a Party exempted in accordance with Article IV) would lead to the service to that Party being withdrawn at the end of the calendar year in which payment was due. The service is not re-instated until the Party concerned fully settles its debt. It is the prerogative of each Party to decide whether or not to recover the assessment it has paid under

the Agreement from users (aircraft operators). Such cost recovery by a Party should, however, in so far as it applies to international civil aviation, be in conformity with the principles and practices set out in the Chicago Convention and *ICAO's Policies on Charges for Airports and Air Navigation Services.*[56]

Any dispute relating to the interpretation or application of the Agreement which is not settled by negotiation between the Parties involved, could be referred to the Council of ICAO for its recommendation upon request of any of these Parties. The Agreement is open to accession by the civil aviation administration or other such designated entity of any State being served by the SADIS. Accession is effected by notice in writing to that effect given to the Secretary General of ICAO by the head of the civil aviation administration or other such designated entity in the State concerned. Any Party may withdraw from participation in the Agreement on December 31st in any year by notice in writing to that effect given to the Secretary General not later than January 1st of that year by the Party concerned. The Agreement may be terminated by the United Kingdom as the SADIS provider State on December 31st in any year by notice in writing given to the Secretary General not later than January 1st of that year.[57]

III. CONCLUSION

Pre-flight planning is the most vital and critical stage of the journey by air. In the planning process, weather data is the most valued information relating to the safety of the flight, along with the technical soundness of the aircraft. Meteorological forecasts made with the aid of satellite technology project a good example of the interaction between aviation and space technology, particularly in the exchange of technological and

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[56] ICAO Assembly Doc. 9082/6, ICAO's Policies on Charges for Airports and Air Navigation Services (6th ed. 2001).

[57] Article XIX (b) provides that if at any time it proves impossible for the United Kingdom to perform the services within the limit determined pursuant to the provisions of Article X, the United Kingdom shall immediately notify the Secretary General in writing of such fact and shall furnish to the SCRAG through the Secretary General a detailed estimate of the additional amount required. SADIS Agreement, *supra* note 54, at art. XIX (b).

economic resources. It is noteworthy that, originally, the exploration of outer space was undertaken for military and scientific purposes. Therefore, the sole protagonists in this exercise were States, such as the United States and the Union of Soviet Socialist Republics (now the Russian Federation) and some international Organizations. Prominent among the latter was the United Nations Office for Outer Space Affairs which was responsible for the work of the Committee on Peaceful Uses of Outer Space (UNCOPUOS). As was discussed earlier, the exploration of outer space was undertaken within a stringent regulatory umbrella, and it was carried out under the firm principle established by the Outer Space Treaty of 1967; that the exploration and use of outer space shall be the province of all humankind. However, the current trend in space activities clearly shows a significant detour toward commercial activities, as a consequence of which actors other than the traditional States and international Organizations have entered the arena. This commercial activity is predominantly seen in satellite communications and in satellite remote sensing.

Although the realigned focus on commercial activities in outer space by no means implies that such commercial activities could be carried out outside the general principle laid out in the Outer Space Treaty, a growing number of private or hybrid actors have entered the commercial arena of outer space activities making it necessary to inquire into the rights of a State, which does not engage in outer space activities either at State level or at the level of private enterprise, whose physical resources may nonetheless be vulnerable to satellite remote sensing and satellite communications. First, every State must accept that Earth observation data, obtained through remote sensing, and communications exchanged via satellite are essential tools for sustainable development and its management. Second, observation of the Earth from outer space can be a useful tool in providing solutions to the complex web of environmental and geophysical problems confronting the globe. In this context, the most practical, and efficient tool that a State might gain from commercial activities in outer space is the use of satellite imagery as harbingers of natural disasters and bad weather.

CHINESE-BRAZILIAN PROTOCOL ON DISTRIBUTION OF *CBERS* PRODUCTS

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Álvaro Fabrício dos Santos[**]

The Complementary Protocol to the Framework Agreement Between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Application of Outer Space Science And Technology on the Cooperation for the *CBERS* Application System[1] was signed on November 12, 2004, during the visit of the President of China to Brazil. It marks a great change. Both countries become suppliers of remote sensing data instead of only users. It is supplemented by the annexed text on *CBERS* Data Policy and regulates the distribution of the Chinese-Brazilian Earth Resources Satellite (*CBERS*) imagery between them and to third parties.

The regulation applies to the data from *CBERS-2*, which was launched on October 21, 2003, and from *CBERS-2B*, *CBERS-3* and *CBERS-4*[2], which are scheduled to be launched in 2006, 2008 and 2010, respectively.

The *CBERS* Program began in 1986 and its first Protocol was signed by both Governments in 1988, in Beijing. It was also the first agreement signed by two developing countries on high space technology cooperation. Brazil and China confronted and overcame many difficulties to accomplish their goals. That is

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[1] The Complementary Protocol to the Framework Agreement Between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Application of Outer Space Science and Technology on the Cooperation for the CBERS Application System, Nov. 12, 2004 [hereinafter Protocol] (on file with authors).

[2] It has been agreed that the *CBERS-4* will be launched from the Brazilian Alcantara Launch Center if the necessary conditions to do so exist at that time.

why its first result took eleven years to happen when the experimental *CBERS-1* was launched on October 14, 1999, from the Chinese base in Taiyuan. Both countries have invested US$ 300 million in *CBERS-1* and *2*: US$ 182 million by China and US$ 118 million by Brazil. *CBERS 2B* will cost US$ 34 million for China and US$ 15 million for Brazil.[3]

The current Protocol is a result of the Memorandum of Understanding signed on May 24, 2004. It extends the scope of the *CBERS* Program to establish criteria for commercializing *CBERS* data. The Chinese National Space Administration (CNSA) and the Brazilian Space Agency (BSA) were designated to implement the agreement.

The Protocol establishes the requirements for tasks, functions, and specifications of the application system's infrastructure; consolidates the technical organization of the application system's infrastructure; and defines a plan for developing and producing an application system that shall privilege Chinese and Brazilian companies. It also creates a cooperation program to develop software for the reception and processing system for *CBERS* data for use by other countries.

The Protocol develops and improves software for *CBERS* data application and for generating products for end users; provides for meetings for exchanging experiences regarding *CBERS* data; and promotes technical exchange of *CBERS* data among users from China, Brazil, and other countries. It also establishes and implements criteria and patterns for evaluating *CBERS* products; and, promotes and summarizes discussions of feedback from users in order to improve *CBERS* sensors and then propose new onboard sensor technical requirements.

In accordance with the Protocol, disputes and doubts regarding its terms will be resolved through mutual consultations between both countries. The questions related to intellectual property will be established in specific agreements which will take into account the national legislation of both parties and international rules accepted by them. The Protocol will remain

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[3] Earth Observation General Coordination Division of INPE (Coordenação-Geral de Observação da Terra) (research on file with authors).

valid for five years and will be renewed automatically for successive periods, unless one party notifies the other six months in advance that it wishes to terminate the agreement.

The *CBERS* Data Policy, which is annexed to the Protocol, establishes the policy for commercializing *CBERS* data and includes provisions for receiving, processing, and disseminating *CBERS* images to countries other than Brazil and China. Accordingly, *CBERS* images will be made available to any country or organization through a network of licensed representatives operating an application system that can receive and process the *CBERS* data.

International ground stations will not have access to the onboard data recorder (OBDR), which will be operated exclusively by the China Center for Resources Satellite Data and Applications (CRESDA) and the Brazilian National Institute for Space Research (INPE). Each ground station will receive raw data only for specific regions as determined by contract and will then process it into image products, which will then be distributed to users. The licensing of *CBERS* data downlinks will be based on fees which are charged on a per-minute basis. Distribution of *CBERS* images to third parties will be done solely on the basis of the international price list, as agreed to by China and Brazil. China and Brazil may, in special cases, upon mutual consultations, decide on the transfer of data free of charge. Mozambique, Angola and some other African countries will be benefited by this exception, receiving data free of charge from Brazil.

Brazil provides 30% of the *CBERS* budget. Nonetheless, it will receive the same revenues as China from the distribution of *CBERS* data. Moreover, ground stations operated by INPE[4] and by CRESDA[5] will have unlimited access to all data collected within their footprint.

There are guidelines that regulate the use of the OBDR. The number of hours available each month for use of the OBDR

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[4] Instituto Nacional de Pesquisas Espaciais, *at* www.inpe.br (last visited Jan. 9, 2006).

[5] China Center for Resource Satellite Data and Applications, *at* www.cresda.com.cn/ (last visited Jan. 9, 2006).

will be established periodically by the engineering teams of *CBERS*. INPE and CRESDA will equally share the available time, for example, 50% to CRESDA and 50% to INPE, on a non-cumulative basis, so unused hours in a month cannot be accumulated for subsequent periods; images stored in the OBDR will be downloaded at the Brazilian and Chinese ground stations. Data downlinks to ground stations will have priority over the use of OBDR, except in the case of emergency situations, as determined by INPE and CRESDA.

The interface between a satellite and a ground station is regarded as the intellectual property of INPE and CRESDA and will not be disclosed to third parties unless agreed to in writing by both parties. INPE and CRESDA will encourage Brazilian and Chinese companies to act as suppliers of components and equipment for *CBERS* application system infrastructure.

As for Chinese and Brazilian ground stations, each party is free to decide on its own development strategy that will preferably be carried out only by national companies. The parties agree that any component of the ground station that cannot be built by its national industry will first be requested from the other partner, before any contracts are placed in the international market.

The document also deals with the licensing policy for international ground stations. The licensed representative will commercialize *CBERS* data downloaded to ground stations based on an annual fixed fee, to be determined by INPE and CRESDA. The annual fee will be determined by the conditions of the ground stations, including geographical location and tracking system footprint. The licensed representatives shall hold annual meetings with their customers and promote the diffusion of any news and decisions regarding *CBERS*.

The document adopts as well terms and conditions for commercial agreements between licensed representatives and *CBERS* data distributors. The images sold within the distributor's national market may not be exported abroad.

Brazil is developing a rich experience regarding satellite data satellite as a public good. *CBERS-2* images have been distributed freely within the country. Since June 2004 to November 2005 more than 150,000 images were distributed in the

Brazilian territory to more than 14,000 users – more than 2,000 institutions. Among these institutions only 5 took 2% of the images and 25 took between 2% and 0.5%; the average of requests for *CBERS* data is about 800 per week; over 2,100 images are downloaded per week; each user takes 10.5 images. 22.9% of the demand for *CBERS* images is from government; 25.9% from educational and research institutions; and 51.2% from the private sector, including companies and individuals.[6]

Thus, Brazil has largely been disseminating the culture of utilization of remote sensing data in a wide variety of different forms, creating a wide and equitable internal market for its products. It used to purchase 20,000 images from *Spot-5* and 12,000 from *Landsat*, and distribute 1,000 *Landsat* images each year.[7] The free distribution data policy will last at least two years.

The *CBERS* Program has become a long term cooperative system. *CBERS-5, 6, 7* and perhaps more can be expected. Brazil and China have signed 15 bilateral agreements, protocols and minutes of understanding since 1982. They consider their collaborative efforts as "strategic partnership".

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[6] Earth Observation General Coordination Division of INPE, *supra* note 3.

[7] *Id.*

COMPLEMENTARY PROTOCOL TO THE FRAMEWORK AGREEMENT BETWEEN THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF CHINA AND THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL ON COOPERATION IN THE PEACEFUL APPLICATION OF OUTER SPACE SCIENCE AND TECHNOLOGY ON THE COOPERATION FOR THE *CBERS* APPLICATION SYSTEM

The Government of the People's Republic of China, and The Government of the Federative Republic of Brazil (hereinafter referred to as "The Parties"), For the purpose of further strengthening the cooperation in the field of peaceful use of space technology between the Parties;

In order to further promote the role of space technology in the social, economic and cultural development of the two countries;

Recalling the terms of the Framework Agreement between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Applications of Outer Space Science and Technology, signed in Beijing, on November 8th, 1994;

Recalling the terms of the Protocol on Cooperation in Space Technology between the Government of the People's Republic of China and the Government of the, Federative Republic of Brazil signed in Brasilia, on September 21st, 2000;

Considering that the Parties have signed a Protocol for the extension of the *CBERS* program, and have agreed to establish a cooperation project to develop China-Brazil Earth Resources Satellites (*CBERS*) numbers 03 and 04, with provisions for cooperation in the application system; and

Recalling the terms of the Memorandum of Understanding on the Cooperation for the Development of an Application System for the China-Brazil Earth Resources Satellite Program, signed in Beijing on May 24th, 2004,

Have agreed as follows:

ARTICLE I

The Parties agree to extend the scope of the *CBERS* Program by setting up a cooperative framework which will enable

establishing the *CBERS* application system through specific cooperation projects, which shall include the distribution of *CBERS* products to countries other than China and Brazil.

ARTICLE II

All cooperation projects under this Protocol are subject to the general terms and conditions agreed between China and Brazil as regards the *CBERS* Program.

ARTICLE III

The Parties designate respectively the Chinese National Space Administration (CNSA) and the Brazilian Space Agency (AEB) as the entities responsible for implementing the actions agreed in this Protocol and to oversee the implementation of all cooperation projects proposed under this Complementary Protocol.

The CNSA and the AEB may, each on its side and under its discretion, entrust other entities with the responsibilities set forth in this Article.

Major cooperation projects and decisions should be approved by each Party after assessment by both the Joint Project Committee of the *CBERS* Program (hereinafter referred to as JPC) and the Program Coordination Committee between China and Brazil (hereinafter referred to as PCC).

ARTICLE IV

The Parties agree to appoint or to establish a proper organization or joint committee which will be responsible for organizing and implementing the cooperation projects proposed under this Complementary Protocol.

ARTICLE V

The Parties agree to implement, through specific cooperation projects, the following work:

1. Jointly establish the requirements for the tasks, functions and specifications of the Application System Infrastructure.

2. Jointly consolidate the overall and implementation technical schemes of the Application System Infrastructure.

3. Jointly define a development and production plan for the Application System Infrastructure that prioritizes the supply of technology by Chinese and Brazilian companies.

ARTICLE VI

1. The Parties agree to distribute *CBERS* products to countries other than China and Brazil subject to the conditions set in the *CBERS* Data Policy, which is annexed to and as an integral part of the Complementary Protocol.

2. The Parties shall share equally the revenues of the distribution of *CBERS* products, according to the *CBERS* Data Policy.

ARTICLE VII

The Parties agree to establish a specific cooperation project aimed at the construction of data receiving and processing systems for *CBERS* satellites, as part of the effort of distributing *CBERS* products in countries other than China and Brazil. The specific cooperation project shall be submitted to the PCC, through the JPC, for approval by the Parties and shall conform to the *CBERS* Data Policy defined and approved by the Parties.

ARTICLE VIII

The Parties agree to carry out the following activities regarding cooperation and development of *CBERS* data applications:

1. Develop and extend *CBERS* data application software and end users' products.

2. Hold meetings for exchanging experience on *CBERS* data applications.

3. Jointly promote technical training on *CBERS* data applications for users from China, Brazil and other countries.

4. Jointly establish and implement criteria and standards for the evaluation of *CBERS* image products and procedures for image calibration and quality assessment.

5. Jointly compile and promote discussions regarding users' requirements for the sensors of future satellites of the *CBERS* series and prepare proposals of technical requirements for such sensors.

The activities outlined above shall be implemented through specific cooperation projects.

ARTICLE IX

The Parties agree to make their best effort to facilitate the entry and exit of equipment and materials from the other Party necessary for the implementation of activities under this Complementary Protocol.

ARTICLE X

Subject to its laws and regulations, each Party shall facilitate, on a reciprocal basis, entry documentation for the other Party's nationals to enter and exit its national territory in order to carry out activities within the scope of this Complementary Protocol.

ARTICLE XI

The Parties should establish special arrangements concerning the issue of intellectual property, taking into account national laws and regulations of each country and international rules adopted by both Parties.

ARTICLE XII

Disputes concerning the interpretation or application of this Complementary Protocol shall be settled by mutual consultations between the Parties through diplomatic channels.

ARTICLE XIII

This Complementary Protocol shall enter into force upon Signature. This Complementary Protocol shall remain in force for five consecutive years. It shall be automatically renewed for equal and successive periods of five years, unless either of The

Parties notifies the other Party, through diplomatic channels, with a minimum of six months prior notice, of its intention to terminate this Protocol. Unless otherwise agreed between the Parties, the denouncement notice shall not affect on-going cooperation projects.

This Complementary Protocol may be amended by written agreement between the Parties.

Done in Brasilia on November 12, 2004, in duplicates, in the Portuguese, Chinese and English languages, all three texts being equally authentic. In case of any difference of interpretation, the English text shall prevail.

FOR THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL

FOR THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF CHINA

CBERS Data Policy

1. INTRODUCTION

This document defines the data policy directives for the *CBERS* Program, which includes provisions for reception, processing and dissemination of *CBERS* imagery to countries other than Brazil and China.

2. GENERAL CONSIDERATIONS

The downlink data is open to any country or organization and is based on the conception that *CBERS* imagery will be distributed by licensed representatives who operates an *application system infrastructure* that performs data reception and processing. In this document, the term *"ground station"* stands for *application system infrastructure.*

The data downlink for *CBERS* will be carried out through a ground station. International ground stations will not have access to the on-board data recorder (OBDR), which will be operated exclusively by CRESDA and INPE. Each ground station receives the image raw data and process it into image products, which will then be distributed to users. The licensing of *CBERS* data downlinks is based on fees which are charged in a per-minute basis.

China and Brazil may, in a few special cases, upon mutual consultation, decide on the transfer of data free of charge.

The revenues resulting from the distribution of *CBERS* data will be equally shared between China and Brazil, with accounting adjustments taking place every six (6) months.

3. THE BRAZILIAN AND CHINESE GROUND STATIONS

The ground stations operated by INPE in Brazil and by CRESDA in China have unlimited access to all data collected

within their footprint. The policy for distribution of data collected by those ground stations will be defined by each operator.

INPE and CRESDA will jointly agree on an international price list for *CBERS* images. Distribution of *CBERS* images to third parties will be done solely on the basis of the international price list, as agreed by China and Brazil, except in cases for which Brazil and China, upon mutual consultation, decide on the transfer of *CBERS* data free of charge.

4. USE OF THE ON-BOARD DATA RECORDER

Usage of the OBDR will be subject to the following guidelines:

a) The number of hours monthly available for the OBDR will be established periodically by the engineering teams of *CBERS*. INPE and CRESDA will equally share the available time, i.e, 50% to CRESDA and 50% to INPE, on a non-cumulative basis, such that unused hours in a month cannot be accumulated for subsequent periods. In special situations, the usage of time could be changed after mutual consultation.

b) Considering the lifetime and the reliability of the OBDR, usage of OBDR should be kept to a minimum level jointly specified by CRESDA, INPE, CAST and CLTC.

c) It is suggested that the OBDR should mainly be used in emergency situations and for demonstration and test purposes.

Images stored in the OBDR are downloaded at the Brazilian and Chinese ground stations. INPE and CRESDA will distribute these data according to the agreed international price list for *CBERS* images, except in special cases for which Brazil and China, upon mutual consultation, decide on the transfer of *CBERS* data free of charge.

5. DEVELOPMENT OF APPLICATION SYSTEM INFRASTRUCTURE

INPE and CRESDA shall agree on the policy for the construction or update of the receiving and processing systems to be installed at all, international, licensed ground stations, which will be defined in a specific document.

Information regarding data downlink, i.e., satellite to ground station interface, is regarded as intellectual property of

INPE and CRESDA and will not be disclosed to third parties unless agreed in writing by the parties. INPE and CRESDA will encourage Brazilian and Chinese companies to act as providers of the *CBERS* application system infrastructure.

INPE and CRESDA shall agree on a common specification for the *CBERS* application system infrastructure, hardware and software, and on a work breakdown structure which defines which component will be built by each party.

In the case of the Brazilian and Chinese ground stations, the parties shall agree on a joint specification. Each party is then free to decide on his development strategy that will preferably be done only by its national companies. The parties agree that any component of the ground station that cannot be built by its local industry will first be offered to the other partner, before any contracts are placed in the international market.

6. Licensing Policy for International Ground Stations

International ground stations will be licensed according to the following guidelines:

a) *CBERS* data reception, processing and distribution to other countries will be carried out by licensed representatives jointly appointed by CRESDA and INPE.

b) The licensed representative will commercialize *CBERS* data downlink to ground stations based on a annual fixed basis, based on a fee determined by INPE and CRESDA. The annual fee will be determined by the conditions of the ground stations, including geographical location and antenna footprint.

c) The *CBERS* reception and production systems will be provided by Brazilian and Chinese companies, according to the provisions set on item 5.

d) The agreements for data reception are limited by technical capabilities of the satellite.

e) The data downlink to the ground station will have priority over use of the on-board data recorder, except in the case of emergency situations, as determined by INPE and CRESDA.

f) When requested by INPE or CRESDA, the licensed representative shall provide a copy of collected *CBERS* raw data.

g) Within the valid period of the license, INPE and CRESDA will provide technical support to the licensed representative, according to the provisions set in the licensing agreement.

h) The licensed representatives shall provide their customers satellite, receiving and processing parameters such as: satellite ephemeris, calibration data of the payloads, orbit holding information, satellite attitude control status data, satellite attitude control performance data and sensor performance attenuation information.

i) The licensed representatives shall hold annual meetings with their customers and promote the diffusion of any news or decisions about *CBERS*.

7. PRODUCT DISTRIBUTION POLICY

The commercial agreement between licensed representatives and distributors shall include the following:

a) The right of receiving, processing and distributing *CBERS* data shall be granted to the distributor by the licensed representative.

b) For the distributed products, definition, name, content, processing level, media, browsing and search mode, ordering procedure and after-service shall conform to a standard product format, specified in a specific document by INPE and CRESDA.

c) An authorization for a *CBERS* distributor will be granted only after the acceptance by CRESDA and INPE of a sample of its products.

d) INPE and CRESDA will set up, maintain and run a central catalog on *CBERS* data, including the metadata, browse data and related updated technological data.

e) All the browse images of *CBERS* data collected by the distributor must be sent to the central catalog at least once every month.

f) Each distributor could set its native price list independently for distribution solely within its respective national market. Images distributed within the distributor's national market may not be exported abroad.

g) When distributing abroad, the distributor must refer to the international price list set by INPE and CRESDA.

h) The distributor must provide its domestic price list, i.e., the price for its native users, to INPE and CRESDA.

i) The distributor shall provide an report of the data distribution every six months to INPE and CRESDA.

j) The distributor must provide and update the following documents for the users: (a) *CBERS* users' handbook; (b) standard PATH/ROW map; (c) *CBERS* orbit forecast; (d) application demonstration CD.

THE BALLISTIC MISSILE DEFENSE SYSTEM AND ITS EFFECTS ON THE OUTER SPACE ENVIRONMENT

Steven A. Mirmina[*]

"The deployment of missile defenses is an essential element of our broader efforts to transform our defense and deterrence policies and capabilities to meet the new threats we face."

– President George W. Bush, December 17, 2002

"Of course, the whole point of a Doomsday Machine is lost, if you *keep* it a *secret!*"

– Dr. Strangelove, in *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb* (1964)

I. INTRODUCTION

International Peace and Security

The Charter of the United Nations provides that "Nothing in the present Charter shall impair the inherent right of individual or collective self defense . . . to maintain international peace and security."[1] This fundamental provision of international law comprises two elements: that States have an inherent right of self-defense; and that this right of self-defense is to be exercised to maintain international peace and security. The provision assumes that a State's application of its right of self-

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[1] U.N. CHARTER art. 51, para. 1 [hereinafter U.N. CHARTER].

defense preserves the balance of international peace and security. However, there have been instances when a State's exercise of its right of self-defense can threaten this delicate balance. In fact, an imbalance of peace and security was seen during the decades of the Cold War and through the ensuing arms race between the Western powers and the Communist bloc, lasting from the end of World War II to approximately 1989.

As noted in the quotation that opened this study, the U.S. is in the process of creating a Ballistic Missile Defense System (BMDS) to protect against the threat of rogue nations attacking the U.S. with ballistic missiles. The basic objective of the system is to provide a type of shield that will guard against attack from ballistic missiles. The system is designed to track incoming missiles by radar and then destroy them before they reach U.S. soil. In a nutshell, there are three basic phases to missile defense: the boost phase, the midcourse phase, and the terminal phase. The main subject of this paper is the mid-course phase:

> *Boost phase*: In this phase, the missile is being propelled through the atmosphere into space;
>
> *Midcourse phase*: During midcourse, the warhead separates from the missile body and proceeds through space; and
>
> *Terminal phase*: This is the final phase in which the warhead reenters the atmosphere and falls to Earth toward its intended target.

Unfortunately, certain space-based effects of the BMDS could result in the pollution of critical orbits in outer space. Without making direct judgment on whether the BMDS is, or is not, a worthwhile endeavor to defend the homeland from attack by rogue states, this paper will focus on the international law implications of the BMDS' effects on the outer space environment.

The present study begins by providing background on the Missile Defense Agency (MDA) and examining its fundamental objective: to develop the capability to defend the forces and territories of the United States and its allies against all classes of

ballistic missile threats.[2] It will then explain how the missile defense system is intended to work – particularly its application in outer space.

Part three of this article will start by examining a fundamental question: whether or not it is legal under international law to use space for military purposes. Secondly, it will explain some of the specific concerns raised by using the BMDS in outer space, most notably: the effects caused by orbital debris resulting from the BMDS and the dangers to other civil users of outer space such as the *Space Shuttle*, the *International Space Station*, and astronauts generally. Part three will close with an examination of international law's restrictions on environmental contamination of outer space. The conclusion of this article will note that the BMDS is not the only national security application of concern to those interested in maintaining the outer space environment for use by future generations. Other military space applications, including the use of anti-satellite weapons that would damage or destroy another country's space assets, must be scrutinized to determine the long-lasting effects of resulting debris on the outer space environment as a whole.

II. HISTORY AND DESCRIPTION OF MISSILE DEFENSE

What is the MDA?

The U.S. Department of Defense (DoD) is the executive department of the Federal Government that generally supervises the responsibilities of national security and military affairs. The three principal departments of DoD are the Army, Navy, and Air Force.[3] DoD agencies[4] include the Missile Defense

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[2] On February 24, 2005, Foreign Affairs Minister Pierre Pettigrew announced Canada would not be joining the U.S. missile defense program. Pettigrew cited Canadian independence from Washington and fundamental policy principles as factors for rejecting the program. *See Canada won't join missile defence plan,* Canadian Broadcasting Corporation/Radio Canada (CBC) News, *available at* http://www.cbc.ca/story/canada/national/2005/02/24/missile-canada050224.html (last visited Nov. 21, 2005).

[3] 10 U.S.C. §§ 3001-4842 (2000 & Supp. 2005); 10 U.S.C. §§ 5001-7903 (2000 & Supp. 2005); and 10 U.S.C. §§ 8011-9842 (2000 & Supp. 2005).

[4] 10 U.S.C. §§ 191-203 (2000 and Supp. 2005).

Agency (MDA),[5] formerly referred to as the Ballistic Missile Defense Organization (BMDO),[6] as well as the Defense Advanced Research Projects Agency (DARPA), Defense Intelligence Agency, the National Geospatial Intelligence Agency, and the National Security Agency (NSA).[7]

The National Missile Defense Act of 1999, succinctly states: "It is the policy of the United States to deploy as soon as is technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate) . . . ."[8] The MDA's budget has been estimated to be between seven and nine billion dollars annually.[9] The Mission of the MDA is to: "Develop and field an integrated BMDS capable of providing a layered defense for the homeland, deployed forces, friends, and allies against ballistic missiles of all ranges in all phases of flight."[10]

A Brief History of Missile Defense

After witnessing the damage caused by Nazi Germany firing missiles at England, U.S. military planners knew that, as accuracy and explosive capability increased, the damage inflicted by missiles could be massive. The U.S. thus concluded that it must research how to defend itself against missile attack. America's first missile defense system, called "*Safeguard*," be-

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[5] "Pursuant to the authority vested in the Secretary of Defense by reference (a), and consistent with references (b) and (c), this Directive establishes the Missile Defense Agency . . . ." Department of Defense, Directive No. 5134.9, Oct. 9, 2004, *available at* http://www.dtic.mil/whs/directives/corres/pdf/d51349_1092004/d51349p.pdf (last visited Nov. 21, 2005).

[6] Actually, to be precise, the MDA is the successor to the Strategic Defense Intelligence Organization (SDIO).

[7] The DoD was created by the National Security Act of 1947 by combining the Departments of War and Navy and was called the National Military Establishment; it became the DoD when the Act was amended in 1949.

[8] National Missile Defense Act Of 1999, Pub. L. No. 106-38, 113 Stat. 205, at § 2.

[9] *See Missile Defense Agency Fiscal Year (FY) 2005 Budget Estimates Overview*, at 22 (2004), *available at* http://www.cdi.org/news/missile-defense/mdafy05.pdf (last visited Nov. 21, 2005).

[10] Missile Defense Agency, *MDA Link*, *available* http://www.mda.mil/mdalink/html/aboutus.html (last visited Nov. 21, 2005) [hereinafter *MDA Link*].

gan just after World War II. Closely related to *Safeguard* were America's *Nike* and *Zeus* programs, which were intended to protect against nuclear threats.[11] Safeguard closed in 1976, in part because of problems associated with the use of nuclear warheads on the tip of each interceptor. Since 1976, DoD has focused on a new type of interceptor – a kinetic kill vehicle that would destroy its target by colliding with it. In 1983, President Reagan announced the Strategic Defense Initiative (SDI) that had the stated goal of rendering nuclear weapons obsolete. Opponents of SDI called it "*Star Wars*", and derided it as unrealistic. Other critics asserted that SDI would encourage the militarization of outer space and destabilize the nuclear balance of power.[12] Critics also argued that such a system would be unable to defend against cruise missiles, airplanes, or several other possible delivery systems.[13] With the end of the Cold War, SDI was considered no longer necessary, and in 1993, SDI was reorganized as the Ballistic Missile Defense Organization. In the late 1990s and early in the 21st Century, there was a resurgence

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[11] In the late 1950s the Nike-Zeus program utilized Nike nuclear missiles to intercept Soviet ICBMs. The system was designed to detonate a Nike warhead at high altitudes (60+ miles) above the Polar Regions in the vicinity of an incoming Soviet missile. Unfortunately, problems of identification and tracking of incoming missiles could not be resolved, especially in light of easily envisioned countermeasures such as decoys and chaff, and thus the Nike-Zeus project was cancelled in 1961.

[12] Militarization of outer space is addressed in Part 3 of the present study.

[13] Interestingly, the very same assertions leveled against SDI are repeated presently as reasons why the BMDS must be abandoned. "Weapons in space are likely to be politically destabilizing. They may threaten the commercial, scientific, and military use of space, all without clearly reaping their intended security benefits." Union of Concerned Scientists, Global Security: Space Weapons, *at* http://www.ucsusa.org/global_security/space_weapons/ (last visited Nov. 29, 2005). "The administration's top priority should instead be combating the threat of nuclear terrorism by increasing its programs to keep nuclear warheads and materials out of the hands of terrorists. The Bush administration, however, is giving this problem a fraction of the attention and funding being given to missile defense. The missile defense system being rushed into deployment is not relevant to the war on terrorism." *Id.* at *Missile Defense, at* http://www.ucsusa.org/global_security/missile_defense (last visited Nov. 29, 2005). "The daunting technical problem of destroying a large number of ballistic missiles with other missiles, which has been characterized as trying to 'shoot bullets with bullets,' remains unsolved. A country determined to preserve its nuclear deterrent will deploy comparatively inexpensive countermeasures to foil comparatively expensive BMD weapon systems, and will deploy a larger number of ballistic missiles confident that a few will pierce even the best missile defense." John Hickman, *Sidereum Spolium: Pork-Barreling Through Space*, CREATIVE LOAFING - ATLANTA, June 13-19, 2001, at 24.

of the "rogue nation" threat (e.g., Iran, Iraq, and North Korea), and a renewed call for a national missile defense system to protect against a rogue missile attack.[14] However, as this would contravene the 1972 Anti-Ballistic Missile (ABM) Treaty,[15] in December, 2001, President George W. Bush subsequently withdrew from the ABM treaty to permit the missile defense system's development and deployment.

How Missile Defense Is Designed to Function

Intercepting an enemy missile during the boost phase appears to be the ideal military solution: the launch vehicle is climbing against Earth's gravity, and, thus, would be moving more slowly than at subsequent stages of flight.[16] Furthermore,

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[14] Iran, Iraq, and North Korea were named "regimes that sponsor terror" in President Bush's State of the Union Address. President George W. Bush, State of the Union Address (Jan 29, 2002), *available at* http://www.whitehouse.gov/news/releases/2002/01/20020129-11.html (last visited Jan. 15, 2006). A year earlier in January 2001, what later became known as the "Rumsfeld Report" characterized the missile threat to the U.S. as follows:

> Ballistic missiles armed with WMD payloads pose a strategic threat to the United States. This is not a distant threat. Characterizing foreign assistance as a wild card is both incorrect and misleading. Foreign assistance is pervasive, enabling and often the preferred path to ballistic missile and WMD capability. A new strategic environment now gives emerging ballistic missile powers the capacity, through a combination of domestic development and foreign assistance, to acquire the means to strike the U.S. within about five years of decision to acquire such a capability (10 years in the case of Iraq). During several of those years, the U.S. might not be aware that such a decision had been made. . . .
>
> The threat is exacerbated by the ability of both existing and emerging ballistic missile powers to hide their activities from the U.S. and to deceive the U.S. about the pace, scope and direction of their development and proliferation programs.

THE COMMISSION TO ASSESS THE BALLISTIC MISSILE THREAT, EXECUTIVE SUMMARY OF THE REPORT OF THE COMMISSION TO ASSESS THE BALLISTIC MISSILE THREAT TO THE UNITED STATES , Pursuant to Public Law 106-65, July 15, 1998 [hereinafter Rumsfeld Report], *available at* http://www.fas.org/irp/threat/bm-threat.htm (last visited Nov. 30, 2005).

[15] Treaty on the Limitation of Anti-Ballistic Missile Systems, U.S.-U.S.S.R., May 26, 1972, 23 U.S.T. 3435. Article I of the ABM Treaty explicitly banned nationwide missile defense systems: "Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region . . . ." *Id.* at art. I.

[16] *MDA Link*, *supra* note 10.

intercepting early would more likely cause the debris resulting from the collision to fall on the attacking state and not on the innocent defending state or on innocent intermediary states that would be traversed by the missile's path. Finally, hitting the target early would allow interception before the missile would have the opportunity to release decoys or chaff to mislead the defensive interceptor.

If interception fails to occur during the boost phase, the midcourse phase allows the greatest opportunity to intercept the attacking missile: perhaps as much as 20 minutes. Its rocket would likely no longer be thrusting of its own power, so it would follow a more predictable glide path. The tracking radars and other sensors would have additional time to track the target compared to during the boost phase. The military downside of waiting until this phase, however, (besides the resulting debris in outer space) is that the attacking missile would have the opportunity to deploy countermeasures against the defense.

Finally, the terminal phase is the last opportunity to intercept the oncoming missile. In this phase, the missile is falling back through the atmosphere towards the Earth. This phase might last between 30 seconds and one minute.

In regard to the midcourse phase specifically, the MDA explained how its system is expected to function in outer space:

> *How fast is the Kill Vehicle going when it hits the hostile reentry vehicle?*
>
> It's going more than 7,000 miles per hour. The target reentry vehicle (warhead) is also traveling about 15,000 miles per hour. The collision between the two occurs at a relative (closing) speed in excess of 16,000 miles per hour.
>
> *Is there an explosion?*
>
> No. There is a collision in space. It is very powerful and generates debris, gas and dust. The gas and dust may actually look like they burn, but only for an extremely short time. The debris and dust will reenter the atmosphere and burn up like a meteor.
>
> *What is inside the reentry vehicle?*

> The reentry vehicle will carry a bomb of some kind. That bomb could be nuclear, biological or chemical. It could cause mass destruction of people and cities if it reached its target intact. We want to collide with it in space and prevent it from reaching earth.[17]

The BMDS is now in the testing phase and interceptor missiles are currently based in Alaska and California.[18] While these tests are currently being conducted at altitudes too low to create a space debris problem, future tests of the system occurring relatively close to the upper ranges of the Earth's atmosphere or in outer space may result in debris remaining in orbit after the test's conclusion. In regard to the potential problem of tests creating orbital debris, some commentators have been quite blunt: "It should also be very clear that, given the choice between debris in space and a nuclear warhead falling on a U.S. city, no U.S. leader would hesitate for a nanosecond. In fact, the same holds true for any nation with a moderately sane leadership."[19] There is no disagreement that debris in space is a lesser evil than a nuclear bomb falling into a city. Of course, the two assumptions implicit in this conclusion are that the nuclear bomb would be delivered to the U.S. via an Inter-Continental Ballistic Missile (ICBM) and that the BMDS would successfully intercept it. Many observers have commented that the nations about which the Administration is most concerned would likely use a less advanced means of attacking the U.S. than an ICBM,[20] sug-

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[17] Missile Defense Agency, *Frequently Asked Questions*, *available* http://www.mda.mil/mdalink/html/faq.html (last visited Nov. 21, 2005).

[18] On December 17, 2005, the tenth interceptor for the Ground-based Midcourse Missile Defense System was installed, bringing the total to eight in Ft. Greely, Alaska, and two in Vandenberg Air Force Base, California. While an eleventh interceptor is scheduled to be deployed in January 2006, installation of future interceptors will not be made public. According to the MDA, "in the interest of operational security, future interceptor emplacements will not be announced." *See* MDA Press Release, Dec. 20, 2005, *Tenth Interceptor Emplaced for the Ballistic Missile Defense System*, *available at* http://www.mda.mil/mdalink/pdf/05fyi0071.pdf (last visited January 15, 2006).

[19] Taylor Dinerman, *Space Debris: not just an American problem?*, THE SPACE REVIEW, Nov. 29, 2004, at 3, *available at* http://www.thespacereview.com/article/279/1 (last visited Dec. 2, 2005).

[20] "In this age of the war on terror, the United States is vulnerable not to sophisticated ballistic missile systems that leave an easily recognizable return address but rather to the demonic use of relatively unsophisticated or crude weapons by hidden and

gesting that a nuclear or "dirty" bomb might be smuggled into a U.S. city via traditional car or truck, or placed on a ship and sailed into a U.S. harbor for detonation.[21]

Having briefly addressed the history of the U.S. missile defense program, along with the justifications for the BMDS and its functionality, it is appropriate to examine some international law aspects of the system. This examination will focus particularly on using outer space for military purposes and examining the effects of the BMDS on the outer space environment.

III. INTERNATIONAL LAW IMPLICATIONS OF MISSILE DEFENSE IN OUTER SPACE

The Use of Outer Space for Military Purposes

The 1967 Outer Space Treaty is considered the bedrock of international space law, and all major spacefaring nations are parties.[22] It has several articles that outline what conduct is permissible in outer space.

Articles I and II outline the general framework that exploration and use of outer space shall be "carried out for the benefit and in the interests of all countries," and that outer space "shall be free for exploration and use by all States . . . in accordance with international law."[23]

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anonymous opponents determined to undermine our way of life. Terrorists or rogue states delivering weapons of mass destruction – particularly nuclear weapons—by long-range ballistic missiles is one of the least likely threats that we face." AMBASSADOR THOMAS GRAHAM JR., COMMON SENSE ON WEAPONS OF MASS DESTRUCTION 98 (University of Washington Press, 2004).

[21] *See, e.g.*, George Will, *Holocaust in a Suitcase*, WASH. POST, Aug. 29, 2004, at B07. "A nuclear weapon is much less likely to come to America on a rogue nation's ICBM – which would have a return address – than in a shipping container, truck, suitcase, backpack or other ubiquitous thing." *Id.* "Of the 7 million seaborne cargo containers that arrive at U.S. ports each year, fewer than 5 percent are inspected. Less than 10 percent of arriving noncommercial private vessels are inspected. Given that 21,000 pounds of cocaine and marijuana are smuggled into the country each day, how hard would it be to smuggle a softball-sized lump of H[ighly] E[nriched] U[ranium] on one of the 30,000 trucks, 6,500 rail cars or 50,000 cargo containers that arrive every day?" *Id.*

[22] 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 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[23] *Id.* at art. I.

Article III mandates that States party 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."[24] Applying this Article to BMDS, the provision's requirement that any activities carried out in space be in the interest of "maintaining international peace and security" could be interpreted to imply that activities that imperil international peace and security would be prohibited. It is reasonable, therefore, to address whether the BMDS would put international peace and security at risk.

In part, Article IV of the Outer Space Treaty helps to answer this question. Its first paragraph prohibits the orbiting or installation of nuclear weapons or "any other kinds of weapons of mass destruction."[25] It also prohibits such weapons from being installed in the space between celestial bodies. Its second paragraph provides that the "Moon and other celestial bodies shall be used . . . exclusively for peaceful purposes."[26] Furthermore, it forbids the establishment of military bases, the testing of any types of weapons and the conduct of military maneuvers on celestial bodies.

Analyzing the first paragraph of Article IV, one sees that, although it appears broad in application *prima facie*, in fact, it is quite limited. While it is the only article in the Outer Space Treaty to address not only celestial bodies but also the "void" of space between celestial bodies, the scope of its prohibition is limited to nuclear weapons and weapons of mass destruction (WMD). The second paragraph of Article IV forbids military installations and conduct on celestial bodies, as well as testing activities – but apart from that, it does not address other military applications. Particularly, there exists no prohibition in the Outer Space Treaty on military testing not located on celestial bodies.

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[24] *Id.* at art. III.
[25] *Id.* at art. IV.
[26] *Id.*

Apart from these specifically enumerated prohibitions, the Outer Space Treaty does not appear to impose any other restrictions on the military uses of space. Provided that military activity does not orbit or install nuclear weapons or WMD, and provided that such activity is in accordance with international law and the UN Charter, then military activity is permissible under the Treaty.[27] Any other interpretation would be indefensible. Present military practice shows that "indeed, any category not forbidden is carried into orbit, for example, spy satellites, interceptor satellites, [and] laser beam experimental satellites."[28] Missions of military satellites are numerous, ranging from navigation and communications to meteorology and reconnaissance.

However, Article IV explicitly provides that the Moon and other celestial bodies shall be used "exclusively for peaceful purposes."[29] To understand the term "peaceful" as it is used in Article IV,[30] one might query whether certain conduct is in accordance with the UN Charter: the key provision of which is Article 2(4): "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."[31] Article 1(1) of the UN Charter describes the purpose of the UN: "To maintain international peace and security, and to that end: to take effective collective measures for the prevention and re-

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[27] "The only limitation placed on military activities...is the prohibition against placing in orbit nuclear weapons or other weapons of mass destruction (Article IV, para. 1). The treaty thus legitimizes other military use of outer space." Bhupendra Jasani, *Outer Space: Militarization Outpaces Legal Controls*, *in* MAINTAINING OUTER SPACE FOR PEACEFUL USES, at 241-42 (Nandasiri Jasentuliyana ed., 1984).

[28] MARIETTA BENKÖ ET AL., SPACE LAW IN THE UNITED NATIONS 164 (1985).

[29] Outer Space Treaty, *supra* note 22, at art. IV.

[30] Article 31 of the Vienna Convention on the Law of Treaties provides that 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." Vienna Convention on the Law of Treaties, May 23, 1969, art. 31, 1155 U.N.T.S. 331, 8 I.L.M. 679 [hereinafter Vienna Convention]. The U.S. is not a party to the Vienna Convention but nevertheless follows the majority of its provisions on the basis that they are customary international law.

[31] U.N. CHARTER, *supra* note 1, at art. 2(4).

moval of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace."[32]

There is no element of the BMDS that appears to threaten force against the territorial integrity or political independence of any State; thus, it appears that the requirements of Article 2(4) are satisfied. The question next arises whether the BMDS is inconsistent with the purpose of the UN under Article 1(1). In a nutshell, there are generally two instances in which the UN Charter expressly permits the use of force. The first is to enforce a UN Security Council action under Chapter VII of the UN Charter.[33] The other instance is when a nation exercises its inherent right to self defense under Article 51 of the UN Charter.

Article 51 provides: "Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations . . . ."[34] In so far as BMDS is concerned, if it is only used to defend against incoming ballistic missiles launched as an act of aggression against the U.S., the U.S. would be acting within its inherent right of self defense to defend against this attack. Thus, the BMDS does not appear to violate the UN Charter specifically or the purposes of the UN more generally.

To conclude, therefore, it appears that the concept of a BMDS itself does not violate the Outer Space Treaty. Provided that it does not orbit or install nuclear weapons or WMD, and is not used in a manner violative of the UN Charter, it does not appear that a BMDS itself would violate international space law specifically, or public international law in general. However, the theoretical conception of a weapons system may be different from its practical application. The next section of this study examines what other provisions of law might be applicable to a functioning BMDS.

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[32] *Id.* at art. 1(1).

[33] *Id.* at arts. 24(1), 39, 41 & 42. Article 42, in particular, provides that the Security Council may take "such action by air, sea, or land forces as may be necessary to maintain or restore international peace and security."

[34] *Id.* at art. 51.

Potential Effects of the BMDS in Outer Space

The MDA plans to begin testing its space-based missile interceptors around 2012. Much of the debris resulting from these tests is not likely to cause any problems on Earth, as it will likely burn as it reenters the atmosphere or land in an ocean or unpopulated area.[35]

However, that is not the case for all the debris. For example, the BMDS Draft Programmatic Environmental Impact Statement (DPEIS) provided that, regarding its test assets: If countermeasures are used and remain on-orbit, they have the potential to disrupt or damage space-based assets (e.g., communication satellites).[36] The DPEIS further notes that: "Orbital debris could be produced from BMDS space-based sensors. Orbital debris that remains on orbit *could create hazards to orbiting spacecraft and could have impacts upon reentry if the debris reaches the Earth's surface in large pieces or containing hazardous materials.*"[37] Furthermore, the report acknowledges the risks to astronauts who might be involved in space walks, or Extra-Vehicular Activity (EVA): "*Astronauts or cosmonauts engaging in extra-vehicular activities could be vulnerable* to the

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[35] The Missile Defense Agency Ballistic Missile Defense System (BMDS) Draft Programmatic Environmental Impact Statement, Sept. 1, 2004, at ES-21 [hereinafter DPEIS], *available at* http://www.mda.mil/mdalink/pdf/peisvol1.pdf (last visited Nov. 29, 2005), states:

> Debris created from a booster failure while operating in the exoatmosphere would reenter Earth's atmosphere within a few months. Because the debris would be on orbit for a relatively short time it would not have a significant impact on orbiting structures. In addition, only a small amount of debris would survive reentry and therefore no significant impacts are expected.

See also:

> Space-based radars could reenter the Earth's atmosphere due to failure; however, most objects break up and vaporize in the upper atmosphere under intense forces and heating during reentry. Even if an object survives reentry, it would most likely land in an ocean area, and the chance of hitting populated land area would be small. Therefore, no significant orbital debris impacts would be expected.

Id. at ES-23. The report provided similarly for the space-based infrared, optical, and laser sensors.

[36] *Id.* at ES-27.

[37] *Id.* at ES-32 (emphasis added).

impact of small debris. On average, debris one millimeter (0. 04 inch) is capable of perforating current U.S. space suits."[38]

However, while the report mentions the risk of debris, it does not adequately address the gravamen of the associated risks. In one instance, where MDA reports on the possibility of debris so serious that it could impact the *International Space Station* (*ISS*), it merely calls on NASA to perform collision avoidance and move the *ISS* when tracking facilities on the ground predict a potential impact.[39] Unfortunately, maneuvering the *ISS* to avoid hazardous debris following BMDS engagement is not a realistic option, considering that the majority of the debris generated would likely be too small to track.

Not everyone agrees that the MDA assessment is a complete, factually accurate characterization of the impact on orbital debris.[40] NASA has repeatedly stated its concern that or-

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[38] *Id.* at ES-33 (emphasis added). The provision further states that: "It may be possible for debris from an exoatmospheric intercept to become orbital debris." *Id.*

[39] *See id.* at ES-39:

> The National Aeronautics and Space Administration (NASA) and the U.S. Air Force Space Command monitor orbiting space objects and are aware of instances when the *ISS* is predicted to be in proximity to space debris, which has the potential to damage spacecraft. One way to minimize the potential for orbital debris to damage orbiting structures such as the *ISS* would be to perform collision avoidance. Collision avoidance refers to moving the orbiting space structure to a higher or lower orbit to avoid the potential for collision with known orbiting space objects or debris. Because the proposed BMDS activities would be expected to produce small quantities of debris which would eventually be removed from orbit and because it may be possible to use collision avoidance strategies, there would be no significant impacts expected to the *ISS* . . . .

[40] Theresa Hitchens, *Is DoD Dropping the Ball on Space Debris?*, SPACE NEWS, Oct. 12, 2004:

> However, the MDA document fails to provide any scientific proof for its assessment that the orbital debris threat from missile defense will be negligible. Modeling debris creation and possible tracks is notoriously difficult and involves many complex factors. Impact velocity, angle of impact, altitude of impact and mass of the objects involved all affect the size and path of debris created by any orbital or suborbital collision.
>
> And while one shot with one interceptor at one target may well create little debris, multiple shots at multiple targets would likely create a heck of a lot more.
>
> There is absolutely no evidence in the document that MDA did the necessary calculations to properly analyze these scenarios. Further, while it is obvious that the longer debris stays in orbit the more chances it has to collide with

bital debris could damage the *Space Shuttle* (*Shuttle*) or the *ISS*. It does not take a large piece of debris to cause serious damage to the *Shuttle* or the *ISS* and risk the loss of human life.[41] A fleck of paint as small as four one-hundredths of one millimeter hitting a *Shuttle* window would require the window's replacement. Debris as small as one tenth of one millimeter could penetrate an astronaut's protective suit when involved in a space walk. The *Shuttle's* reinforced carbon-carbon panels on the leading edge of its wings would be compromised if impacted by debris as small as one millimeter, while debris from three to five millimeters in size could penetrate the thermal protection system tiles on the *Shuttle*. Larger debris (five millimeters) could penetrate the crew cabin, and a piece between five and ten millimeters in size could cause payload bay damage.[42] Compounding this concern is that debris of this size is too small to be tracked from Earth.

Only debris larger than ten centimeters is capable of being tracked, and *Shuttle* orbiters have executed collision avoidance maneuvers to avoid these objects. "When the Shuttle is on orbit, NASA turns the orbiter during flight with its windows facing away from the direction of the velocity vector (in layman's terms, backwards) to protect its sensitive systems from collisions with small debris. Furthermore, during Extra-Vehicular Activity (EVA), NASA has adopted operational restrictions so that the EVA crew is shielded from debris by the orbiter itself. When the *Shuttle* is on orbit, the U.S. Space Surveillance Net-

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something, it is not correct to assume, as MDA seems to do, that if debris makes just one or two orbital passes, it is harmless.

The document also fails to take into account that moving the space station is not a trivial task. In addition, there is no recognition of the fact that there are numerous high-value space assets in addition to the space station in low Earth orbit such as commercial Earth-imaging satellites. Many satellites and spacecraft would not be able to maneuver to avoid debris created by missile defense tests.

[41] *See* Nick Johnson, USA Space Environment and Space Debris Characterization in 2002, Presentation to the 40th Session of the Scientific and Technical Subcommittee (Feb. 2003), *available at* http://www.oosa.unvienna.org/COPUOS/stsc/2003/presentations/Johnson/sld001.htm (last visited Nov. 29, 2005).

[42] Nicholas L. Johnson, Program Manager, NASA Orbital Debris Program Office, *Orbital Debris, Population and Policies*, Mar. 1, 2000 (on file with author).

work watches the orbits of oncoming orbital debris and informs NASA if an object is expected to pass within a few kilometers of the *Shuttle*. About once every year or two, NASA maneuvers the *Shuttle* away from the trajectory of oncoming orbital debris, even if the chances of collision are relatively slim."[43] In addition to its concern for the lives of the astronauts, NASA is also concerned about its other assets in outer space, including observatories such as the *Hubble Space Telescope*. *Hubble's* high gain antenna was completely pierced by a piece of debris too small to be tracked from Earth.

The MDA acknowledges that the BMDS is likely to cause debris that is too small to be tracked (smaller than ten centimeters). In fact, the DPEIS states that a fragment of debris ten centimeters long is "roughly comparable to 25 sticks of dynamite."[44] This makes it very difficult for orbital debris analysts conducting complex simulations to assess and agree upon the potential danger to humans and other physical assets in space. While "opponents of space-based interceptors have often focused on the political implications of using such systems, the debris threat discussed in the MDA report presents another 'serious argument' against their development."[45] In that light, therefore, it is appropriate for this study to examine precisely what norms are provided in international law concerning protection of the outer space environment from debris expected to result from the BMDS.

Legality of Environmental Contamination of Outer Space

There are several treaties that address the protection of the outer space environment in addition to some general principles of international law recognized in the jurisprudence of the In-

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[43] Steven A. Mirmina, *Reducing the Proliferation of Orbital Debris: Alternatives to a Legally Binding Instrument*, 99 AM. J. INT'L L. 649, 653 (2005).

[44] DPEIS, *supra* note 35, at 4-131. As a means of comparison, the report notes that an aluminum sphere only one centimeter in diameter "is comparable to a 181-kilogram (400-pound) safe traveling at 97 kilometers per hour (60 miles per hour)." *Id.*

[45] Jeremy Singer, *Space.Based Missile Interceptors Could Pose Debris Threat*, SPACE NEWS, Sept. 13, 2004 (quoting Theresa Hitchens, President and Director of the Space Security Project, at the Center for Defense Information).

ternational Court of Justice. These are examined within and subsequently applied to the BMDS.

The Outer Space Treaty obliges States to maintain outer space free for exploration and use by all States.[46] Article IX of the Treaty may also be relevant to debris considerations, as it requires States pursuing studies of outer space, including the Moon and other celestial bodies, to "conduct exploration of them so as to avoid their harmful contamination" and, where necessary, to "adopt appropriate measures for this purpose."[47] As a State-Party, the U.S. is required to observe Article IX's requirement to avoid harmful contamination of outer space as it conducts the tests of the BMDS.

A related area is the liability on the part of the U.S. for damage caused by debris resulting from BMDS to other States. The primary source of international law directly addressing liability in outer space for damage caused by orbital debris is known as the Liability Convention.[48] The Convention's definition of the term "space object" is broad enough to encompass orbital debris: "The term 'space object' includes component parts of a space object as well as its launch vehicle and parts thereof."[49] The Liability Convention is also important because it imposes absolute liability on a "launching State" for damage caused by its space object.[50] The Convention sets up a regime in which a launching State is absolutely liable for damage caused on the Earth or to aircraft in flight; and it is liable for damage to a space object of another State in outer space, if the damage was due to its fault (or the fault of persons for whom the State is responsible).[51] Although there has never been a final decision

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[46] Outer Space Treaty, *supra* note 22, at art. I.

[47] *Id.* at art. IX.

[48] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 (hereinafter Liability Convention).

[49] *Id.* at art. I(d).

[50] The term "launching State" is defined as: "(i) a state which launches or procures the launching of a space object; (ii) a State from whose territory or facility a space object is launched." The term "launching State" was defined broadly deliberately to encompass as many possible responsible States in order to assist potential claimant States in finding a party able to compensate damages caused by a space object. *Id.* at art. I(c)(i)-(ii).

[51] If orbital debris were to damage a functional space object, a preliminary determination would be based on fault. The fault determination would be relatively straightforward in instances where the debris is one of the approximately 9,000 pieces that is

rendered by a claims commission under the Liability Convention, a reasonable reading of the Outer Space Treaty's and the Liability Convention's provisions could conclude that a State launching a space object, or a State that is responsible for private entities who launch that object, could incur legal liability under the Treaty for that object. Regarding damage caused on the surface of the Earth or to aircraft in flight, the strict liability regime applies. As referred to earlier, the only issue is one of proof: identification of the source of the object causing the damage.

International Environmental Law

Although international environmental law would apply to the terrestrial aspects of the BMDS, there is no consensus as to its application to the outer space segments of missile defense. While there do not appear to be any reported court decisions applying international environmental law to activities occurring solely in outer space, some scholars have suggested that international law may contain a supervening obligation to protect the global commons, which includes the outer space environment: "[g]eneral customary international law requires that all States behave in a manner so as not to cause harm to the environment of areas beyond the jurisdiction of any state including, *a fortiori*, the high seas, outer space, and the Antarctic."[52] Therefore, without specifically needing to address whether or not international environmental law applies to the space segments of BMDS, this article examines several general principles of international environmental law as they would apply to a State's missile defense system generally.

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tracked; however, if the source of the debris is one of the estimated 100,000 multifarious pieces of orbital debris one centimeter or larger in diameter in low Earth orbit that is not tracked, then the source of the object causing the damage would likely be unknown, as would the particular launching State, and thus the imposition of fault and liability under the Liability Convention would be difficult if not impossible. In the end, however, identification of the source of the debris is essentially a technical question, rather than a legal one.

[52] Jonathan I. Charney, *Third State Remedies for Environmental Damage to the World's Common Spaces*, *in* INTERNATIONAL RESPONSIBILITY FOR ENVIRONMENTAL HARM, at 175 (Francesco Franconi and Tullio Scovazzi eds., 1991).

There is widespread agreement that States have a general duty to protect areas outside of their jurisdiction from environmental damage. While the origins of this notion are often attributed to the *Trail Smelter* arbitration,[53] Principle 21 of the Stockholm Declaration states it explicitly.[54] Although Principle 21 is merely hortatory as a conference declaration and thus is not itself legally binding, it was reiterated twenty years later in the 1992 Rio Declaration.[55] It has also been repeated in various forms many times since, leading some experts to note its widespread acceptance and conclude that it now either reflects customary international law, or, alternatively, at least indicates that it is in the process of crystallizing as customary international law.[56]

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[53] Trail Smelter Arbitration (U.S. v. Can.), 3 R. Int'l Arb. Awards 1911 (1938), 3 R. Int'l Arb. Awards 1938 (1941) (Canada ordered by an international arbitration panel to pay for damage to U.S. crops and forests caused by a lead and zinc smelting complex).

[54] Declaration of the United Nations Conference on the Human Environment, Principle 21, U.N. Doc. A/CONF.48/14/Rev.1 (1973), *available at* http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1503 (last visited Dec. 13, 2005). Principle 21 states that:

> [s]tates have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Id.

[55] Rio Declaration on Environment and Development, 31 I.L.M. 874 (1992) [hereinafter Rio Declaration]. Principle 2 of the Rio Declaration states, in relevant part: "States have . . . the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction." *Id.*

[56] *See* United Nations Convention on the Law of the Sea, art. 194(2), Dec. 10, 1982, 21 I.L.M. 1261:

> States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution arising from incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights . . . .

Id.

See also U.S. Dept of State, Office of the Legal Adviser, *Draft Principles Prepared by the World Meteorological Organization's and United Nations Environmental Program's Informal Meeting on Legal Aspects of Weather Modification, April 1978*, 1978 Dig. U.S. Prac. Int'l L. 1204–05 ("States shall take all reasonable steps to ensure that weather

Section 601 of the Restatement (Third) of the Foreign Relations Law of the United States suggests a principle of environmental law that could apply to the BMDS. Namely, a State has a duty to avoid causing significant environmental damage outside of its national boundaries. Specifically:

> (1) A State is obligated to take such measures as may be necessary to the extent practicable under the circumstances, to ensure the activities within its jurisdiction or control
>
> (a) conform to generally accepted international rules and standards for the prevention, reduction, and control of injury to the environment of another state or of areas beyond the limits of national jurisdiction; and
>
> (b) are conducted so as not to cause significant injury to the environment of another state or of areas beyond the limits of national jurisdiction.[57]

Prima facie, it appears that this provision would encompass a State's missile defense system. Section 601(1) (b) imposes upon States the duty to avoid causing significant environmental injury beyond the limits of their national jurisdiction. Debris caused by BMDS in outer space, i.e. outside the territory of the U.S., (if determined to be the cause of significant injury) appears to fall within the scope of this prohibition.[58]

Critics of the BMDS might also point to an overriding principle of international environmental law known as the "precautionary principle" or "precautionary approach."[59] Although there is not yet consensus on the precise scope of the principle, there is general agreement that, where there is a lack of scientific cer-

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modification activities under their jurisdiction or control do not cause adverse environmental effects in areas outside their national jurisdiction.")

[57] RESTATEMENT (THIRD) OF THE FOREIGN RELATIONS LAW OF THE UNITED STATES § 601(1) (1987). Written by the American Law Institute since the 1920's, the Restatement does not have the force of law. However, it could be viewed as an accurate description of the basic law of the United States.

[58] As to §601's potential application to the use of Nuclear Power Sources in outer space, *see generally* Steve Mirmina & David Den Herder, *Nuclear Power Sources and Future Space Exploration*, 6:1 CHI. J. INTL L. 149, 164-65 (2005).

[59] While the Rio Declaration refers to it as the "precautionary approach," it does so under the caption of *Principle* 15. Rio Declaration, *supra* note 55, at Principle 15.

tainty concerning the harmful, damaging, irreversible, or transgenerational effects of an activity, then:

> (1) the activities should not be prohibited;
>
> (2) one should weigh the benefits of the activity against its potential environmental damage, accounting for the probability of damage and its magnitude; or
>
> (3) one should take action to reduce the magnitude and likelihood of the potential damage to the environment.[60]

It is arguable that U.S. environmental law has already incorporated the precautionary principle into practice.[61]

One other Treaty potentially applicable to the debris resulting from the BMDS is the Environmental Modification Convention, which prohibits: "military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects" as a means of inflicting injury on another state.[62] These terms have been elaborated by the Treaty as "any technique for changing – through the deliberate manipula-

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[60] EDITH B. WEISS, INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 159 (Aspen 1998) (quoting M.P.A. Kindall, *UNCED and the Evolution of Principles of International Environmental Law*, 25 J. Marshall L. Rev. 19, 23–25 (1991)).

[61] For example, this can be seen in the DPEIS that MDA completed on BMDS pursuant to the National Environmental Policy Act (NEPA). As to the norm's application to the outer space environment, one noted Space Law professor suggests that the norm might already be applicable to the Moon. *See*, Paul Larsen, Application of the Precautionary Principle to the Moon, presented at the International Institute of Space Law Colloquium (Oct. 17-21, 2005) (on file with author).

[62] Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, May 18, 1977, art. I, 31 U.S.T 333 (entered into force Oct. 5, 1978). Scholars have stressed the purposeful use of the word "or" before "severe effects" rather than the word "and" in this Convention, thus noting that damage need only be widespread, long-lasting or severe to contravene its provisions. See, "The International Responses to the Environmental Impacts of War," Symposium, Opening Remarks of Professor Edith Brown Weiss, Vol. XVII G'town Int'l Envtl. L. Rev. Summer 2005, at p. 569. *Compare* Protocol I to the Geneva Convention, Methods and Means of Warfare, Article 35.3: "It is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment." Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol 1), adopted on 8 June 1977 by the Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law applicable in Armed Conflicts, entry into force 7 December 1979.

tion of natural processes – the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space."[63] For the provisions of this Treaty to be applicable, proponents would likely assert that the orbital debris resulting from the BMDS would alter the natural composition of outer space by its very introduction into the outer space environment.

Thus, even though space can be used for military purposes, there are other considerations that weigh in the equation. International environmental law contains several provisions that are potentially applicable to protection of the commons including outer space, and the prohibition against causing environmental damage beyond a State's borders has been recognized in the jurisprudence of the International Court of Justice.[64] At a minimum, therefore, the U.S. should take into account the interests of other States when considering the implications of the testing activities of the BMDS in outer space.

IV. CONCLUSION

> Of course, the *people* don't want war.... But after all, it's the *leaders* of the country who determine the policy. And it's always a simple matter to drag the people along, whether it's a democracy, a fascist dictatorship, a Parliament, or a Communist dictatorship.... [V]oice, or no voice, the people can always be brought to the bidding of the leaders. That is *easy*. All you have to do is tell them they are being attacked and denounce the pacifists for a lack of patriotism and exposing the country to greater danger.[65]

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[63] *Id.* at art. II.

[64] In *Legality of the Threat of Nuclear Weapons*, the ICJ recognized: "The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now a part of the corpus of international law relating to the environment." Legality of the Threat of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 15, at 29 (Jul. 8).

[65] GUSTAVE GILBERT, NUREMBERG DIARY (Da Capo Press, 1995), *citing* Hermann Goering, *Before the International Military Tribunal at Nuremberg*. Gilbert, a German-speaking intelligence officer and psychologist was granted free access by the Allies to all the prisoners held in the Nuremberg jail. Gilbert kept a journal of his observations of the proceedings and his conversations with the prisoners. The quote offered above was part of a conversation Gilbert held with Goering in his cell on the evening of April 18,

If the U.S. were considering only the BMDS, its effects on the outer space environment might be chiefly academic in nature. However, the BMDS is just one element of a military strategy to ensure U.S. superiority in outer space:

> The Air Force in August put forward a Counterspace Operations Doctrine, which described "ways and means by which the Air Force achieves and maintains space superiority" and has worked to develop weapons to accomplish such missions. On March 1, [2005,] Defense Secretary Donald H. Rumsfeld signed a new National Defense Strategy paper that said the use of space "enables us to project power anywhere in the world from secure bases of operation." A key goal of Rumsfeld's new strategy is "to ensure our access to and use of space and to deny hostile exploitation of space to adversaries." The Pentagon is developing a suborbital space capsule that could hit targets anywhere in the world within two hours of being launched from U.S. bases. It also is developing systems that could attack potential enemy satellites, destroying them or temporarily preventing them from sending signals.[66]

An integral component of the Pentagon's plan for space superiority includes systems to disable enemy satellites.[67] These systems are being promoted as pre-emptive measures to be taken against third party space assets, including civilian uses.[68] Thus, the issue of creation of space debris is broader in scope than just

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1946. *See* detailed discussion *available at* http://www.snopes.com/quotes/goering.htm (last visited Dec. 12, 2005).

[66] Walter Pincus, *Plans by U.S. to Dominate Space Raising Concerns, Arms Experts Worried at Pentagon Push for Superiority*, WASH. POST, Mar. 29, 2005, at A02.

[67] "The Pentagon wants to be able . . . to develop and deploy systems that can destroy enemy satellites by kinetic energy (KE) interceptors . . . [I]f the US were to suddenly need a satellite killer within say, a 24-month time frame, a KE a-sat would be the only way to go." Taylor Dinerman, *supra* note 19, at 3.

[68] "Proposed anti-satellite (ASAT) weapons are not limited to 'shoot back' systems on vulnerable U.S. satellites. Instead, space warfare proponents are pushing for first-strike ASAT systems to be used pre-emptively against any satellites – including those with primarily civilian functions and those owned and/or operated by neutral governments or commercial entities . . . These services include precision navigation, high resolution imagery, environmental monitoring and satellite communications." Theresa Hitchens, *Space Control: Who Ya Gonna Shoot*, SPACE NEWS, Jan. 24, 2005, at 11-13.

the BMDS. In fact, the issue of space debris caused by the kinetic energy satellites was recently raised in the U.N.[69]

Apart from the specific legal issues raised by the BMDS, the holistic impact of the system should be examined. Criticisms and doubts have been leveled about the BMDS from both technical and political points of view. At a technical level, it has been asserted that the system "would not provide significant protection" for the U.S. "for many years, if ever."[70] The author of the cited *Scientific American* article explains that after having spent more than $80 billion on missile defense since 1985, the system "will not counter even the earliest threats from the emerging missile powers . . . it can do nothing to stop a short- or medium-range missile launched from a ship off America's coasts."[71] The article explains a litany of fundamental technical flaws in the BMDS, such as the Pentagon's need to carpet the nation with interceptors to provide effective defense of U.S. cities, which of course, even assuming a perfect defense, could lead to the targeting of an undefended city. The author also demonstrates the relative ease with which an adversary could employ countermeasures.[72] If an interceptor is unable to distinguish

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[69] "The view was expressed that, to date, insufficient attention had been given to the creation of debris that future anti-satellite weapons would cause through kinetic impact or explosion damaging or destroying space assets." Report of the Scientific and Technical Subcommittee on its forty-second session, held in Vienna from 21 February to 4 March 2005, Committee on the Peaceful Uses of Outer Space, U.N. General Assembly, A/AC.105/848, p. 20, par. 107.

[70] Richard Garwin, *Holes in the Missile Shield,* Scientific American.com, Oct. 25, 2004, at 1 [hereinafter Garwin], *available at* http://www.sciam.com/article.cfm?articleID=000A45A2-E044-115D-A04483414B7F0000 (last visited Jan. 18, 2006).

[71] *Id.*

[72] "One obvious countermeasure would be to reduce the radar and infrared signatures of the ballistic missile and its warhead to make it harder for the interceptors to home in. For example, putting the warhead in a reentry vehicle shaped like a sharply pointed cone and coated with radar-absorbing material could significantly shrink the object's appearance on X-band radar. Also, an attacker could cool the black shroud of the warhead using liquid nitrogen, making it invisible to the kill vehicle's infrared sensor. Another countermeasure would be to load each ICBM with dozens of decoys designed to look just like the warhead." *Id.* at 3. *See also,* WRIGHT, ET AL., THE PHYSICS OF SPACE SECURITY, A REFERENCE MANUAL 7 (American Academy of Arts and Sciences, 2005) "[A space-based missile defense system] would be intrinsically vulnerable to debilitating attack and to being overwhelmed. Any country with the capability to launch a long-range ballistic missile could also develop an effective capability do destroy satellites in low earth orbit using ASATs launched on short-range missiles. Once one or more space-

between decoys and the actual warhead, hundreds of interceptors would need to be launched, quickly overwhelming the missile defense. Furthermore, the author explains, countries such as China could feel vulnerable if the U.S. continues to develop interceptors and place them into orbit, potentially leading to the destabilization of peace and security. China may feel compelled to build more long range missiles "because the space-based system can be defeated by launching many ICBMs at once from a small region. China would also have every incentive to destroy the orbiting interceptors."[73] Finally, the article also observes that, from a public international law perspective, unlike a preemptive strike on an enemy's ground or sea based forces, an attack against a weapons system in outer space likely would not cause human casualties, and thus might not be considered an act of war by the international community.[74]

At a political level, the foundation of the Administration's plans to achieve space superiority can be seen in the January 2001 Rumsfeld Report, in which there is a specific demand for anti-satellite technology: "The U.S. will require means of negating satellite threats, whether temporary and reversible or

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based interceptors were destroyed, producing a hole in the defense constellation, an attacker could launch a long-range missile through this hole. . . . Alternatively, an attacker could overwhelm the defense. A defense system designed to intercept one ballistic missile launched from any given region would require many hundreds or even a few thousand orbiting interceptors, depending on the design of the constellation and the interceptors. Increasing the defense capability so the system could attack two missiles launched simultaneously from the same region would require doubling the total number of interceptors in the constellation. Because the system costs would increase rapidly with the number of interceptors, any plausible defense system would be designed to intercept only one or two ballistic missiles launched simultaneously. Thus, any country launching more than one or two missiles roughly simultaneously from the same region would penetrate such a defense, even if it worked perfectly."

[73] Garwin, *supra* note 70, at 4-5.

[74] Ironically, perhaps, this perspective is contrary to U.S. national space policy as enunciated by the Clinton Administration: "Purposeful interference with space systems shall be viewed as an infringement on sovereign rights." Office of Science and Technology Policy, *National Space Policy*, Sept. 19, 1996, *available at* http://www.ostp.gov/NSTC/html/pdd8.html (last visited Dec. 13, 2005). In a June 10, 2005 press briefing, White House spokesman, Scott McClellan, explained that the national space policy has been "undergoing an interagency review..., has not been updated in over nine years..., [and that] it needs to be updated." Scott McClellan, Press Briefing, (June 10, 2005) (transcript *available at* http://www.whitehouse.gov/news/releases/2005/06/20050610-10.html#I).

physically destructive."[75] However, in pursuit of its interests for national security, some may question whether the Administration is considering the destabilizing effects that its 'space dominance' philosophy may be causing.[76] In fact, in a recent issue of the Naval War College Review, a member of the faculty of the Naval War College's Strategy and Policy Department observed: "Before the nation moves forward to develop space-based weapons, it must conduct a thorough military analysis . . . [that] should then feed a larger policy debate. [T]he debate must fully consider the long-term strategic implications of space-based weapons and potential alternatives to them. To proceed with space-based weapons on any other foundation would be the height of folly."[77]

The outset of the present study examined the U.N. Charter and its opening provision in Article 1(1) that the purpose of the U.N. is to "maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace."[78] While the U.S. would assert that the BMDS specifically, and space based militarization more generally, share the very same central purpose, namely, maintenance of international peace and security, there exists a risk that the aims of the Administration will not be viewed in the same light by all nations.[79] Thus, while the

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[75] Report of the Commission to Assess United States National Security Space Management and Organization, Jan. 2001, pursuant to P.L. 106-65, at 29.

[76] When asked about pursuing the U.S. missile defense system, Noam Chomsky commented that, from the points of view of Russia, China, India, and Pakistan, the system's deployment will be regarded as a "first-strike threat," and he observed that Russia's "only rational response to the [BMDS] would be to maintain, and strengthen Russian nuclear force" thus undermining progress towards nuclear disarmament. Noam Chomsky, *National Missile Defense System,* The American Prospect, July 18, 2000, at 1, *available at* http://www.chomsky.info/letters/20000718.htm (last visited Dec. 13, 2005).

[77] Capt. David C. Hardesty, U.S. Navy, *Space Based Weapons: Long-Term Strategic Implications and Alternatives*, 58:2 NAVAL WAR C. REV. 45, 65-66 (2005).

[78] U.N. CHARTER, *supra* note 1, at art. 1(1).

[79] "In an attempt to avert Washington's ambition of 'space superiority,' Russia is preparing to put forward a draft resolution to the United Nations General Assembly on measures to ensure that the outer space is free of weapons, the Russian Foreign Ministry said Wednesday. 'Moscow was particularly worried about reports of US plans to deploy strategic weapons in outer space, in particular to deploy missile defense components in circum-terrestrial orbit,' Foreign Ministry spokesman Alexander Yakovenko

U.S. clings to the provision of the U.N. Charter that "Nothing in the present Charter shall impair the inherent right of individual or collective self defense . . . to maintain or restore international peace and security,"[80] it also should recall that this right may not be absolute – in fact, it could very well be tempered by the U.N. Charter Article 2(4), which provides that: "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."[81]

While some portions of the BMDS could contravene international space and environmental law, particularly, the BMDS-caused orbital debris, the U.S. Administration may be walking a fine line regarding the maintenance of "international peace and security."[82] Provided that the actions of the U.S. in the name of national security (ranging from the BMDS specifically to ASAT weapons and space superiority more generally) are not viewed as a threat against another state's territorial integrity, political independence, or as any form of an act of aggression, then the U.S. would likely be compliant with the U.N. Charter's exhortation to maintain international peace and security. Conversely, countries that view space dominance as an aggressive stance might consider it a threat to peace and security, and thus in violation of the U.N. Charter specifically, and public international law in general.

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said in an article published in the Wednesday issue of *Rossiiskaya Gazeta*." *Russia To Submit UN Resolution On Weapons Ban In Outer Space*, SPACE DAILY, May 26, 2005, *available at* http://www.spacedaily.com/news/milspace-05zh.html (last visited Dec. 13, 2005).

[80] U.N. CHARTER, *supra* note 1, at art. 51.

[81] *Id.* at art. 2(4).

[82] "The Air Force, saying it must secure space to protect the nation from attack, is seeking President Bush's approval of a national-security directive that could move the United States closer to fielding offensive and defensive space weapons, according to White House and Air Force officials. The proposed change would be a substantial shift in American policy. It would almost certainly be opposed by many American allies and potential enemies, who have said it may create an arms race in space." Tim Weiner, *Air Force Seeks Bush's Approval for Space Arms*, N.Y. TIMES, May 18, 2005, at 1.

INTERNATIONAL COOPERATION FOR SUSTAINABLE SPACE DEVELOPMENT

Chukeat Noichim[*]

I. INTRODUCTION

Space is a vast realm into which the human species is expanding physically and intellectually. This expansion not only has the potential to enhance the human condition but also the power to transform it radically. As Tsiolkovsky said:

> Men are weak now, and yet they transform the Earth's surface. In millions of years their might will increase to the extent that they will change the surface of the Earth, its oceans, the atmosphere, and themselves. They will control the climate and the Solar System just as they control the Earth. They will travel beyond the limits of our planetary system; they will reach other suns, and use their fresh energy instead of the energy of their dying luminary.[1]

Tsiolkovsky's expression may be criticized on the grounds that it puts humans at the center of universe. However, more importantly, it is essential to note that despite intelligence and capacity, humans cannot excel in space activities without coordination and cooperation. These sentiments are described in the following quote: "No longer can nations, or people, live in

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[1] Konstantin Tsiolkovsky (1857-1935) was the first person to study rocket powered space flight and was the father of Russian cosmonautics. He wrote many books, inspired Soviet rocket engineers, and was the first to elaborate on the theory of multistage rockets. He also proposed liquid oxygen and liquid hydrogen as fuel. *The life of Konstantin Eduardovitch Tsiolkovsky*, *at* http://www.informatics.org/museum/tsiol.html (last visited Dec. 4, 2005).

isolation. They must come together in education and global (space) cooperation."[2]

II. THE CONCEPT OF "INTERNATIONAL COOPERATION"

Definitions of the term "cooperation" include "action of cooperating or acting jointly with another or other"[3], "action taken by a group of people"[4], and "cooperative work done by a team"[5]. In keeping with these definitions, cooperation must involve obligations on the part of each party to enter into such coordinated action so as to achieve a specific goal.[6] Thus, international cooperation is the obligation of States to cooperate with each other.[7] Furthermore, international cooperation is considered a political-legal concept as explained in the following:

> It is a political concept in the sense of being based on the premise that, according to certain principles, States and their governments are motivated by a constructive and positive spirit of seeking peace through an organized international community in order to fundamentally change the nature of relations among independent States. In the legal concept, it arises from the implementation of the principle of interna-

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[2] *Space Science and Microgravity Research and Their Benefits*, Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space [hereinafter UNISPACE-III], A/CONF.184/BP/6, at 4 (1998).

[3] BLACK'S LAW DICTIONARY 334 (6th ed. 1990).

[4] Free Online Dictionary, *at* http://www.thefreedictionary.com/cooperation (last visited Sept. 26, 2005).

[5] *Id.*

[6] "Cooperation" must be distinguished from "interdependence" and "solidarity". Interdependence describes a factual situation of mutual dependence among States but not obligations or rights to act. Interdependence consequently is a sociological term without direct legal consequence. The steadily increasing interdependence of States leads to an intensification of cooperation. Solidarity refers to the obligation of an individual State to take into consideration in its policy the interests of other States or their subjects or the common interests of the world community. This can also lead to the intensification of cooperation for development. *See* RÜDIGER WOLFRUM, INTERNATIONAL LAW OF COOPERATION: ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW 9, 193-198 (Rudolf Bernhardt and Rudolf L. Bindschedler eds., Max Planck Institute for Comparative Public Law and International Law 1986).

[7] *Id.* The obligation to cooperate has been established through international agreement. Legal obligations for mutual cooperation among States were already recognized in legal writings as well as in the practice of international law before the principle of sovereignty became the key element in international law in the 19th century.

> tional cooperation of States which has certain repercussions not only in the institutions established through this cooperation, but primarily in the content which jurists are obliged to give to this principle.[8]

However, the term "international cooperation" had never been defined by an international treaty or international decision until 1970 when the UN General Assembly adopted Resolution 2625 (XXV) proclaiming the Declaration on Principles of International Law concerning Friendly Relations and Cooperation Among States in accordance with the Charter of the United Nations.[9] This Declaration described "international cooperation" as the voluntary coordinated action of two or more States which takes place under a legal regime and serves a specific objective.[10] The principal objective of international cooperation is not only to promote the interests of all those States involved in effectively working together on a particular activity, but also to foster the development of developing countries as well.[11]

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[8] BOGDAN BABOVIC, THE DUTY OF STATES TO COOPERATE WITH ONE ANOTHER IN ACCORDANCE WITH THE CHARTER: PRINCIPLES OF INTERNATIONAL LAW CONCERNING FRIENDLY RELATIONS AND COOPERATION 289-290 (Malan Sahovic ed., Oceana Publications 1972).

[9] G.A. Res. 2625, U.N. GAOR, 25th Sess., Supp. No. 18, U.N. Doc A/8018 (1970).

[10] WOLFRUM, *supra* note 6.

[11] *See* the U.N. General Assembly Resolution 2625 (XXV): "The Declaration on Principles of International Law Concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations, 1970, which states:

> *The duty of States to co-operate with one another in accordance with the Charter*
>
> States have the duty to co-operate with one another, irrespective of the differences in their political, economic and social systems, in the various spheres of international relations, in order to maintain international peace and security and to promote international economic stability and progress, the general welfare of nations and international co-operation free from discrimination based on such differences. To this end:
>
> (a) States shall co-operate with other States in the maintenance of international peace and security;
>
> (b) States shall co-operate in the promotion of universal respect for, and observance of, human rights and fundamental freedoms for all, and in the elimination of all forms of racial discrimination and all forms of religious intolerance;
>
> (c) States shall conduct their international relations in the economic, social, cultural, technical and trade fields in accordance with the principles of sovereign equality and non-intervention;

III. LEGAL STATUS OF INTERNATIONAL COOPERATION

The idea of the international cooperation of States with one another is not particularly new. After the Second World War, the term "international cooperation" was enshrined in the UN Charter.[12] Evidently, the legal status of this idea was first asserted as a basic principle of international law.[13] Identified as one of the purposes of the United Nations, Chapter I, Article 1, paragraph 3 of the UN Charter states that the United Nations would like "[t]o achieve international co-operation in solving international problems of an economic, social, cultural, or humanitarian character, and in promoting and encouraging respect for human rights and for fundamental freedoms for all without distinction as to race, sex, language, or religion . . . ."[14] For peaceful and friendly relations among nations, Article 56 of Chapter IX of the UN Charter likewise recites that all UN member-States pledge themselves "to take joint and separate action in co-operation with the [UN] Organization for the achievement of the purposes [based on respect for the principle

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> (d) States Members of the United Nations have the duty to take joint and separate action in co-operation with the United Nations in accordance with the relevant provisions of the Charter.
>
> States should co-operate in the economic, social and cultural fields as well as in the field of science and technology and for the promotion of international cultural and educational progress. States should co-operate in the promotion of economic growth throughout the world, especially that of the developing countries.

G.A. Res. 2625, *supra* note 9.

[12] U.N. CHARTER. The Charter of the United Nations currently represents one of the principal documents for the regulation of international affairs. As such it serves as a constitution for the international community organized on the basis of the maintenance of peace, and it represents a collection of principles, rules and obligations of international law whose enforcement should not only ensure a more just international order and prevent the outbreak of new wars, but also permit and facilitate a proper development of international relations. BABOVIC, *supra*, note 8, at 287.

[13] The concept of co-operation in contemporary international law is part of the "new" international law of the post-Second World War era and is the product of an historical-dialectical process of law-making drawing, variously, on old customary law, court jurisprudence (international and national), legal doctrines, States' practices, treaties (bilateral, regional, and general), and international legislation. *See* Edward McWhinney, *The Concept of Co-operation, in* INTERNATIONAL LAW: ACHIEVEMENTS AND PROSPECTS 425-36 (Mohammed Bedjaoui ed., Martinus Nijhoff Publishers, 1991).

[14] U.N. CHARTER, *supra* note 12 at art. 1, para. 3.

of equal rights and self-determination of peoples[15]] set forth in Article 55."[16]

A. *International Cooperation in International Law*

In the post-Second World War era, the concept of international cooperation became a major principle of international law as expressed in the UN Charter. Furthermore, the existence and importance of this principle in "new" international law has been confirmed by the UN Declaration on Principles of International Law concerning Friendly Relations and Co-operation among States of 1970.[17] The fundamental objective of international cooperation among States is not only to contribute to the maintenance of world peace and the stability of international

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[15] The principle of equal rights and self-determination of peoples states:

> By virtue of the principle of equal rights and self-determination of peoples enshrined in the Charter of the United Nations, all peoples have the right freely to determine, without external interference, their political status and to pursue their economic, social and cultural development, and every State has the duty to respect this right in accordance with the provisions of the Charter.
>
> Every state has the duty to promote, through joint and separate action, realization of the principle of equal rights and self-determination of peoples, in accordance with the provisions of the Charter, and to render assistance to the United Nations in carrying out the responsibilities entrusted to it by the Charter regarding the implementation of the principle, in order:
>
> (a) To promote friendly relations and co-operation among States.

G.A. Res. 2625, *supra* note 9.

[16] *Id.* at art. 56. Article 55 of United Nations Charter: Chapter IX (International Economic and Social Co-operation) reads:

> With a view to the creation of conditions of stability and well-being which are necessary for peaceful and friendly relations among nations based on respect for the principle of equal rights and self-determination of peoples, the United Nations shall promote:
>
> (a) higher standards of living, full employment, and conditions of economic and social progress and development;
>
> (b) solutions of international economic, social, health, and related problems; and international cultural and educational cooperation; and
>
> (c) universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion.

U.N. CHARTER, *supra* note 12, at art. 55.

[17] G.A. Res. 2625, *supra* note 9.

security[18] but also to promote human rights and international economic and social cooperation.[19] Accordingly, States should choose the means by which to attain the objective of international cooperation because, as a result of the UN Declaration, they are under a general legal obligation to cooperate with one another[20] irrespective of the differences in their political, economic and social system; the differences in the various spheres of international relations; and regardless of issues based on respect for the principles of sovereign equality of State[21] and non-intervention.

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[18] In order to ensure the peaceful coexistence among all sovereign States, the emphasis of traditional international law is placed on the preservation of peace understood as the abolition of the use of force. To achieve this goal, international law uses two interrelated approaches. The first path tries to rule out war as a means of national policy by way of general treaties that prohibit resorting to armed force. The other approach tries to strengthen the organizational structure of international society by creating a system of collective security. Both means were combined in the United Nations. The obligation to cooperate derived from the Charter entails cooperation with other States and cooperation with United Nations for the maintenance of international peace and security. WOLFRUM, *supra* note 6, at 193-98.

[19] G.A. Res. 2625, *supra* note 9.

[20] The duty of States to co-operate with one another in accordance with the Charter:

> States have the duty to co-operate with one another, irrespective of the differences in their political, economic and social systems, in the various spheres of international relations, in order to maintain international peace and security and to promote international economic stability and progress, the general welfare of nations and international co-operation free from discrimination based on such differences.

Id.

[21] The principle of sovereign equality of States provides:

> All States enjoy sovereign equality. They have equal rights and duties and are equal members of the international community, notwithstanding differences of an economic, social, political or other nature.
>
> In particular, sovereign equality includes the following elements:
>
> (a) States are juridically equal;
>
> (b) Each State enjoys the rights inherent in full sovereignty;
>
> (c) Each State has the duty to respect the personality of other States;
>
> (d) The territorial integrity and political independence of the State are inviolable;
>
> (e) Each State has the right freely to choose and develop its political, social, economic and cultural systems;
>
> (f) Each State has the duty to comply fully and in good faith with its international obligations and to live in peace with other States.

Id.

Since the UN Declaration on Friendly Relations merely includes the principal contents of international cooperation found in the UN Charter, the principle of international cooperation has been applied in many fields of international law. In particular, this principle is a fundamental principle for legal regimes dealing with areas beyond national sovereignty. Areas beyond national sovereignty, including natural resources found there, are characterized by the fact that they are not subject to national appropriation in any form or by any means. For the reasons of politics, security, economics, and the environmental safety of mankind, there is a need for proper international regulation of these areas. Without proper regulation, increasing competition among States and groups of States for economic resources and for control and supremacy over strategic positions in a region could easily lead to instability or open conflict.[22] Legal regulation in these areas could be vital for human well-being, prosperity, and even for the very survival of humankind.[23] Thus, the exploration, exploitation, and access to these areas beyond national sovereignty should be regulated by international treaties with founding principals based in peace, the prohibition of legal abuse, and a commitment to cooperation based upon sovereign equality and equal rights.[24] At present, the areas beyond national sovereignty are considered to include not merely the high seas, seabeds, and Antarctica but also outer space (see section IV.B.).

1. The High Seas and Seabeds

The high seas consists of the zone of sea that is open to all States, whether coastal or land-locked based on the principle of freedom of the high seas.[25] However, any State claiming this

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[22] Nagendra Singh, *Introduction to International Law of the Sea and International Space Law, in* INTERNATIONAL LAW: ACHIEVEMENTS AND PROSPECTS 827 (Mohammed Bedjaoui ed., 1991).

[23] *Id. at* 826-27.

[24] Reinhard Müller & Mario Müller, *Cooperation as a Basic Principle of Legal Régimes for Areas Beyond National Sovereignty; with Special Regard to Outer Space,* 31 GERMAN Y.B. OF INT'L L. 555 (1988).

[25] United Nations Convention on the Law of the Sea, Dec. 10, 1982, art. 87, 1833 U.N.T.S. 397.

freedom must consider the interests, rights,[26] and duties[27] of all other States under the 1982 Law of the Seas Convention, which states that this area "shall be reserved for peaceful purpose"[28] and "no State may validly purport to subject any part of the high seas to its sovereignty."[29] The legal status of international seabeds and their resources is described as the "common heritage of mankind"[30] and:

> No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.[31]

Further, this area must be used exclusively for peaceful purposes and, without discrimination and prejudice, held open to all States, whether coastal or land-locked.[32] With respect to the effective protection of human life,[33] the exploration and exploitation in this area shall be carried out for the benefit of mankind[34] and controlled by the authority under the Convention.[35] Therefore, in order to maintain international peace and security and promote international cooperation, the general conduct of States in relation to this area and its resources must be organized in accordance with the provisions of Part XI of the 1982 Law of the Seas Convention, the UN Charter and international law.[36]

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[26] *Id.* at arts. 90, 110, and 111.
[27] *Id.* at arts. 94, 98, and 100.
[28] *Id.* at art. 88.
[29] *Id.* at art. 89.
[30] *Id.* at art. 136.
[31] *Id.* at art. 137(1).
[32] *Id.* at art. 141.
[33] *Id.* at art. 146.
[34] *Id.* at art. 140.
[35] *Id.* at arts. 140 (2), 152 and 153.
[36] *Id.* at art. 138.

2. Antarctica

The main legal regime to regulate the activities of States in Antarctica[37] is the Antarctic Treaty of 1959.[38] The objective of this Treaty is to prevent the escalation of an arms race into this area and to promote international cooperation among all nations for peaceful coexistence in the interest of all humankind as Antarctica is recognized as a commonwealth of humankind[39] because of its "frozen" territorial claims.[40] Thus, Antarctica must be used exclusively for peaceful purposes and demilitarization[41] as well as "denuclearization."[42] Furthermore, in order to strengthen international cooperation on the basis of freedom of scientific investigation, the contracting parties to the Treaty have a duty to exchange information regarding plans for scientific programs and scientific personnel and to make scientific observations and results freely available.[43]

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[37] Antarctica was the last continent to be discovered, with Great Britain, the Soviet Union, and the United States each claiming that distinction. In 1773, Captain Cook first crossed the Southern polar circle, searching for Antarctica, the Terra Australis. However, systematic scientific exploration of Antarctica only started at the turn of this century. Antarctica has a surface area of more than 14 million square kilometers including its large ice-shelves; thus, it represents about nine percent of the Earth's landmass. Some ninety-eight percent of Antarctica is covered by ice, with an average thickness of 2300 meters, which may reach up to 4800 meters. Unlike the Arctic, Antarctica had no native inhabitants. *See* RÜDIGER WOLFRUM & ULF-DIETER KLEMM, *Antarctica, in* ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW 11 (Rudolf Bernhardt & Rudolf L. Bindschedler eds., 1986).

[38] Antarctic Treaty, Dec. 1, 1959, 12 U.S.T. 794, T.I.A.S. No. 4780, 420 U.N.T.S. 71.

[39] In 1956, India asked the General Assembly of the United Nations to consider the matter of the specific use of Antarctica. In a memorandum, it stated that it would be appropriate and opportune for all nations to agree and assert that the area should be used entirely for peaceful purposes and the general welfare. All nations should therefore agree to promote the harmonization of their actions to that end and to ensure that no activity in Antarctica might have any adverse effects on climate and other natural conditions. The idea of the internationalization of Antarctica by declaring it a "common heritage of mankind" was raised again by the Non-Aligned Countries at the meeting of New Delhi, in 1983, and Luanda (Angola), in 1985. *See* Ernesto J. Rey Caro, *Antarctica, in* INTERNATIONAL LAW: ACHIEVEMENTS AND PROSPECTS 984 (Mohammed Bedjaoui ed., 1991).

[40] Antarctic Treaty, *supra* note 38, at art. IV. There is strong support for the internationalization of Antarctica or at least excluding the exercise of any State sovereignty or jurisdiction in the region. Caro, *supra* note 39, at 984.

[41] Antarctic Treaty, *supra* note 38, at art. I (1).

[42] *Id.* at art. V.

[43] *Id.* at arts. II and III.

B. International Cooperation in International Space Law

With regard for the corresponding benefit and interests of all humankind, States shall be guided by the principle of international cooperation in peaceful exploration and use of outer space. The principle of international cooperation is a crucial element[44] in the exploration and utilization of outer space and is enshrined not merely in all outer space treaties[45] and the five sets of legal principles[46] but also in those United Nation General Assembly (UNGA) resolutions concerned with outer space activities.[47] Because outer space, including the moon and other

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[44] Peter P.C. Haanappel, *Co-operation between Canada and the United States in Civilian Space Activities*, XII ANNALS OF AIR & SPACE L. 235 (1987).

[45] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *done on* Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347 [hereinafter Outer Space Treaty]; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *done on* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119; Convention on International Liability for Damage Caused by Space Objects, *done on* March 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762; Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480; and, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *adopted on* Dec. 5, 1979, 1363 UNTS 3, 18 I.L.M. 1434 [hereinafter Moon Agreement].

[46] Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVIII), 18th Sess., 1280th plen. mtg., U.N. Doc Res. 1962 (Dec. 13, 1963).; Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, G.A. Res. 37/92, U.N. Doc. RES/37/92 (Dec. 10, 1982) [hereinafter Principles Governing the Use by States of Artificial Earth Satellites]; Principles Relating to Remote Sensing of the Earth from Outer Space, G.A. Res. 41/65, U.N. Doc. RES/41/65 (Dec. 3, 1986); Principles Relevant to the Use of Nuclear Power Sources in Outer Space, G.A. Res. 47/68, U.N. Doc. RES/47/68 (Dec. 14, 1992); and, 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, G.A. Res. 51/122, U.N. Doc. A/RES/51/122 (Dec. 13, 1996) [hereinafter Declaration on International Cooperation].

[47] *See* Question on the Peaceful Uses of Outer Space, G.A. Res. 1348 (XIII), U.N. Doc. RES/1348 (Dec. 13, 1958); International Co-operation in the Peaceful Uses of Outer Space, G.A. Res. 1472 (XIV), U.N. Doc. RES/1472 (Dec. 12, 1959); G.A. Res. 1721 (XVI), U.N. Doc. RES/1721 (Dec. 20, 1961); G.A. Res.1802 (XVII), U.N. Doc. RES/1802 (Dec. 14, 1962); G.A. Res. 1963 (XVIII), U.N. Doc. RES/1963 (Dec. 13, 1963); G.A. Res. 2130 (XX), U.N. Doc. RES/2130 (Dec. 12, 1965); G.A. Res. 2223 (XXI), U.N. Doc RES/2223 (Dec. 19, 1966); G.A.Res. .2453 (XXIII), U.N. Doc. RES/2453 (Dec. 20, 1968); G.A. Res. 2600 (XXIV), U.N. Doc. RES/2600 (Dec. 16, 1969); G.A. Res. 2601 (XXIV), U.N. Doc. RES/2601 (Dec. 16, 1969); G.A. Res. 2733 (XXV), U.N. Doc. RES/2733 (Dec. 16, 1970); G.A. Res. 2776 (XXVI), U.N. Doc. RES/2776 (Nov. 29, 1971); G.A. Res. 2915 (XXVII), U.N. Doc. RES/2915 (Nov. 9, 1972); G.A. Res. 3182 (XXVIII), U.N. Doc. RES/3182 (Dec. 18, 1973);

celestial bodies, is declared as the "province of all mankind"[48] (*res communis*), peaceful exploration and use in this area is free for all States.[49] This area is also not subject to national appropriation by claim or any other means of sovereignty of any State.[50] Furthermore, since the beginning of the space era, the world community has recognized the great importance of international cooperation in exploration and use of outer space for peaceful purposes[51] and has believed that such cooperation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples[52] irrespective of economic or scientific development.

The international space regime regulating human space activities creates the rights and obligations[53] of all States with re-

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G.A. Res. 3234 (XXIX), U.N. Doc. RES/3234 (Nov. 12, 1974); G.A. Res. .3388 (XXX), U.N. Doc. RES/3388 (Nov. 18, 1975); G.A. Res. 31/8, U.N. Doc. RES/31/8 (Nov. 8, 1976); G.A. Res. 32/196, U.N. Doc. RES/32/196 (Dec. 20, 1977); G.A. Res. 33/16, U.N. Doc. RES/33/16 (Nov. 10, 1978); G.A. Res. 34/66, U.N. Doc. RES/34/66 (Dec. 5, 1979); G.A. Res. 36/35, U.N. Doc. RES/36/35 (Nov. 18, 1981); G.A. Res. 37/89, U.N. Doc. RES/37/89 (Dec. 10, 1982); G.A. Res. 38/80, U.N. Doc. RES/38/80 (Dec. 15, 1983); G.A. Res. 39/96, U.N. Doc. RES/39/96 (Dec. 14, 1984); G.A. Res. 40/162, U.N. Doc. RES/40/162 (Dec. 12, 1985); G.A. Res. 41/64, U.N. Doc. RES/41/64 (Dec. 3, 1986); G.A. Res. 42/68, U.N. Doc. RES/42/68 (Dec. 2, 1987); G.A. Res. 43/56, U.N. Doc. RES/43/56 (Dec. 6, 1988); G.A. Res. 44/46, U.N. Doc. RES/44/46 (Dec. 8, 1989); G.A. Res. 45/72, U.N. Doc. RES/45/72 (Dec. 11, 1990); G.A. Res. 46/45, U.N. Doc. RES/46/45 (Dec. 9, 1991); G.A. Res. 47/67, U.N. Doc. RES/47/67 (Dec. 14, 1992); G.A. Res. 48/39, U.N. Doc A/RES/48/39 (Dec. 10, 1993); G. A. Res. 49/34, U.N. Doc, A/RES/49/34 (Dec. 9, 1994); G.A. Res. 50/27, U.N. Doc. A/RES/50/27 (Dec. 6, 1995); G.A. Res. 51/123, U.N. Doc. A/RES/51/123 (Dec. 13, 1996); G.A. Res. 52/56, U.N. Doc. A/52/56 (Dec. 10, 1997); G.A. Res. 53/45, U.N. Doc. A/RES/53/45 (Dec. 3, 1998); G.A. Res. 54/67, U.N. Doc. A/RES/54/67 (Dec. 6, 1999); G.A. Res. 55/122, U.N. Doc. A/RES/55/122 (Dec. 8, 2000); G.A. Res. 56/51, U.N. Doc. A/RES/56/51, (Dec. 10, 2001); G.A. Res. 57/116, U.N. Doc. A/RES/57/116 (Dec. 11, 2002); and G.A. Res. 58/89, U.N. Doc. A/RES/58/89 (Dec. 9, 2003).

[48] Outer Space Treaty, *supra* note 45, at art. I.

[49] *Id.*

[50] *Id.* at art. II.

[51] *See* Question of the Peaceful Use of Outer Space, G.A. Res. 1348 (XIII), U.N. Doc. RES/1348 (Dec. 13, 1958).

[52] Outer Space Treaty, *supra* note 45, at pmbl.

[53] An analysis of the detailed interpretation of the "common-benefit clause" in the Outer Space Treaty (Articles II, III, IX, X, and XI) and The Moon Agreement (2, 4, 5) reveals the following constellation of rights and duties:

> (a) each state has the right to perform national activities; however, national programs which exclude other states from the exploration and use of outer space are prohibited;
>
> (b) international cooperation based on equality, in accordance with international law, has to be shaped in such a way as to ensure that exploration and

spect to their activities in outer space. Because of the benefit and interests of all humankind, there is the urgent need to strengthen important aspects of international cooperation with respect to the exploration and use of outer space. The five treaties[54] provide for the non-appropriation of outer space by any one country and the freedom of exploration;[55] arms control;[56] liability for damages caused by space objects; the safety and rescue of spacecraft and astronauts; the prevention of harmful interference with space activities and the environment;[57] the noti-

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use of outer space is carried out for the benefit and in the interests of all countries;

(c) those states engaged in the exploration and use of outer space shall afford other states party to the Outer Space Treaty, on the basis of equality, an opportunity to observe the flight of space objects whereby the nature and conditions of such an observation shall be determined by agreement between the states concerned; and

(d) finally, the state party to the Outer Space Treaty commits themselves to informing 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 their outer space activities and in particular the results of such activities.

See Müller, *supra* note 24, at 563.

[54] *Supra* note 45.

[55] Under Articles I, II and III of the Outer Space Treaty of 1967 and Articles 6 and 11 of the Moon Agreement of 1979, exploration and use of outer space are governed by the principles of freedom, the prohibition of appropriation and the requirement of cooperation in research activities on the basis of equality of sovereignty, non-discrimination of States and in accordance with international law. Outer Space Treaty, *supra* note 45, at arts. I, II, & III; Moon Agreement, *supra* note 45, at arts. 6 & 11.

[56] Article IV of the Outer Space Treaty, with the aim of complete demilitarization and denuclearization definitely prohibits all States from the specific acts or attitudes that infringe the concept of peace and security. Furthermore, the Moon Agreement of 1979 insists that, as the "province of all mankind", the Moon shall be used by all States exclusively for peaceful purposes and also guided by the principle of international cooperation. Due to the moon's status as a demilitarized region, this Agreement prohibits the following: the threat or use of force or any other hostile act or threat of hostile act on the moon, the placing of nuclear weapons and other weapons of mass destruction on orbit around, or other trajectory to or around the moon or upon its military bases, installations, the testing of weapons, and the conduct of military maneuvers. Outer Space Treaty, *supra* note 45, at art IV.

[57] Under Article IX of the Outer Space Treaty of 1967 and Article 7 of the Moon Agreement of 1979, exploration and use of outer space are guided by the principle of cooperation. All outer space activities of States have to be conducted with due regard to the corresponding interests of other parties to the Treaty. In particular, any harmful contamination of outer space, including the moon and other celestial bodies, should be avoided and also adverse changes in the environment of the earth resulting from the introduction of extraterrestrial matter. To ensure the observance of this important

fication and registration of space activities; scientific investigation; the exploitation of natural resources in outer space; and the settlement of disputes. Each of the treaties puts great stress on the notion that the domain of outer space, the activities carried out therein and whatever benefits might accrue therefrom should be devoted to enhancing the well-being of all countries and humankind, and each includes elements elaborating the common idea of promoting international cooperation in outer space activities. Moreover, the five sets[58] of legal principles adopted by the United Nations General Assembly provide for the application of international law and promotion of international cooperation and understanding in space activities,[59] the dissemination and exchange of information through transnational direct television broadcasting via satellites[60] and remote satellite observations of the Earth[61] and general standards regu-

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duty, a consultative mechanism on an international level has been envisaged. *Id.* at art. IX.

[58] *Supra* note 46.

[59] *See* Declaration on International Cooperation, *supra* note 46.

[60] *See* Principles Governing the Use by States of Artificial Earth, *supra* note 46. In the Preamble of these principles, the General Assembly states that the establishment of principles for international direct television broadcasting will contribute to the strengthening of international cooperation in this field and further the purposes and principles of the Charter of the United Nations. *Id.* at pmbl. Article D of these Principles confirm that:

> Activities in the field of international direct television broadcasting by satellite should be based upon and encourage international co-operation. Such co-operation should be the subject of appropriate arrangements. Special consideration should be given to the needs of the developing countries in the use of international direct television broadcasting by satellite for the purpose of accelerating their national development.

Id. at art. D.

[61] *See* Principles Relating to Remote Sensing of the Earth from Outer Space, *supra* note 46. In the Preamble of this principle, the General Assembly indicates that the adoption of the principles relating to remote sensing of the Earth from space will contribute to the strengthening of international cooperation in this field. *Id.* at pmbl. In particular, Principle V provides, "States carrying out remote sensing activities shall promote international co-operation in these activities. To this end, they shall make available to other States opportunities for participation therein." *Id.* at Principle V. Such participation shall be based in each cases on equitable and mutually acceptable terms. Further, with regard to the needs of developing countries, Principle XIII provides that "To promote and intensify international co-operation, a State carrying out remote sensing of the Earth from space shall, upon request, enter into consultations with a State whose territory is sensed in order to make available opportunities for par-

lating the safe use of nuclear power sources[62] necessary for the exploration and use of outer space.[63]

Comparing the legal regimes governing areas beyond national sovereignty (see Table No. 1), they are too diverse to expect any uniform or comparable legal developments owing to the history of discovery and exploration of these areas as well as economic and technological factors. However, it can be noted that within certain limits, across these areas there has been the development of rules of international cooperation in international law and international space law such as the promotion of international community, the alteration of the rights and duties of States, and the change in the status of those subject to international law. Finally, there are two fundamental purposes of international cooperation: first, to preserve these areas for peaceful purposes; and second, to promote exploration and use in these areas.

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ticipation and enhance the mutual benefits to be derived therefrom." *Id.* at Principle XIII.

[62] *See* Principles Relevant to the Use of Nuclear Power Sources in Outer Space, *supra* note 46. Principle 7 states the following:

> [A]ll States possessing space monitoring and tracking facilities, in the spirit of international cooperation, shall communicate the relevant information that they may have available on the malfunctioning space object with a nuclear power source on board to the Secretary-General of the United Nations and the State concerned as promptly as possible to allow States that might be affected to assess the situation and take any precautionary measures deemed necessary.

Id. at Principle 7.

[63] *See* Office for Outer Space Affairs, United Nations Office at Vienna, *The United Nations Treaties and Principles on Space Law*, *at* http://www.oosa.unvienna.org (last visited Dec. 3, 2005).

Table No.1

The Structure of Legal Regimes for Areas Beyond National Sovereignty

Areas	The Antarctica/ On the Earth	The Outer Space/ Outside of the Earth	The High Sea and Sea bed/On the Earth
Special Legal Regime	The Antarctic Treaty 1959	The Outer Space Treaty 1967	The Law of the Seas Convention 1982
Legal Status	A quasi-sovereignty-free area / "frozen" territorial claims (art. IV)	The Province of all Mankind (art. I)	The Common Heritage of Mankind (arts. 89 and 136)
The principles Governing the Use & Exploration	-The Peaceful Purpose (art. I) - Freedom of scientific investigation (art. II) - International Cooperation (art. III)	- Freedom of the Outer Space (art. I) - Non appropriation (art. II) - International Cooperation (art. I, III, X and XI) - The Peaceful Purpose (art. IV)	-Freedom of the high seas (art. 87) - The Peaceful Purpose (art. 88 and 141) - International Cooperation (art. 98, 100 and 150)

IV. APPLICATION OF INTERNATIONAL COOPERATION IN SPACE ACTIVITIES

In order to ensure that all countries have access to outer space and to its benefits, the application of the concept of international cooperation into space activities is indispensable. Though governments have largely shaped space activities, it is recognized that many national space activities, such as satellite communication and meteorology, require international cooperation in order to function successfully. Moreover, space activities

have clearly shown how countries with widely varying political and legal systems, levels of development, and cultures can work together for mutual benefit.[64] Thus, governments choose to cooperate with others in the exploration and use of outer space on an equitable and mutually acceptable basis.

International cooperation should be guided by the principles of 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;[65] UNISPACE III;[66] and the desire to enhance potential benefits including scientific payoff. We should also consider the benefit of sharing costs, increasing cost effectiveness, providing access to technology and experience possessed by others, increasing domestic support for space programs, strengthening relationships among allies and creating friendlier relationships with non-allies, influencing the content or direction of a partner's space efforts, and demonstrating leadership and enhancing prestige.[67] International cooperation should be conducted in the most effective and appropriate manner[68] as determined by the countries concerned. Though, this course of action may create some associated risks such as a loss of autonomy, increasing interdependence, and increasing overall costs (cooperation itself may cost money), increasing managerial complexity, and political problems if one or more partners do not honor cooperative commitments.[69] Moreover, international cooperation should aim, *inter alia*, at the following goals, taking into account the need for technical assistance and rational and efficient allocation of financial and technical resources: (a) Pro-

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[64] *International Space Programmes and Policies*, Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space [hereinafter UNISPACE-II] 109 (N. Jasentuliyana & Ralph Chipman eds., Elsevier Science Publishers B.V.: the Netherlands, 1984).

[65] Declaration on International Cooperation, *supra* note 46.

[66] UNISPACE-III, *supra* note 2.

[67] *Id.*

[68] Declaration on International Cooperation, *supra* note 46.

[69] *See* INTERNATIONAL SPACE UNIVERSITY, KEY TO SPACE: AN INTERDISCIPLINARY APPROACH TO SPACE STUDIES 2-20 (A. Houston & M. Rycroft eds., International Space University Publication, The McGraw-Hill Companies, Inc., 1999).

moting the development of space science and technology[70] and all of its applications,[71] (b) Fostering the development of relevant and appropriate space capabilities in interested States, and (c) Facilitating the exchange of expertise and technology among States on a mutually acceptable basis.[72]

With respect to both general and specialized forms international cooperation in all levels of space development, not only

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[70] International Cooperation for Developing Space Science and Technology: the most important areas for the promotion of sustainable international space cooperation are areas of space science (such as Earth systems science, microgravity science, astrobiology and life science, space physics, astrophysics, and solar system exploration) and space technology (automation and robotics, miniaturization, advanced materials, data processing, and software development). This cooperation is an effective way of stimulating the utilization and evolution of space science and technology and helping bridge the gap in space science and technology knowledge between member countries. Moreover, not only among nations participated in the cooperation but also other countries, in particular developing countries, derive enhanced capabilities in developing space science and technology which can lead to accelerated economic, cultural and social growth and help them to leapfrog stages in development.

[71] International Cooperation for Using Space Applications: this cooperation is very important because most nations, particularly the developing countries, can easily use or share the benefits of space technology. Moreover, several space applications have already had a significant economic development / impact such as the Following:

(a) *Telecommunications* – Space can be a powerful tool for direct-to-home (DTH) delivery of information, including TV broadcasting and broadband services. Space can also be used to collect information from dispersed terrestrial entities (e.g. network of franchisees or subsidiaries of multinational enterprises [MNEs], monitoring of meters);

(b) *Navigation* – Space-based navigation devices facilitate the management of mobile fleets (e.g. trucks, ships, taxis), improve the regulation of air and rail traffic, and assist individuals with navigation tasks;

(c) *Earth observation* – Remote sensing can play a role, for example, in the design and implementation of new land infrastructure, the management of crops and natural resources, and the enforcement of agricultural policy and environmental treaties;

(d) *Meteorology* – Meteorological satellites help to improve weather forecasting and to anticipate extreme conditions and take appropriate mitigating action; and

(e) *Development assistance* – For developing countries, space assets can offer ways to better manage their natural resources and extend services to their populations (e.g. telemedicine, distance education, telecommunications, broadcasting), particularly in remote areas. Although these space-based services require the deployment of appropriate ground equipment, they can be extremely valuable when terrestrial infrastructures are not fully developed.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD), SPACE 2030: EXPLORING THE FUTURE OF SPACE APPLICATIONS 31 (OECD Publication: Paris, 2004).

[72] Declaration on International Cooperation, *supra* note 46.

between governmental and non-governmental agencies but also between commercial and non-commercial enterprises, at present, international space cooperation itself can be divided into three main groups: global cooperation, regional cooperation, and bilateral cooperation.

A. Global Space Cooperation Level

In considering the notion of a common heritage of humankind, the problem arises of access for developing countries to space technologies and the control of exports of "sensitive" technologies, particularly ballistics technologies. The exploration and use of outer space is one of the key contemporary global problems which can only be successfully settled through the mutual efforts of all States acting in the interest of humankind and through the efforts of each State acting separately by means of creating corresponding mechanism to complement interactions of States. Global problems require the internationalization of efforts and universal mechanisms.[73]

As a result, the idea of creating a World Space Organization (WSO) has been voiced within the international community.[74] The main goal of forming a WSO would be to create conditions for all countries to utilize the benefits of space science and technology in order to promote the well-being of humanity and spe-

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[73] E. Kamenetskaya, *On the Establishment of World Space Organization: Some Considerations and Remarks*, *in* PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 358 (1989).

[74] The idea of creating a World Space Organization is not a new one. It has been set out either as a limited proposal in order to resolve restricted purposes, or in a global form. The first expression of this idea was made during the UNISPACE-I session in Vienna in 1968. It was restated during the UNISPACE-II organized in 1982 with a view to undertake an international action program in the space field. Furthermore, many of space academicians (such as Simone Courtelx, Alexander V. Yakovenko, K.B. Serafimov, E.Kamenetskaya, and Kenneth S. Pedersen) have offered their ideas to the world community for the establishment of the World Space Organization. *See* Kamenetskaya, *supra* note 73; Alexander V. Yakovenko, *World Space Organization: Pro et Contra*, *in* PROCEEDING OF 3RD ECSL COLLOQUIUM ON INTERNATIONAL ORGANIZATIONS AND SPACE LAW 365 (1999); Simone Courteix, *Is it necessary to establish a World Space Organization?*, *in* PROCEEDINGS OF THE THIRTY-SIXTH COLLOQUIUM ON THE LAW OF OUTER SPACE 20 (1993); K.B. Serafimov, *Achieving Worldwide Cooperation in Space*, 5 SPACE POLICY 111 (1989); and Kenneth S. Pedersen, *Is it Time to create a World Space Agency?*, 9 SPACE POLICY 89, May 1993.

cifically economic, social and cultural development.[75] It would also reaffirm the common interest of all humanity in the progress of the exploration and use of outer space for peaceful purposes together with promoting the need to prevent an arms race in outer space as an essential condition for the promotion of international cooperation.[76] Currently, and in the foreseeable future, in canvassing global government organizations with general functions, no general purpose World Space Organization yet exists. Moreover, such an entity may never come into being because space activities until now have reflected a focus on security and commercial benefits. As a result, many States (especially space-faring nations) will likely not support such an organization and allow their projects to be subject to its authority.

However, there are other forms of global organizations that might be adopted for particular space activities. For example, global government organizations with specialized functions such as the World Meteorological Organization (WMO)[77] and the In-

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[75] The principal aims of the World Space Organization are the following: to serve as a focal point for broad international co-operation for the exploration and use of outer space exclusively for peaceful purposes; to co-ordinate efforts undertaken by States and international organizations in the context of peaceful space activities; to facilitate for all States access to and participation in space activities and the benefits derived therefrom; and to verify compliance with international agreements to prevent the extension of an arms race into outer space. *See* Yakovenko, *supra* note 74.

[76] UNISPACE-III, *supra* note 2, at pmbl, *The Space Millennium: Vienna Declaration on Space and Human Development.*

[77] The World Meteorological Organization (WMO) is an intergovernmental organization with a membership of 187 Member States and Territories. It originated from the International Meteorological Organization (IMO), which was founded in 1873. Established in 1950, WMO became the specialized agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences. The purposes of WMO are the following: to facilitate world-wide co-operation in the establishment of networks of stations for the making of meteorological as well as hydrological and other geophysical observations related to meteorology, and to promote the establishment and maintenance of centers charged with the provision of meteorological and related services; to promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information; to promote the standardization of meteorological and related observations and to ensure the uniform publication of observations and statistics; to further the application of meteorology to aviation, shipping, water problems, agriculture and other human activities; to promote activities in operational hydrology and to further close co-operation between Meteorological and Hydrological Services; and to encourage research and training in meteorology and, as appropriate, in related fields and to assist in coordinating the international aspects of such research and training.

ternational Telecommunication Union (ITU)[78], global non-governmental organizations with specialized function such as the Committee on Space Research (COSPAR),[79] as well as global

[78] The International Telecommunication Union (ITU) was established last century (on May 17, 1865) as an impartial, international organization. In 1947, after the Second World War, ITU held a conference in Atlantic City with the aim of developing and modernizing the organization. Under an agreement with the newly created United Nations, it became a UN specialized agency on October 15, 1947. The purposes of ITU are the following:

> (a) to maintain and extend international cooperation between all its Member States for the improvement and rational use of telecommunications of all kinds;
>
> (b) to promote and enhance participation of entities and organizations in the activities of the Union, and to foster fruitful cooperation and partnership between them and Member States for the fulfilment of the overall objectives embodied in the purposes of the Union;
>
> (c) to promote and to offer technical assistance to developing countries in the field of telecommunications, and also to promote the mobilization of the material, human and financial resources needed for its implementation, as well as access to information;
>
> (d) to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public;
>
> (e) to promote the extension of the benefits of new telecommunication technologies to all the world's inhabitants;
>
> (f) to promote the use of telecommunication services with the objective of facilitating peaceful relations;
>
> (g) to harmonize the actions of Member States and promote fruitful and constructive cooperation and partnership between Member States and Sector Members in the attainment of those ends;
>
> (h) to promote, at the international level, the adoption of a broader approach to the issues of telecommunications in the global information economy and society, by cooperating with other world and regional intergovernmental organizations and those non-governmental organizations concerned with telecommunications.

ITU CONST. art. 1, *available at* http://www.itu.int/aboutitu/basic-texts/constitution/chapter1/chapter01_01.html (last visited Dec. 8, 2005).

[79] The Committee on Space Research (COSPAR) was established during an international meeting in London in 1958. COSPAR's first Space Science Symposium was organized in Nice in January 1960. COSPAR's objectives are to promote on an international level scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research. These objectives are achieved through the organization of Scientific Assemblies, publications and other means.

organizations with both government and private sector membership such as INTELSAT[80] could be considered.

B. Regional Space Cooperation Level

In the evolution of the international community, regional cooperation plays a vital role. Regional cooperation may be defined as cooperation among States of a specific area or a group of States with the same political identity by establishing international organizations for the purpose of serving the interests of the member States such as economic, cultural, and technological. The first real such regional organization was created on the American continent namely Organization of American States (OAS) at the end of the nineteenth century. However, after the Second World War the use of regional organizations became worldwide, especially within the growing interdependence of States in space activities. Governments realized that they could achieve far more important results through cooperation than when they acted individually.[81] By the 1960s in Western Europe, two new international cooperative programs were established, the European Space Research Organisation (ESRO) and the European Launcher Development Organization (ELDO), both to facilitate cooperative space development in Western Europe. In 1975, ESRO and ELDO were consolidated into the European Space Agency.

Nowadays, with respect to regional government organizations with general functions, the European Space Agency (ESA)[82] is considered the most successful regional organization.

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[80] In 1964, Intelsat established the first commercial global satellite communications system and changed the way the world connects. This landmark achievement enabled people, businesses and governments to communicate instantly, reliably and simultaneously, for the first time, from all corners of the globe. With a global workforce representing more than 90 countries, and a satellite fleet that covers more than 99% of the world's population, Intelsat is the definition of an international company.

[81] E.R.C. VAN BOGAERT, ASPECTS OF SPACE LAW 264-276 (Kluwer Law and Taxation Publishers 1986).

[82] The European Space Agency is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe. ESA has 15 Member States: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Greece and Luxem-

With respect to regional government organizations with specialized functions, the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)[83] and the Arab Satellite Communications Organization (ARABSAT)[84] are two leaders.

C. Bilateral Space Cooperation Level

Bilateral cooperation between countries is the primary method used to realize and promote international activities, especially in the field of space. Since recognizing the importance of space science and space applications in the understanding of the Universe, education, health, environmental monitoring, management of natural resources, disaster management, meteorological forecasting and climate modeling, satellite communications and navigation, and the major contribution that space science and technology make to the higher standards of living and conditions of economic, social, and cultural development, many States have entered into bilateral agreements and conventions, each with their own objectives.[85] Agreements range

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bourg are expected to become members of ESA in 2005. In addition, Canada and Hungary participate in some projects under cooperation agreements. By coordinating the financial and intellectual resources of its members, it can undertake programs and activities far beyond the scope of any single European country.

[83] The European Organisation for the Exploitation of Meteorological Satellites is an intergovernmental organisation created through an international convention agreed by 18 European Member States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. These States fund the EUMETSAT programs and are the principal users of the systems. EUMETSAT also signed 11 Cooperating State Agreements. The agreements with Croatia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia have entered into force, whereas the agreements with Bulgaria, the Czech Republic and Serbia and Montenegro are to be ratified by the respective governments in the near future.

[84] The Arab Satellite Communication Organization (ARABSAT) was established by the member States of the Arab League with a broader goal; to serve the needs of Telecommunication, Information, Culture and Education sectors. ARABSAT was given a mandate to design, configure and operate a satellite system, as well as to define and deliver a portfolio of satellite-based, public and private telecommunications services to the Arab States, in accordance with the International Standards.

[85] The list of activities fostered through such cooperation includes: (a) the provision of a launch for satellites; (b) the "loan" of an orbiting satellite or of part of its capacity; (c) the loan of ground equipment; (d) the provision of sound rockets for scientific experiments; (e) the provision of tracking support for spacecraft; (f) the Provision of the recep-

from arrangements for technical assistance, education and training, financial assistance for space projects, to the establishment of a network of satellite communication systems. Cooperation extends from basic science to operational application. They include bilateral cooperation between space-faring countries,[86] and between the space-faring nations and developing nations,[87] as well as between international organizations and developed countries or developing countries.[88] However, there has been increasingly little bilateral cooperation between the developing countries.[89]

V. CONCLUSION

There is no question as to the importance and binding character of the principle of international cooperation as defined in the UN Charter, international law, and international space law. Without a doubt, greater benefits from space can be derived by intensifying international cooperation. However, since

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tion of data; (g) the exchange or provision of scientific and other data; (h) the provision of training facilities; (I) the provision of advice and consultancy; (j) joint planning, development and manufacturing of space systems; (k) integration of payloads/experiments of one country in the other country's satellites/space vehicles; (l) rendezvous of space vehicles; (m) complementary space missions; and, (n) joint flights by cosmonauts from two countries on space stations of one of these countries. *See International Space Programmes and Policies*, *supra* note 64, at 121.

[86] *Id.* Bilateral cooperation between developed countries or spacefaring countries has also been very productive. It has enabled a pooling of skills and sharing of cost, to mutual advantage and resulting in the development of new technologies and systems. *See also* UNISPACE-III, *Promotion of International Cooperation, supra* note 2, U.N. Doc A/CONF.184/BP/12 (1998).

[87] *International Space Programmes and Policies*, *supra* note 64, at 121. Bilateral cooperation between spacefaring nations and some developing nations has had very beneficial results. It has often begun the processes of space technology development and application in developing countries and has, in many cases, led to demonstration or experimental projects in space applications and science. Such demonstration projects have been of great importance for the adoption of various space applications in developing countries. *See also* UNISPACE-III, *Promotion of International Cooperation, supra* note 2, U.N. Doc A/CONF.184/BP/12 (1998).

[88] UNISPACE-III, *Promotion of International Cooperation, supra* note 2, U.N. Doc A/CONF.184/BP/12 (1998). As a regional intergovernmental organization, ESA has also entered into several bilateral agreements with both spacefaring and non-spacefaring States covering different space activities.

[89] *International Space Programmes and Policies*, *supra* note 64, at 122; UNISPACE-III, *Promotion of International Cooperation, supra* note 2, U.N. Doc A/CONF.184/BP/12 (1998).

the dawn of the space age, international cooperation in space activities has not been, *de facto*, entirely successful as evidenced by the widening gap between industrialized and underdeveloped countries so evident in this era. As a result of complex political, economic, educational, scientific and technological, and other global problems, there has been almost exclusively only international cooperation for sustainable space development among the developed countries. The United Nations has urged nations, particularly the developing countries, to cooperate in the exploration and peaceful use of outer space. International, regional, and bilateral cooperation is beginning to be recognized by many as an effective way of stimulating the use and development of space science and technology and helping bridge the gap in space science and technology knowledge between member countries.

In order to move this process forward, any cooperation for sustainable space development among developing countries should be identified and its benefits shared among States. In particular, there should be regional cooperation within geographically close countries, such as members of the Association of Southeast Asian Nations (ASEAN). The benefits of such cooperation in the exploration and use of outer space include the reduction of natural resource consumption, increase in job distribution, the development and coordinated building of space knowledge, and the decrease in competition among participating countries. If, despite widely varying levels of economic, scientific, technological, and industrial development, there is regional space cooperation between ASEAN nations, this cooperation could be an effective way of stimulating the use of space applications and the development of space science and technology, and helping bridge the gap in space science and technology knowledge between member countries. These advancements could also contribute to accelerated economic, cultural and social growth and help these poorer countries leapfrog stages in development.

SATELLITE EARTH OBSERVATION AS "SYSTEMATIC OBSERVATION" IN MULTILATERAL ENVIRONMENTAL TREATIES

Masami Onoda[*]

"In the middle of the 20th Century, we saw our planet from space for the first time."

– "Our Common Future", World Committee on Environment and Development, 1997

"Some people say that environmental protection hinders economic development, but I disagree with this. I think that environmental protection and economic development can both be achieved through the power of science and technology."

– Remarks by Prime Minister J. Koizumi at Earth Observation Summit II, 2004

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I. INTRODUCTION

It was the view of Earth from outer space that inspired the world to see the environment as a whole, and to move forward to protect it.[1] Half a century has passed since then, and the images taken from space have offered information on the Earth's environment, revealing the ozone hole, the *El Nino* phenomenon, global precipitation, forest cover and various other features. Such information plays a significant role in international environmental frameworks, in particular in "systematic observation" as provided in the Vienna Convention for the Protection of the Ozone Layer[2] and the United Nations Framework Convention on Climate Change.[3] The specific role of the information is still somewhat ambiguous in relation to the principles of environmental law and rights and responsibilities of States.

When the first image of planet Earth was taken, remote sensing[4] had originated with the dawn of the space age, driven by motivations rooted in national prestige and international power balance in the times of the Cold War. The 1967 Outer Space Treaty[5] and the 1986 U.N. Remote Sensing Principles[6] have been the major legal instruments governing remote sensing activities. Primarily because of the limited range of outer space activities, these instruments were able to achieve certain innovative agreements – though in many aspects reached by a compromise – on how to coordinate sovereign rights and State responsibility with the international common interest for space development. Nevertheless, while these instruments encouraged freedom of exploration, use of outer space and international co-

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[1] *See* OUR COMMON FUTURE: THE WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (G. Bruntland ed., 1987).

[2] Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, T.I.A.S. No. 11,097, 1513 U.N.T.S. 293 [hereinafter Vienna Convention].

[3] United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC].

[4] *See* discussion *infra* Section II for descriptions of remote sensing.

[5] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Jan. 1, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 2005 [hereinafter Outer Space Treaty].

[6] Principles Relating to Remote Sensing of the Earth from Space, G.A. Res. 41/65, Annex, U.N. Doc. A/RES/41/65/Annex (Dec. 3, 1986) [hereinafter Remote Sensing Principles].

operation in scientific investigation, they lacked agreement on how to systematically collect and exchange information, and how to specifically utilize acquired scientific information. In other words, at this early stage, States were not sure why or how to collect and use the scientific information obtained through space activities. Associated to the question was what specifically "province of all mankind"[7] was to mean.

During the last decades however, remote sensing has been largely re-directed towards international cooperation for providing information required by and under the rules of international environmental law: to monitor this planet by means of enhanced science and technology, in hope of sustaining the Earth's environment for the next generations. This is why today remote sensing is commonly called "(satellite or space-based) Earth observation." What is the significance of this re-direction in terms of international law? Are such activities deemed as an international obligation, and what are the rights and responsibilities of States?

To answer these questions, the author would like to start from the following hypothesis: *It is a general obligation of international environmental law for States to cooperate in promotion of global Earth observation to protect the environment.* If the prime objectives of remote sensing programs were of national interest, as was the situation at the outset, then it would have been difficult to lay down such an obligation. So if there is, to any extent, such an obligation for international cooperation today, there must have been a different interest to be protected. A key underlying this issue is how States pursue the protection of an emerging common interest: *the environment*, or the *global commons*. Also, it is essential to consider the change of States' *attitude towards scientific information*. This relates to the so-called "precautionary principle" in terms of the significance of scientific understanding. This "principle" – or an "approach" at least – reflects the altered role of scientific information, calling for States to take political measures even when there is scientific uncertainty. It is in this context that States are to enjoin

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[7] Outer Space Treaty, *supra* note 5, art. I.

themselves in the promotion of monitoring, or more specifically, systematic observation of the Earth's environment.

Therefore, the aim of this paper is to examine and identify *the change in the role of scientific information in defending the global commons*, regarding "systematic observation" as a key issue to this matter. The paper will examine the case for Earth observation and will attempt to streamline an agreed general obligation, through principles and rules of international law, down to its implementation phase. The lack of this process has been most often the case for national space development programs, which are too often technology-oriented and pay less attention to the fundamental need. On the other hand, there are to date numerous environmental treaties, each attempting to establish a working framework for the protection of the environment. However, securing implementation is one of the most difficult issues, and if there is no implementation, the whole work for negotiation would have been in vain. Thus, such a coherent examination from State agreement to implementation, linking law and technology through the subject of information, should be a worthwhile subject.

There have been several recent studies to link Earth observation activities to the environmental conventions. There are studies on the issue of contributions by remote sensing technology to Multilateral Environmental Agreements (MEAs) and how to utilize satellite data for supporting the international environmental frameworks.[8] As a result, there are growing links and dialogs today with the space sector and the environmental sector, not only at the scientific but also at the political level. Nev-

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[8] *See generally* Christian Patermann & Werner Richter, *International Treaty Monitoring by Earth Observation*, 48 GERMAN JOURNAL OF AIR AND SPACE LAW (ZLW) 187, 187-194 (1999); International Society for Photogrammetry and Remote Sensing (ISPRS), REMOTE SENSING AND THE KYOTO PROTOCOL: A REVIEW OF AVAILABLE AND FUTURE TECHNOLOGY FOR MONITORING TREATY COMPLIANCE (Ake Rosenqvist, Marc Imhoff, Anthony Milne & Craig Dobson eds., 1999) [hereinafter MONITORING TREATY COMPLIANCE], *available at* http://www.eecs.umich.edu/kyoto/kyoto/KP&RS_WS-Rep_ISPRS_VII-5&6.pdf (last visited Nov. 11, 2005); Karen Kline & Kal Raustiala, *International Environmental Agreements and Remote Sensing* Technologies (2000), *available at* http://sedac.ciesin.columbia.edu/rs-treaties/rs-treaties_bckgnd.pdf (last visited Nov. 11, 2005); Ikuko Kuriyama, *Supporting Multilateral Environmental Agreement with Satellite Earth Observation*, 21 SPACE POLICY 151, 51-160 (2005).

ertheless, it is far from establishing a consensus on how and to what extent space technology should contribute to the broad and complicated agenda of protecting the environment. Meanwhile, very little study has been made from the perspective of environmental policy or law on this issue. Overall, because of the insufficiency on the part of technology development to direct and apply itself to the fundamental policy needs of human society, and on the part of the human society to identify their own fundamental requirements and direct their technology towards it, neither has been able to find a way to overcome the situation.

The issue here is how to effectively correlate these two processes, which lack a theoretical and practical approach of uniformity. This paper will analyze, through agreement between States, the vision of Earth observation as an integral part of the environmental legal framework, and consider through the agreement and practice of States if such a vision is realizable, proposing alternatives and a possible way forward. Legal consideration would be the basis of discussion, taking into account political and technical aspects as background elements. It should serve as a case study on whether legal instruments could be effective in ensuring implementation of an international framework based on a harmonization of national policies and science and technology initiatives.

Section two of this paper will examine the general principles of international environmental law relevant to Earth observation, the change of the interest to be protected, i.e. the global commons, and the need and role of its "monitoring". The next section discusses the significance of "systematic observation" as a specific form of monitoring, provided in the environmental treaties for the protection of atmosphere and climate change. Section three examines the sufficiency of the existing legal framework in meeting these requirements and identifies if there are any legal voids remaining. The conventional legal instruments governing activities in outer space will be considered, examining the rights and obligations attached to the activity in the field of traditional space law. The next section will walk through national practices and consider how the Earth observation data policy of each country has developed. Then, the efforts for multilateral coordination of these programs and policies will

be examined, and how the concept of the Global Earth Observation System of Systems (GEOSS) has emerged as a contribution to systematic observation. The next section will present the prospects and issues towards effective implementation, including the potential role of Earth observation to enforcing the treaty procedures, and frameworks needed at the global, international and national level as well as technical adequacy and cost efficiency. Some considerations on the role of the rising commercial sector will also be made. Finally, the author would propose a vision of a framework in defending the global commons, the whole issue described above being the first phase of the broader picture. The final section will give a few conclusions with a future prospect for international space and environmental law.

II. DEFINITION – REMOTE SENSING AND EARTH OBSERVATION

Remote sensing is a relatively new term that came into use around the 1950s - 60s in the U.S.[9] In short, it refers to "the technology for measuring the shape, size and characteristics of an object from a distance without directly contacting it."[10] A comprehensive definition of applied remote sensing is:

> the acquisition and measurement of data/information on some property(ies) of a phenomenon, object, or material by a recording device not in physical, intimate contact with the feature(s) under surveillance; techniques involve amassing knowledge pertinent to environments by measuring force fields, electromagnetic radiation, or acoustic energy employing cameras, radiometers and scanners, lasers, radio frequency re-

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[9] Nicholas M. Short, Remote Sensing Tutorial, Introduction: Technical and Historical Perspectives of Remote Sensing (2004) [hereinafter Remote Sensing Tutorial], *at* http://www.fas.org/irp/imint/docs/rst/Intro/Part2_1.html (last visited Dec. 14, 2005). The writer indicates that the term "remote sensing" had been coined in the mid-1950's by Ms. Evelyn Pruitt, a geographer/oceanographer with the U.S. Office of Naval Research (ONR), to take into account the new views from space obtained by the early meteorological satellites which were obviously more "remote" from their targets than the airplanes that up until then provided mainly aerial photos as the medium for recording images of the Earth's surface. *Id.*

[10] JAPAN ASSOCIATION OF REMOTE SENSING, WAKARIYASUI RIMOTO SENSHINGU TO CHIRIJYOHO SHISUTEMU [BASIC REMOTE SENSING AND GIS] 4 (National Space Development of Japan, 1996).

> ceivers, radar systems, sonar, thermal devices, seismographs, magnetometers, gravimeters, scintillometers, and other instruments.[11]

A more simplified and restricted definition is: "Remote Sensing is a technology for sampling radiation and force fields to acquire and interpret *geospatial data* to develop information about features, objects, and classes on the Earth's land surface, oceans, and atmosphere."[12]

The 1986 U.N. Remote Sensing Principles provides the following definition:

> The term "remote sensing" means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment.[13]

Remote sensing of the Earth is called *Earth observation.* While remote sensing is essentially a technical term, Earth observation has a more general implication. Literally, it means "to observe the Earth," including observations not only from space but also by means of *in-situ,* or *ground* observations (e.g. measurement performed on ground by people, or by using sensors on balloons, buoys, airplanes etc.). However, in the generally used, more limited sense, Earth observation refers to satellite remote sensing of the Earth, and is sometimes referred to as *satellite* or *space-based* Earth observation as distinguished from ground observations. In this paper, the term "Earth observation" will be used in the limited sense of space-based Earth observation, unless expressly defined as being used in the broader sense including ground observation.

Earth observation satellites are satellites specifically designed to observe Earth from orbit, sometimes including reconnaissance purposes, but generally civil systems are

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[11] Remote Sensing Tutorial, *supra* note 9.

[12] *Id. See* also AMERICAN SOCIETY OF PHOTOGRAMMETRY AND REMOTE SENSING, 2 MANUAL OF REMOTE SENSING (Floyd M. Henderson & Anthony J. Lewis, eds., 1998).

[13] Remote Sensing Principles, *supra* note 6, at princ. I. The latter phrase defines the range of remote sensing to be subject to the provisions of the Principles.

intended for uses such as environmental monitoring, resource monitoring, meteorology, and mapping. Today, such systems make a considerable contribution to the collection of data required for a wide range of sectors, including climate and environmental studies, and providing other economic, societal and humanitarian benefits as a result.[14]

A. International Coordination and Harmonized Global Observation

Remote sensing is different from other space systems in that a significant portion of the output of the system depends on the process through a larger information management system of which remote sensing is an integral part. Besides the demonstration of the capability of the satellite, the substantive results lie in the use of data derived from the satellite. In this sense, it is similar to satellite communications, but the difference is that the data is acquired in space, then transmitted to Earth, received by a ground station under the coverage of the satellite, recorded, processed and archived. The data could be distributed, and with further added value, serve the needs of respective applications. The analyzed data may be input to another management system, and provide the information needed. The data requests of users will be feedback to future satellite system development. Thus, a circle of continuous monitoring, data use and technology development is formed. Earth observation is about correlating the satellite data and other information to be integrated into larger information systems that provide useful information for scientific research and decision making.

With the geographical significance of remote sensing data of being tied to definite locations on the Earth, it becomes a powerful tool by being integrated into Geographic Information System (GIS). In this way, the system provides large volumes of spacial data in an accessible and retrievable way, now playing an essential role in many fields of planning, decision making and management.

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[14] *See* Committee on Earth Observation Satellites, Earth Observation Handbook (2002), *at* http://www.eohandbook.com/ (last visited Dec. 14, 2005).

These features of Earth observation indicate that there is no point in developing separate satellite systems or information systems in individual countries. The early efforts could be seen in the initiatives of the Committee on Earth Observation Satellites (CEOS), established in 1984, to develop a harmonization of space programs, as well as standard data formats and services, and data principles.[15] With the increasing international awareness towards environmental issues, the capability of satellites was of great advantage, and the international space community heavily turned to environmental monitoring. In 1998, the Integrated Global Observing Strategy Partnership (IGOS-P) was established.[16] Together with the expanding need for global observations, a number of other multilateral initiatives were established during this timeframe.[17]

In parallel an increasing number of environmental agreements came into existence, and provisions for research and systematic observations, monitoring, or scientific research cooperation were included in most of them. The Vienna Convention for the Protection of the Ozone Layer expressly mentioned satellite measurement as a means of the treaty process.[18] This gave the space community the momentum to link their activities to the frameworks of conventions, and such interrelations were developed through the World Summit for Sustainable Development (WSSD) held in Johannesburg in 2002. The WSSD Plan of Implementation adopted several proposals of Japan, the United States and Europe supported by other countries including the developing countries, on actions for satellite Earth observation and global mapping, and integrated global observations.[19] At the same time, efforts to identify the adequacy of global observa-

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[15] Committee on Earth Observation Satellites, *Homepage*, *at* http://www.ceos.org/ (last visited Oct. 30, 2005).

[16] Integrated Global Observing Strategy Partnership, *Homepage*, *at* http://www.igospartners.org/ (last visited Oct. 30, 2005).

[17] *See* discussion *infra* Section IV.

[18] Vienna Convention, *supra* note 2, at art. 3, annex I.

[19] *Report of the World Summit on Sustainable Development, Plan of Implementation of the World Summit on Sustainable Development*, U.N. Doc. A/CONF. 199/20 (2002). [hereinafter World Summit], *available at* http://www.johannesburgsummit.org/html/documents/summit_docs.html (last visited Dec. 14, 2005).

tions for climate change[20] were carried out by Global Climate Observing System (GCOS),[21] and have been reported to the Conference of Parties (COP) to the United Nations Framework Convention for Climate Change (UNFCCC). Seeing the situation had matured, the U.S. took the initiative to host the first ministerial Earth Observation Summit in Washington D.C. in 2003. The third Earth Observation Summit took place in Brussels in February 2005, initiating the formation of a Global Earth Observation System for Systems (GEOSS).[22] This will be further discussed in section IV.C.

In half a century, the remote sensing programs that started out as individual national satellite projects are moving towards integration into a global multilateral system of systems. However, it is noteworthy that such rapid evolution has taken place while little has changed in the legal framework governing space activities. Nevertheless, the legal terms covering Earth observation activities seem to have shifted, or expanded, from the traditional space law regime to include a branch of environmental law, as Earth observation – particularly as integrated with ground observations – provides invaluable information for decision-making in environmental issues. The role of integrated Earth observation is developing as the role of scientific information has evolved in environmental law. The following sections will examine how this development has occurred, and the legal implications involving these programs.

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[20] *See* Global Climate Observing System (GCOS), *The Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCC* [hereinafter *GCOS Second Adequacy Report*], *available at* http://www.wmo.ch/web/gcos/Second_Adequacy_Report.pdf. (last visited Oct. 30, 2005).

[21] The GCOS is sponsored by: the World Meteorological Organization (WMO), United Nations Educational, Scientific and Cultural Organization (UNESCO) and its Intergovernmental Oceanographic Commission (IOC), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU). GCOS, *What is GCOS, at* http://www.wmo.ch/web/gcos/whatisgcos.htm (last visited Oct. 30, 2005).

[22] *See generally* Group on Earth Observations, *Homepage*, *at* http://earthobservations.org/ (last visited Oct. 30, 2005).

III. PROTECTION OF THE ENVIRONMENT AND SYSTEMATIC OBSERVATION

This section deals with the legal development in multilateral treaties for the protection of the global environment, and the status of monitoring the environment in the treaty framework. Further, it will discuss how the undertakings of "systematic observation" in two major environmental conventions, namely, the Vienna Convention for the Protection of the Ozone Layer and the United Nations Framework Convention on Climate Change, have emerged. As we have seen in the previous section, space-based Earth observation technology, first carried out as individual national space flight programs, has developed into a worldwide harmonized effort in monitoring the global environment. It has revealed the changing features of the globe, the atmosphere, the oceans, the forests, and ecosystems. This technology has been used as one of the central undertakings of States to manage the preservation of the environment, under the newly recognized principles and guidelines of international law. First, the status of monitoring in light of customary law and its relation to the general legal principles of international environmental law will be discussed. Then the treaties that provide the undertakings for systematic observation will be examined. Finally, the role of satellite Earth observation in systematic observation will be considered, leading to further discussions on the applicable legal principles and instruments.

A. International Environmental Law and Monitoring

1. Customary Law and General Principles on the Protection of the Environment

Conventional customary law provides that States have the duty to carry out activities within their territories or in common spaces with regard for the right of other States, that is, by reference to the maxim *sic utere tuo, ut alienum non laedas* or

"principles of good neighborliness".[23] The Stockholm Declaration[24] has given more clarity to the emerging environmental principles, which have been given more detail, and support, through the Rio Declaration[25] and subsequent treaties.

Today, it is possible to say that a body of law called "international environmental law" has developed as a branch of international law.[26] The source of such law comprises very numerous legal instruments, a substantial part of which are the multilateral treaties adopted since the U.N. Conference on the Human Environment at Stockholm in 1972.[27] To date, there are hundreds of multilateral environmental agreements,[28] which include the 1973 MARPOL Convention,[29] 1979 Geneva Convention on Long-Range Transboundary Air Pollution,[30] 1985 Vienna Convention for the Protection of the Ozone Layer, 1972 London Dumping Convention,[31] 1989 Basel Convention on the Control of Transboundary Movement of Hazardous Wastes,[32] 1973 Convention on International Trade in Endangered Species of Wild

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[23] PATRICIA BIRNIE & ALAN BOYLE, INTERNATIONAL LAW & THE ENVIRONMENT 104 (2d ed., 2002); SOJI YAMAMOTO, KOKUSAIHO (SHINPAN) 275, 660 (International Law: New Edition, 2002).

[24] Declaration of the United Nations Conference on the Human Environment, U.N. Doc. A/CONF.48/14/Rev.1 (1973) [hereinafter Stockholm Declaration] *available at* http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1503 (last visited Dec. 13, 2005).

[25] Rio Declaration on Environment and Development, 31 I.L.M. 874 (1992) [hereinafter Rio Declaration].

[26] BIRNIE, *supra* note 23, at 1.

[27] *Id.* at 10-27.

[28] United Nations Environmental Programme, *at* http://www.unep.org/dpdl/Law/Law_instruments/index.asp (last visited Oct. 15, 2005). As of March 2005, there are 242 Multilateral Environmental Agreements since 1933. *Id.*

[29] International Convention for the Prevention of Pollution by Ships (MARPOL), Nov. 2, 1973, 12 I.L.M. 1319 [hereinafter Prevention of Pollution Convention], *available at* http://sedac.ciesin.org/entri/texts/pollution.from.ships.1973.html (last visited Dec. 14, 2005).

[30] Convention on Long-Range Transboundary Air Pollution, Nov. 13, 1979, 34 U.S.T. 3043, 1302 U.N.T.S. 217 [hereinafter Long-Range Air Pollution].

[31] London Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter, 1972, 11 I.L.M. 1294 [hereinafter Marine Pollution Convention], *available at* http://www.londonconvention.org/documents/lc72/LC1972.pdf (last visited Dec. 14, 2005).

[32] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Mar. 22, 1989, 1673 U.N.T.S. 57, *available at* http://www.basel.int/text/con-e.htm (last visited Dec. 14, 2005).

Fauna and Flora,[33] and very numerous others. Birnie and Boyle, in 1992, pointed out that the emphasis in these treaties has changed from older rules of customary law to the prevention of environmental harm and the conservation and sustainable development of natural resources and ecosystems.[34] Further, Birnie and Boyle noted that the Rio Declaration on Environment and Development[35] "constitutes at present the most significant universally endorsed statement of general rights and obligations of States affecting the environment," and they "claim only that the Declaration's contribution to the codification and progressive development of international law relating to the environment has been and is likely to remain considerable and significant."[36]

This said, they suggest that two propositions enjoy significant support in States' practice, judicial decisions, the pronouncements of international organizations, and the work of the International Law Commission and can be regarded as customary international law, or in certain aspects as general principles of law: (i) that States have a duty to prevent, reduce, and control pollution and environmental harm, and (ii) a duty to co-operate in mitigating environmental risks and emergencies, through notification, consultation, negotiation and in appropriate cases, environmental impact assessment.[37] Based on Principle 2 of the Rio Declaration, arbitral and judicial decisions and a wide range of global and regional treaties, "it is beyond serious argument that States are required by international law to take adequate steps to control and regulate sources of serious global environmental pollution or transboundary harm within their territory or subject to their jurisdiction."[38] Also, as required by Principles 17 and 19 of the Rio Declaration, a second principle is that

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[33] Convention on International Trade in Endangered Species of Wild Fauna and Flora, Mar. 3, 1973, T.I.A.S. No. 11079, 993 U.N.T.S. 243.

[34] BIRNIE, *supra* note 23, at 84.

[35] Rio Declaration, *supra* note 25.

[36] BIRNIE, *supra* note 23, at 82-84.

[37] *Id.* at 104-105.

[38] *Id.* at 109.

States are required to co-operate with each other in mitigating transboundary environmental risks.[39]

In 2001, Cassese suggested that there are not many principles formulated in environmental law.[40] The first one is that "enjoining every State not to allow territory to be used in such a way as to damage the environment of other States or of areas beyond the limits of national jurisdiction." Another general principle, borne out by the great number of treaties existing in this area, is that "States [have] the obligation to co-operate for the protection of the environment."[41] A less vague principle is the requirement that every State immediately "notif[ies] other States of the possible risk that their environment may be damaged or affected" by an accident that has occurred on its territory or in an area under its jurisdiction, and lastly, enjoining States to "refrain from causing massive pollution of the atmosphere or the seas".[42] He does not affirm that any specific customary rule has taken shape.

It would be fair to say that every state has a general obligation (1) to use its national territory in a manner that does not harm the environment of other States or of areas beyond national jurisdiction and (2) to cooperate for the protection of the environment. The former principle primarily concerns the States' obligations in the manner in which to carry out their own respective national activities, while the latter concerns the obligations in the cooperation with other States. For the first point, as the early significances were shown in judicial precedents such as the Trail Smelter case, Corfu Channel case and the *Cosmos 954* case, Principle 21 of the 1972 Stockholm Declaration of the United Nations Conference on the Human Environment is a particularly important evidence of States' agreement. It affirms that States have "the sovereign right to exploit their own resources pursuant to their own environmental policies," and at the same time that they have "the responsibility to

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[39] *Id.* at 126-137.

[40] ANTONIO CASSESE, INTERNATIONAL LAW 381 (New York: Oxford University Press, 2001).

[41] *Id.* at 382.

[42] *Id.*

ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."[43] It is observed that the totality of the provision, including its reference to responsibility for environmental damage, was regarded by many States present at the Stockholm Conference, and subsequently by the U.N. General Assembly, as reflecting customary international law,[44] and has been a highly influential statement in the subsequent development of law and practice. It requires States to take suitable preventive measures to protect the environment. Consequently, this is the primary purpose of most environmental treaties including the 1985 Vienna Convention, the MARPOL Convention, the 1982 UNCLOS[45] and 1992 UNFCCC[46]. The 1992 Rio Declaration took this further in Principle 2 requiring States to prevent harm to the environment of other States or areas beyond national jurisdiction.[47] Principle 18 requires States to notify of any natural disasters or emergencies likely to produce sudden harmful effects on the environment of other States.[48] Principle 19 requires States to provide prior and timely notification, relevant information, and consultation in good faith before undertaking activities that may have a significant adverse transboundary environmental effect.[49] These statements in the Rio Declaration have lead to further elaboration of international law by the International Court of Justice.[50]

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[43] Stockholm Declaration, *supra* note 24, at princ. 21.

[44] *Id.* at ch. VII, ¶¶ 64-6.

[45] United Nations Convention on the Law of the Sea, Dec. 10, 1982, S. Treaty Doc. No. 103-39, 1833 U.N.T.S. 3 [hereinafter UNCLOS].

[46] UNFCCC, *supra* note 3.

[47] Rio Declaration, *supra* note 25, at princ. 2.

[48] *Id.* at princ. 18.

[49] *Id.* at princ. 19.

[50] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶29 (July 8) *available at* http://www.dfat.gov.au/intorgs/icj_nuc/unan5a_a.html (last visited Dec. 14, 2005); Case Concerning the Gabčíkovo-Nagymaros Dam, 1997 I.C.J. 7. *See Symposium: The Case Concerning the Gabčíkovo-Nagymaros Project*, 8 Y.B. INT'L ENV'T L. 3-50 (1997).

2. Managing the Global Commons and the Role of Environmental Information

While it is a reasonable extension of the traditional customary law that States should cooperate in preventing transboundary harm, by means such as consultation or notification, whether or not States have the obligation of cooperation to protect the environment in itself, is more the question. Environment was identified in an international treaty of 1993 as including "natural resources both abiotic and biotic, such as air, water, soil, fauna and flora and the interaction between the same factors; property which forms part of the cultural heritage; and the characteristic aspects of the landscape."[51]

Kiss suggests that many of the codified norms and customary standards in the environmental field may be viewed as obligations *erga omnes*.[52] Yamamoto distinguishes between environmental damage subject to remedy, and environmental risk based on probability and foreseeability, and that international environmental interests should only be sustained through aid of international management and cooperation. He further points out the general notion of "global environmental security" such as relating to the climate, biological, chemical, or relating to life security, and the necessity of international common legal measures in order to eliminate and prevent risks that threaten human common existence, and that international cooperation is essential for this purpose.[53] Cassese considers that the decision in the Trail Smelter[54] case has alluded to the principle of "cooperat[ion] for the protection of the environment," and that it was restated in Principle 24 of the 1972 Stockholm Declaration,[55] reflecting a new approach to environmental issues, based on the assumption that the environment is a matter of *general* concern.

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[51] Council of Europe Convention on Civil Liability for Damage Resulting from Activities Dangerous to the Environment, June 21, 1993, art. 2.10, 32 I.L.M. 1228, 1232.

[52] CHARLES ALAXZANDRE KISS & DINAH SHELTON, INTERNATIONAL ENVIRONMENTAL LAW 59 (New York: Transnational Publishers, Inc., 2nd ed., 2000).

[53] YAMAMOTO, *supra* note 23, at 662-664.

[54] Trail Smelter Arbitration (U.S. v. Can.), 3 R. Int'l Arb. Awards 1911 (1938), 3 R. Int'l Arb. Awards 1938 (1941).

[55] Stockholm Declaration, *supra* note 24, at princ. 24.

He further notes that given its looseness, this principle can only be applied jointly with the customary rule on good faith: every State must in good faith endeavor to cooperate with other States with a view of protecting the environment, a blunt refusal of which would amount to a breach of the principle.[56]

"The environment" as common interest (or *erga omnes* if it applies) is indeed a rather general or loose notion and seems rather ambiguous as a legally protected interest. Both the 1972 Stockholm Declaration and the 1992 Rio Declaration point to the issue from a clearly anthropocentric approach. That is, that "[m]an is both creature and moulder of his environment" and that "[t]he protection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world"[57] as stated in the Stockholm Declaration, taken further in the Rio Declaration stating that "human beings are the centre of concerns for sustainable development,"[58] and the Johannesburg Declaration starts with the recognition that "humankind is at a crossroads."[59] If it is right to observe that at least the general agreement of States through these major declarations is to protect the environment primarily because of human interests, then there arises the question why "the environment" could be a legal interest to be protected. If this is no more of an extension of the traditional principle of territorial sovereignty, it is only a matter of recognition that certain environmental elements would be affected as a whole by the collective or individual act of State(s).

Birnie and Boyle suggest that the protection of the global commons,[60] or areas of common concern, such as the high seas, ozone layer or global climate, presents a comparable problem to the protection of human rights as *erga omnes*, in that without community standing there might be no "injured" state capable

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[56] CASSESE, *supra* note 40, at 382.

[57] Stockholm Declaration, *supra* note 24, ¶ 1.

[58] Rio Declaration, *supra* note 25, at princ. 1.

[59] The Johannesburg Declaration on Sustainable Development, World Summit on Sustainable Development, princ. 7, U.N. Doc. A/CONF.199/L.6/Rev.2 (2002), revised by U.N. Doc. A/CONF.199/L.6/Rev.2/Corr.1 (2002) [hereinafter Johannesburg Declaration].

[60] OUR COMMON FUTURE, *supra* note 1, at ch. 10 (defining global commons as oceans, outer space, and Antarctica).

of holding States responsible for the violation of these obligations.[61] Thus, they suggest that "collective supervision of such global responsibilities by inter-governmental treaty commissions or conferences of the parties will often be a more effective and realistic remedy than public interest claims and countermeasures by individual States."[62]

This leads to the crucial role of environmental information, and the functioning of international organizations. All the fundamental bases for decision of States, such as whether the specific "use of territory" would "harm" other States or areas beyond national jurisdiction, and how and when and for what sort of information should States "cooperate" in notifying, consulting or assessing for the protection of the environment, and why rules such as the emerging "precautionary principle" apply, would be based on information of the state of environmental harm or risk. Therefore, it is essential to understand what in fact the features of environmental information are, and the rights and obligations of States in handling it.

3. Legal Status of "Monitoring"

In protecting the global commons, there is little possibility that responsibility of a certain State or States can be identified for a damage or risk, or even if the damage or risk itself can be proved. This is different from the conventional approach to due diligence in terms of state responsibility. Now in the implementation of these environmental treaties it is recognized that a different approach is needed, not only for compliance but for the implementation of the objectives of the treaty. That is the major reason why these treaties lay down the issue of "supervisory techniques" such as monitoring and reporting, fact-finding and research, inspection, or non-compliance procedures.[63] These are the procedural techniques on which to build the decisions on measures to be taken by States.

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[61] BIRNIE, *supra* note 23, at 196.
[62] *Id.* at 198.
[63] *Id.* at 206-211.

For example, the 1982 UNCLOS provides that "monitoring" is a process whereby States "observe, measure, evaluate and analyse, by recognized scientific methods, the risks or effects of pollution or environmental harm."[64] Yamamoto also perceives "monitoring" as a means to follow-up an environmental impact assessment (EIA), and also mentions procedural international cooperation in providing the information and knowledge obtained by EIA and monitoring.[65] In practice, "monitoring" plays an important role through applications for human and natural disasters and surveillance and other features that might have impact on the environment of other States.

Cassese provides that monitoring mechanisms taken by international organizations, which could represent either the collectivity of States behind a particular treaty, or the whole of humanity, would have the task of both verifying whether States are complying with international standards and promoting respect for such standards. His classification, based on a survey of the numerous treaties, is that the most widespread supervisory systems may be grouped into four main classes: (a) States' self-reporting procedures; (b) inspection; (c) so-called non-compliance procedures; (d) preventive global monitoring. He describes the fourth system as being different from the others in that it is not primarily designed to verify whether States infringe international rules for the protection of the environment, but rather to collecting data and information so to better prevent possible damage to the environment.

In this sense, monitoring is closely related to the so-called "precautionary principle,"[66] whereby an entity should take all necessary precautions to avoid damage to the environment. While earlier treaties such as the 1972 London Dumping Convention[67], 1973 MARPOL Convention[68] and 1982 UNCLOS[69] imply the general obligation on the part of States to act with due

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[64] UNCLOS, *supra* note 45, at art. 204.

[65] YAMAMOTO, *supra* note 23, at 666.

[66] *See generally* THE PRECAUTIONARY PRINCIPLE AND INTERNATIONAL LAW: THE CHALLENGE OF IMPLEMENTATION (David Freestone & Ellen Hey, eds., 1996).

[67] Marine Pollution Convention, *supra* note 31.

[68] Prevention of Pollution Convention, *supra* note 29.

[69] UNCLOLS, *supra* note 45.

diligence, more recent treaties including the UNFCCC[70] and Biodiversity Convention[71] adopt an approach a further step beyond what was suggested by Principle 21 of the Stockholm Declaration. That is, the approach based on Principle 15 of the 1992 Rio Declaration on Environment and Development:

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[72]

This is a statement of the "precautionary approach." There has been much argument on the terminology of "precautionary principle," "approach" or "measures," which suggests that the interpretation of these words would widely depend on the circumstances. The question arises especially when it comes to determining what the threshold is for the existence of "threats of serious irreversible damage." In other words, what is the point that the obligation of diligent control and regulation arise?

With reference to this point, Freestone[73] points out that the "precautionary approach" is innovative in that it changes the role of scientific data, and also that recourse of the principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified. This means that while there still is need of a certain degree of scientific information enough to identify the potentially dangerous effects, the principle requires States to be more cautious and to allow for the possibility of error or ignorance on the part of science.[74]

Therefore, a significant role of "monitoring" or "systematic observation" should be related to the role of scientific informa-

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[70] UNFCCC, *supra* note 3.

[71] United Nations Conference on Environment and Development: Convention on Biological Diversity, June 5, 1992, S. Treaty Doc. No. 103-20, 1760 U.N.T.S. 79 [hereinafter Convention on Biological Diversity].

[72] Rio Declaration, *supra* note 25, at princ. 15.

[73] David Freestone, *The Road from Rio: International Environmental Law After the Earth Summit*, 6 J. ENVTL. L. 193, 211 (1994).

[74] BIRNIE, *supra* note 23, at 117.

tion as argued here. As we will see in this paper, what the present systems of international environmental law often lacks is a procedure to take in the scientific information into the general principles as have been stipulated so far.

On this point, Sands, in 2003, rightly suggested that improving the ability of information on the state of the environment and on activities which have adverse or damaging effects are well-established objectives of international environmental law, pointing out that information is widely recognized as a prerequisite to effective national and international environmental management, protection and cooperation. He categorizes "[m]onitoring" as part of the nine separate but related techniques concerning the provision and dissemination of information, namely, 1. information exchange; 2. reporting and the provision of information; 3. consultation; 4. monitoring and surveillance; 5. notification of emergency situations; 6. public right of access to environmental information; 7. public education and awareness; 8. eco-labelling; 9. co-auditing and accounting.[75] "Monitoring" here is the requirement of recent international environmental agreements for information relevant to specific or general environmental obligations to be collected, and is also expressed in terms such as "systematic observation," "surveillance," "inspection," and "verification."

The 1992 OSPAR Convention[76] defines "monitoring" as the "repeated measurement" of three separate, but related, factors:

> (a) the quality of the... environment and each of its compartments...;
>
> (b) activities or natural and anthropogenic inputs which may affect the quality of the... environment;
>
> (c) the effects of such activities.

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[75] PHILIPPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 847-868 (Second Edition, Cambridge: Cambridge University Press, 2003).

[76] Convention for the Protection of the Marine Environment of the North-East Atlantic, Sept. 22, 1992, annex IV, art. 1, 32 I.L.M. 1069 [hereinafter Marine Environment Protection].

Treaties requiring monitoring and related activities are: The 1959 Antarctic Treaty (inspections by consultative parties of all areas of Antarctica, and rights of aerial observation),[77] the 1972 London Convention (requiring each party to designate an authority to monitor the condition of the seas),[78] 1982 UNCLOS (providing that States should observe, measure, evaluate and analyze the risks or effects of pollution of the marine environment),[79] the 1992 OSPAR Convention (requiring parties to undertake and publish joint assessments of the quality status of the marine environment),[80] 1979 LRTAP Convention (establishing a cooperative program for the monitoring and evaluation of the long-range transmission of air pollutants in Europe),[81] the 1997 Kyoto Protocol (requiring in its Clean Development Mechanism to monitor levels of greenhouse gas emissions related to clean development projects in order to calculate the proper admissions reductions credits to be issued to the party),[82] the 1992 Biodiversity Convention (requiring all parties to identify and monitor the components of biological diversity and the processes and categories of activities which are likely to have significant adverse impacts on the conservation and sustainable use of biodiversity),[83] and many others.

These international instruments have called for the development and operation of information gathering and dissemination, while there still is widespread consensus on the need to improve data collection and use. Agenda 21[84] calls for "Information for Decision Making" The Johannesburg World Summit Plan of Implementation[85] has a number of propositions relevant to monitoring such as international joint observation and re-

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[77] Antarctic Treaty, June 23, 1961, 12 U.S.T. 794, 402 U.N.T.S. 71.

[78] Marine Pollution Prevention, *supra* note 31.

[79] UNCLOS, *supra* note 45.

[80] Marine Environment Protection, *supra* note 76.

[81] Long-Range Air Pollution, *supra* note 30.

[82] Kyoto Protocol to the Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22 [hereinafter Kyoto Protocol].

[83] Convention on Biological Diversity, *supra* note 71.

[84] United Nations Environment Programme, *Information for Decision-Making,* Agenda 21, *available at* http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=52&ArticleID=90&l=en (last visited on Oct. 30, 2005).

[85] World Summit, *supra* note 19.

search for the water cycle[86] and disaster prevention systematic observation for climate change prediction,[87] promotion of observation strategies including the integrated Earth observation strategy,[88] and to realize Earth observation technology development including satellite remote sensing, global mapping and GIS.[89]

However, the obvious weakness that lies in these procedural techniques for the management of information is that much will depend on the diligence and accuracy of the reporting authorities or the bodies that conduct the research and observation. Thus, it is important that these bodies should not be dependent on government scientists for expertise, but should be able to employ their own experts, or call on international scientific bodies.[90] As a prominent case for this, "systematic observation" as provided in the Ozone and Climate Change frameworks will be closely examined in the following.

B. Systematic Observation in Environmental Agreements

1. "Systematic Observations" in the Vienna Convention

The 1985 Vienna Convention for the Protection of the Ozone Layer[91] was the first effective multinational legal framework on controlling human impacts to the global atmosphere. Of particular significance to the discussion here, it is the first multilateral agreement to adopt the term "systematic observations" as one of the agreed major undertakings of the parties. Looking into this Convention, it is possible to know the initial intentions in the use of this term.

The objective of the Convention is for nations to agree on taking "appropriate measures . . . to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to mod-

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[86] *Id.* ¶ 27.
[87] *Id.* ¶ 38(g).
[88] *Id.* ¶ 104.
[89] *Id.* ¶ 132.
[90] BIRNIE, *supra* note 23, at 206.
[91] Vienna Convention, *supra* note 2.

ify the Ozone Layer."[92] The main thrust of the Convention was to encourage research and overall cooperation among countries and to exchange information. The Vienna Convention set an important precedent, in that for the first time nations agreed in principle to tackle a global environmental problem before its effects were felt, or even scientifically proven.

Initially, in the draft text of the Convention, the term "monitoring" was used instead of "systematic observations". In the former draft Convention,[93] the relevant article was:

> Article 1 DEFINITIONS
>
> [3. "Monitoring" means a system of observations, collation of the results of these observations, and assessment and forecasting of change in the amount and vertical distribution of ozone and substances having a significant impact on the state of the ozone layer on the basis of factual data.]

The Soviet Union submitted this text in response to the need for additional definitions on "monitoring."[94]

During the second part of the 1983 Second Session of the *Ad Hoc* Working Group of Legal and Technical Experts for the Elaboration of a Global Framework Convention of the Ozone Layer,[95] it was agreed that throughout the draft convention and associated texts, "monitoring" would be replaced by "systematic observations." Because of the range of meanings that may be given to the word "monitoring," the technical working group had suggested that "monitoring" be replaced by "systematic observations" which was believed to define more correctly the proce-

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[92] *Id.* at art. 2.

[93] *Revised Draft Convention for the Protection for the Ozone Layer, with Additional Commentary*, at 3, UN Doc. UNEP/WG/78/10 (1983), *available at* http://hq.unep.org/ozone/Meeting_Documents/adhoc/adhoc-gfc-78-10-revised_draft_convention.83-04-11.doc (last visited Dec. 15, 2005).

[94] *Ad Hoc Working Group of Legal and Technical Experts for the Elaboration of a Global Framework Convention for the Protection of the Ozone Layer*, ¶ 15, U.N. Doc. UNEP/WG.78/8 (1983), *available at* http://hq.unep.org/ozone/Meeting_Documents/adhoc/adhoc-gfc-78-8-report_of_1st_part_2nd_session.82-12-10.doc (last visited Dec. 15, 2005).

[95] *Second Revised Draft Convention for the Protection of the Ozone Layer, with Additional Commentary, at 2,* UN Doc. UNEP/WG.94/3 (1983), *available at* http://hq.unep.org/ozone/Meeting_Documents/adhoc/adhoc-gfc-94-3-second_revised_draft_convention.83-10-17.doc (last visited Dec. 15, 2005).

dures envisaged. In view of this change, it was felt unnecessary to define "monitoring" and thus was agreed to delete the proposed definition of "monitoring" from Art. 1. The second draft convention incorporated a draft technical annex on Research and Systematic Observations, based on the proposed text submitted by the delegations of the U.S. and of Norway.[96]

The Vienna Convention provides that "[p]arties shall, in accordance with the means at their disposal and their capabilities: (a) Co-operate by means of systematic observations, research and information exchange in order to better understand and assess the effects of human activities on the ozone layer and the effects on human health and the environment from modification of the ozone layer."[97] The Vienna Convention further provides the detailed outline of States' undertakings on research and systematic observations: the areas on which the parties are to conduct research and scientific assessments; promotion or establishment of joint or complementary programs; and the collection, validation and transmission of research and observational data through appropriate world data centers.[98] Annexes I and II provide the major scientific issues for research and systematic observations, and details on information exchange. The areas of cooperation in conducting research and systematic observations include "interpretation of satellite and non-satellite measurement data sets"(2 (a) (i)), "[i]nstrument development, including satellite and non-satellite sensors for atmospheric trace constituents, solar flux and meteorological parameters" (2(a) (iv)), "[t]he status of the ozone layer ... by making the Global Ozone Observing System, based on the integration of satellite and ground-based systems, fully operational" (2(d)(i)), "wavelength-resolved solar flux reaching, and thermal radiation leaving, the Earth's atmosphere, utilizing satellite measurements" (2(d)(iv)), "Aerosol properties and distribution from the ground to the mesosphere, utilizing ground-based, airborne and satellite systems" (2(d)(vi)).[99]

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[96] *Id.*

[97] Vienna Convention, *supra* note 2, at art. 2.

[98] *Id.* at art. 3.

[99] *Id.* at annex I.

Thus, as the major obligation under the Vienna Convention, parties have agreed to undertake, "in accordance with the means at their disposal and their capabilities" to "[c]o-operate by means of systematic observations, research and information exchange."[100] This includes satellite observations and research using satellite data, instrument development and the establishment of an operational observing system integrated with ground-based systems, as technically outlined in Annex I.[101]

As the experts began to explore specific measures to be taken, the journal *Nature* published a paper written by British scientists about severe ozone depletion in the Antarctic.[102] The paper's findings were confirmed by American satellite observations and offered the initial proof of severe ozone depletion, making the need for definite measures more urgent. As a result, agreement was reached on specific measures to be taken and the Montreal Protocol on Substances that Deplete the Ozone Layer was signed.[103] The Montreal Protocol sets out specific obligations in the form of timetables for the progressive reduction and/or elimination of the production and consumption of certain ozone-depleting substances.[104] The Montreal Protocol also refers to the assessment of the control measures on the basis of available scientific, environmental, technical and economic information.[105] As the control measures are to be based on the understanding and assessment through systematic observations, research and information exchange,[106] it follows that periodical assessment should be based on reliable, updated information on the ozone layer.

The implications of the adoption of the term "systematic observations" in the first multilateral environmental agreement on the control of the atmosphere is that such a framework was

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[100] *Id.* at art. 2.

[101] *Id.* at annex I.

[102] J.C. Farman, B. Gardiner & J.D. Shanklin, *Large Losses of Total Ozone in Antarctica Reveal Seasonal ClOx/NOx Interaction*, 315 NATURE (May 16, 1985).

[103] Montreal Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987, S. TREATY DOC. NO. 10, 100th Cong., 1st Sess. (1987), reprinted in 26 ILM 1541 (1987) [hereinafter the Montreal Protocol].

[104] *Id.* at art. 2.

[105] *Id.* at art. 6.

[106] Vienna Convention, *supra* note 2, at art. 2.

essential in the regime of this treaty. That is, for the purpose of combating issues of the global atmosphere, cooperation in systematic observations is essential for the following reasons:

> 1) To provide scientific information, in principle to tackle a global environmental problem before its effects were felt, or even scientifically proven;
>
> 2) The global nature of the object/interest to be protected;
>
> 3) To ensure access and use of information derived from the system by all nations.

These are features peculiar to the environmental conventions, i.e. legal frameworks with the aim of establishing international management of the global commons. Should the ozone precedent be assessed as a success, at least to a certain degree, there should be lessons to be learned for the protection of other interests involving the global commons, a number of issues which are bound to come up in the near future. In the following discussions the United Nations Framework Convention on Climate Change will be examined, which in principle followed the precedent of ozone protection. The implications suggested above will also be considered in depth.

C. The United Nations Framework Convention on Climate Change

The UNFCCC Preamble recalls the Vienna Convention and its Montreal Protocol, and states:

> Conscious of the valuable analytical work being conducted by many States on climate change and of the important contributions of the World Meteorological Organization, the United Nations Environment Programme and other organs, organizations and bodies of the United Nations system, as well as other international and intergovernmental bodies, to the exchange of results of scientific research and the coordination of research,
>
> Recognizing that steps required to understand and address climate change will be environmentally, socially and economically most effective if they are based on relevant scientific,

> technical and economic considerations and continually re-evaluated in the light of new findings in these areas, . . .[107]

It provides that all parties shall "[p]romote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives ...."[108] It also provides that parties shall support and further develop international and intergovernmental programs and networks or organizations, taking into account the need to minimize duplication of effort.[109]

The Kyoto Protocol provides that "[p]arties ... shall ... cooperate in scientific and technical research and promote the maintenance and the development of systematic observation systems and development of data archives ... and promote the development and strengthening of endogenous capacities and capabilities to participate in international and intergovernmental efforts, programs and networks on research an systematic observation, taking into account Article 5 of the Convention."[110]

Based on the foundation laid out by the Vienna Convention,[111] the UNFCCC has provided the arena for the international agenda on the implementation of "Research and Systematic Observation" for climate change. It has regularly been an agenda item of the Conventions' Subsidiary Body for Scientific and Technological Advice (SBSTA).[112] Parties have discussed priority areas of research and questions for the scientific community relevant to the Convention.[113] Research priorities and

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[107] UNFCCC, *supra* note 3, at preamble.

[108] *Id.* at art. 4(1)(g).

[109] *Id.* at art. 5.

[110] Kyoto Protocol, *supra* note 82, at art. 10.

[111] *See supra* Section III.B.1.

[112] *See* UNFCCC, *Research and Systematic Observation*, *at* http://unfccc.int/methods_and_science/research_and_systematic_observation/items/2312txt.php (last visited Oct. 30, 2005).

[113] *See generally* Subsidiary Body for Scientific and Technological Advice, *Third Assessment Report of the Intergovernmental Panel on Climate Change: Views on priority areas of research and questions for the scientific community relevant to the Convention*, FCCC/SBSTA/2002/MISC.15/ (Sept. 6, 2002); Subsidiary Body for Scientific and Technological Advice, *Third Assessment Report of the Intergovernmental Panel on Climate Change: Views on priority areas of research and questions for the scientific community relevant to the Convention, Addendum*, FCCC/SBSTA/2002/MISC.15/Add.1 (Oct. 2, 2002); Subsidiary Body for Scientific and Technological Advice, *Third Assessment Report*

research conducted in response to the recommendations of the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) have been discussed during SBSTA sessions by governments and international research programs. SBSTA 20 noted the need to assess the adequacy of research activities and their international coordination to meet the needs of the Convention.[114] They agreed further to consider these issues at the next session to be held in 2005.[115]

GCOS and other agencies participating in World Meteorological Organization's (WMO) Climate Agenda have been active in building cooperation with the UNFCCC Parties for the implementation of research and systematic observation. COP 3 and COP 4 both adopted decisions supporting GCOS and its partner agencies, and urged parties to engage fully with their work. COP 5, held in Bonn in 1999, invited the GCOS Secretariat, in consultation with the Global Environmental Facility (GEF) and others, to organize regional workshops to identify priority capacity building needs to enhance the participation of developing countries in systematic observation.[116] The COP also adopted reporting guidelines[117] on global climate observing systems and invited parties to provide detailed reports on systematic observation as part of their national communications (on a voluntary basis, in the case of non-Annex I Parties[118]). SBSTA 18 (Bonn, June 2003) considered the state of the global observing systems for climate, on the basis of the second adequacy report,[119] endorsed by SBSTA 15 and prepared by GCOS. COP 9

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of the Intergovernmental Panel on Climate Change: Synthesis of information submitted by Parties on priority areas of research and questions for the scientific community, FCCC/SBSTA/2002/INF.17 (Sept. 27, 2002).

[114] Subsidiary Body for Scientific and Technological Advice, *Report of the Subsidiary Body for Scientific and Technological Advice on its Twentieth Session*, ¶ 102, FCCC/SBSTA/2004/6 (Sept. 20, 2004).

[115] *Id.* ¶ 103.

[116] Conference of the Parties, Bonn, F.R.G., Oct. 25 – Nov. 5, 1999, *Report of the Conference of the Parties on its Fifth Session, Addendum*, at 10, FCCC/CP/1999/6/Add.1. Decision 5/CP.5 (Feb. 24, 2000).

[117] Conference of the Parties, Bonn, F.R.G.,Oct. 25 – Nov. 5, 1999, *Review of the Implementation of Commitments and of other Provisions of the Convention: UNFCCC guidelines on reporting and review*, FCCC/CP/1999/7 (Feb. 16, 2000).

[118] UNFCCC, *supra* note 3, at annex I.

[119] *GCOS Second Adequacy Report*, *supra* note 20.

(Milan, December 2003) adopted a decision on global observing systems for climate.[120] This decision calls for the preparation of an implementation plan for global climate observations to be coordinated by GCOS in collaboration with the Group on Earth Observations (GEO)[121]. The GCOS Secretariat has made available the final implementation plan for consideration by SBSTA 21/COP 10 (Buenos Aires, December, 2004). COP 10 also adopted a decision on research and systematic observation -/CP.10.[122] GEO and the ten-year implementation plan will be discussed later in 4.3 of this paper.

In this way, the notion of "systematic observation," born with the Vienna Convention, has grown through the UNFCCC negotiations into its implementation phase. So far, these are the only two multilateral treaties that have adopted the term. Nonetheless, in both conventions, it is among the central undertakings or commitments of the framework. It may be possible to note several reasons for this. First, with the crucial need for reliable information on which to build the international community's decision, there was need for an undertaking of States to collect and share this information. Second, in doing so, it was technically sensible to take an approach of integrated data collecting from outer space and ground observations to detect changes in atmospheric parameters. To use the word "monitoring" was not enough to describe this technology, and thus the term "systematic observation" was adopted. Third, the atmosphere, or climate change, being a subject of global common concern, should be protected and managed in a manner different from conventional objects of legal protection such as local damage or injury. Through the COP process, the prospect for this approach has become clearer, as produced in the Implementation Plan: an integrated observation system from space and on

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[120] Conference of the Parties, Milan, Italy, Dec. 1-12, 2003, *Report of the Conference of the Parties on its Ninth Session, Addendum*, at 20-22, FCCC/CP/2003/6/Add1, 11/CP.9 (Apr. 22, 2004).

[121] Group on Earth Observations, *supra* note 22.

[122] Conference of the Parties, Buenos Aires, Arg., Dec. 6-18, 2004, *Report of the Conference of the Parties on its Tenth Session*, Addendum, at 2, FCCC/CP/2004/10/Add1 (Apr. 19, 2005).

the ground, and a harmonized research program using the data acquired.[123]

IV. RIGHTS AND OBLIGATIONS OF STATES IN SATELLITE EARTH OBSERVATION

Having addressed the scope of "monitoring", and specifically "systematic observation" contained in multilateral treaties, it is clear that the treaty objective of the activity is the interest to be protected by international cooperation, e.g. the environmental status of the atmosphere, oceans, biodiversity and other parameters. In other words, the global commons. Satellite observation from space is a powerful tool because a satellite orbit in space also occurs in an area legally regarded as a global commons. Thus, monitoring can be performed without regard to territorial borders of States. All these provisions concerning the collection and sharing of information on the environment suggest that for certain purposes the international common interest seems to have overridden national interest for sovereignty over natural resources and security. However, when it comes down to the operation of specific satellite programs there are many issues to be solved. These include data policies and the legal framework under which they are carried out. In this section, the international space treaty regime will be examined as well as some existing national legal instruments and policies. They will be considered in terms of whether or not they correspond to the rights and obligations laid down by the environmental treaty. Then, the emerging new framework based on the "systematic observation" mandate will be presented, and its consistency with space law will be examined.

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[123] *The Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan* (Feb. 16, 2005) [hereinafter *GEOSS 10-Year Implementation Plan*], *available at* http://earthobservations.org/docs/EOS%20III/10YR%20IMPLEMENTATION%20PLAN.doc (last visited Dec. 15, 2005).

A. Traditional Legal Instruments

1. The United Nations Space Treaty Regime

The significance of the space law in relation to "monitoring" the Earth environment is to be found in three major principles. First, space is the "province of all mankind."[124] Second, space is subject to the principles of free exploration and use of outer space,[125] international cooperation,[126] and third, the call for due regard to interests of all other States.[127]

First, the Outer Space Treaty states that the exploration and use of outer space (including the moon and other celestial bodies) are to be carried out for the benefit and interests of all countries, and shall be "the province of all mankind."[128] The Outer Space Treaty consistently refers to the rights of "all,"[129] and places its emphasis on the "equality" of States.[130] Only in the later agreements, equality was displaced in some respect by considerations of equity.[131] Equity, with its emphasis on fairness and justice, has long served to improve human relationships in international law, especially in the sharing of resources and enjoyments of rights and remedies for the realization of such rights. Thus, the balancing of values of equity, efficiency, economy and equality, and their transformation of these abstract values to specific outcomes in specific situations is necessary.[132]

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[124] Outer Space Treaty, *supra* note 5, at art. I.

[125] *Id.*

[126] *Id.* at art. III.

[127] *Id.* at art. IX.

[128] *Id.* at art. I.

[129] *Id.* at pmbl., arts. I, IV, IX.

[130] *Id.* at arts. I, X.

[131] *See* Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, pmbl., art. XII 24 U.S.T. 2389, 961 U.N.T.S. 187 (on the measure of compensation for damage caused by space objects); Convention on Registration of Objects Launched into Outer Space, adopted on Nov. 12, 1974, art. VI, GAOR, 1023 U.N.T.S. 15 (on assistance in sharing information on the identity of a space object); and Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, Art 11(6)(d), U.N. GAOR, Doc. A/RES/34/68 (in sharing the benefits derived from resource of the Moon and celestial bodies).

[132] *See* Carl Q. Christol, *Equity and International Space Law*, *in* PROCEEDINGS OF THE THIRTY-THIRD COLLOQUIUM ON THE LAW OF OUTER SPACE 270-277 (1990) (for considerations on equity and equality in space law).

This leads to the consideration of equity and equality in remote sensing activities, in relation to the States' sovereign rights to natural resources, rights to participate in activities and the sharing of information. The Outer Space Treaty further provides that space shall be free for exploration and use by all States.[133] This implies that, although it has been established that States are able to freely navigate through outer space, there is the question of whether it is legally accepted to freely gather information over other States from space. The Treaty provides that "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[134] The substantial agreement by States was to prohibit acquisition of territorial rights by States, which remained somewhat vague in expression in the adopted text.[135] There has been argument about to what extension this obligation is applicable concerning property rights and priority by States or private persons authorized by States.[136] Recently, there have been debates regarding alleged claims by private individuals to own the Moon or parts of it. However, it should be understood that claims to property rights to the Moon and other celestial bodies or parts thereof not only by governmental agencies but also non-governmental entities would be regarded as national activities,[137] and thus are prohibited under the Outer Space Treaty.[138]

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[133] Outer Space Treaty, *supra* note 5, at art. I.

[134] *Id.* at art. II.

[135] Megumi Nakamura, *Uchuho no Taikei [the Space Law System], in* NIHON TO KOKUSAIHO NO 100 NEN [THE HUNDRED YEARS OF INTERNATIONAL LAW IN JAPAN] 2

[136] YAMAMOTO, *supra* note 23, at 481.

[137] Sates Parties to the Outer Space Treaty bear responsibility for national activities in outer space, including the moon and other celestial bodies, whether carried on by governmental agencies or non-governmental agencies. Outer Space Treaty, *supra* note 5, at art. VI. Additionally, liability for damage to another state party, "or its natural or juridical persons" by a space object or its component parts, whether in airspace, outer space or on the moon or other celestial body, is attached to each state party that launches the object, or procures its launching, and to each state party from whose "territory or facility" an object is launched. *Id.* at art. VII. Responsibility and liability imply jurisdiction, and on this point it is provided that jurisdiction and control over the object and "over any personnel thereof" is to be retained by "a State Party of the Treaty on whose registry they are carried . . .", while the object is "in outer space or on a celestial body." *Id.* at art. VIII.

It is then a question of what are the rights concerning the information acquired there.

Second, the Outer Space Treaty calls for international cooperation and for due regard to interests of all other States in carrying out activities of States.[139] This point has many implications relevant to environmental law. While it is sometimes argued that the Outer Space Treaty only contains one provision relevant to protecting the environment, there is a body of significant rules that has implications for the Treaty's environmental principles.[140] One of the most detailed provisions in the Outer Space Treaty includes several very important rules concerning the environment: that States "shall be guided by the principle of cooperation and mutual assistance ... with due regard to the corresponding interests of all other States Parties [and] to avoid ... harmful contamination and also adverse changes in the environment of the Earth...."[141] The same Article further provides that States Parties "shall undertake appropriate international consultations before proceeding with any activity or experiment...[when having] reason to believe that [it] would cause potentially harmful interference with activities..." of other States, and that a State Party "which has reason to believe that an activity or experiment...of another State Party...would cause potentially harmful interference...may request consultation...."[142] This demonstrates that international space law is one of the earliest bodies of law to adopt the approaches similar to those that were later developed in environmental treaties. However, it is also evident that the Article IX approach is directed towards the protection of human beings,

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[138] Outer Space Treaty, *supra* note 5, at arts. II, VI. *See also* the International Institute of Space Law's statement on claims to property rights regarding the moon and other celestial bodies. International Institute of Space Law, *Home Page*, *at* http://www.iafastro-iisl.com/ (last visited Dec. 15, 2005).

[139] Outer Space Treaty, *supra* note 5, at arts. I, III, IX.

[140] CHIKUKANKYOJOYAKUSHU [GLOBAL ENVIRONMENTAL TREATIES] 685 (Chikukankyoho Kenkyukai ed., Fourth Edition, Tokyo: Chuohoki Publishers, 2003) (for a commentary on Space Law and the environment); *see also* SANDS, *supra* note 75, at 382-385.

[141] Outer Space Treaty, *supra* note 5, at art. IX.

[142] *Id.*

rather than the protection of the environment as an end in itself.[143]

Furthermore, it is agreed in the Outer Space Treaty that "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."[144] Further, "the Moon and other celestial bodies" are to be used by all States Parties "exclusively for peaceful purposes."[145] In the Outer Space Treaty, the peaceful uses principle is more detailed than in the case of the high seas, adopting a distinction between space and celestial bodies, allowing different levels of military activity.[146]

While the Outer Space Treaty does contain important rules for the protection of the space and Earth environment, it is silent on the role of information obtained by the scientific investigations it encourages. On the other hand, the principle of free exploration and use of outer space has enabled States to perform global observations of the Earth. Consequently, this has resulted in a dispute on the legal status of remote sensing activities and the data acquired thereby. Remote sensing originated as national programs, often with meteorological or military purposes, and with a wide range of applications including not only environmental monitoring but also surveillance, land use detection, resource exploration and many others, which are more of a national, rather than common, interest. The technology to observe the Earth's surface from space was not evident at the time the Outer Space Treaty was negotiated. However, it developed rapidly during the 1970s and 1980s, and was brought to the agenda of the U.N. Committee on the Peaceful Uses of Outer Space, resulting in the formulation of the U.N. Remote Sensing Principles.

It is important to distinguish between environmental problems related to activities conducted in space, for the protection

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[143] SANDS, *supra* note 75, at 383.
[144] Outer Space Treaty, *supra* note 5, at art. IV.
[145] *Id.*
[146] SANDS, *supra* note 75, at 483-484.

of the space environment and activities conducted for the protection of the Earth environment. The discussions here will address the latter. The physical area considered extends to the geostationary orbit which is approximately 360,000km above the Earth's equator. Most satellites, including crewed space vehicles, travel in the lower orbits between approximately 400-800 km. Thus, human activities occur in a very limited layer of outer space. Regarding specific legal discussions it is therefore important not to overstate the degree of humanity's entry into outer space, however tempting and valuable the idea may be. More than 5,000 satellites have been launched to date[147] and used by human society, therefore the legal status of these activities should be more defined. It should be part of such an effort to define the legal framework of space activities for the protection of the Earth environment.

2. The U.N. Principles Relating to Remote Sensing of the Earth from Space

The Remote Sensing Principles is a substantial legal instrument providing the legal basis for remote sensing activities in most countries. The data policies of many Earth observation satellites are based on the provisions of the U.N. Remote Sensing Principles, calling for non-discriminatory access to remote sensing data.[148]

The significance of the Remote Sensing Principles with respect to the protection of the Earth environment is that it attempts to coordinate a sensed State's sovereign rights with the "benefit and in the interests of all countries" for which the exploration and use of outer space shall be conducted.[149] In fact, this was achieved by a compromise which gives a sensed state

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[147] SPACEGUIDE 2004 (AstroArts&YAC eds.,,Tokyo: AstroArts Inc., 2004) *available at* http://www.astroarts.com/ (last visited Dec. 15, 2005); *see also*, JAXA Online Space Notes, *at* http://spaceinfo.jaxa.jp/note/eisei/j/eis14_j.html (last visited Dec. 15, 2005).

[148] Joanne Gabrynowicz, *Expanding Global Remote Sensing Services: Three Fundamental Considerations. in* PROCEEDINGS OF THE WORKSHOP ON SPACE LAW IN THE TWENTY-FIRST CENTURY (International Institute of Space Law & United Nations Office for Outer Space Affairs, New York, 2000) [hereinafter *Expanding Global Remote Sensing Services*].

[149] Remote Sensing Principles, *supra* note 6, at princ. IV.

the right to gain access to data of its own territory, "[a]s soon as the primary date ... are produced ... on a non-discriminatory basis and on reasonable cost terms."[150] The purpose of this compromise was to avoid the condition of requiring prior consent from a sensed State before distributing data to third parties and instead have the States enter into consultations upon the request of a sensed State.[151] Similar issues are also embodied in the compromise that allows data gathering without prior notice to the sensed State in return for making primary and processed data available on a non-discriminatory basis.[152] These principles of access rights to data, equality and equity, and the rights in information apply both to the protection of the Earth's environment[153] and the protection of humankind from natural disasters.[154]

Firstly, in discussing the access rights to remote sensing data, the property position of the holder of the data.must be clarified. In the Remote Sensing Principles, this question is left quite open. In practice, most satellite operators speak of data rights belonging to the owner of the instrument (or jointly to the owner of the satellite that carries it), as described in the following sections. Also, it seems established that remote sensing is open for access except for certain special circumstances where the sensing State places restrictions for national security reasons.[155] Although Principle XII appears to give privilege to sensed States as far as access to data is concerned, on the ground that after all remote sensing does interfere with sovereign rights of the sensed State, on closer examination the privilege does not extend very far, as there is only access "on a non-discriminatory basis." It follows that the observing state may retain data if it does this on equal terms in relation to any other state. In addition, even if there is non-discriminatory access to the data, it would be practically impossible for less-developed States to obtain such data if the cost is too high. Therefore,

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[150] *Id.* at princ. XII.
[151] *Id.* at princ. XIII.
[152] *Id.* at princ. XII.
[153] *Id.* at princ. X.
[154] *Id.* at princ. XI.
[155] *See supra* Section IV.B.1.

pricing policies are of crucial importance, especially with regard to environmental data and information. Principle XII provides that data and information shall be accessible on "reasonable cost terms," which leaves this point quite open, while Principle X and XI do not mention costs, which should be understood that States are expected to disclose environmental information and transmit disaster data and information at no costs to the States concerned.[156] It should be noted here that commercial activities would imply protected data rights and interest in principle, whereas States are to provide non-discriminatory access, at no cost for certain environmental and disaster applications. The relation of commercial activities to non-discriminatory access to data and information, and pricing policy is still quite debatable.

Secondly, regarding equality and equity, the Remote Sensing Principles provide that promotion of international cooperation "shall be based in each case on equitable and mutually acceptable terms."[157] However, the Principles repeat the norm of the Outer Space Treaty, i.e., outer space is to be explored, used, and exploited on a basis of equality.[158] The non-discriminatory principle is also based on equality, though the Remote Sensing Principles add that the "needs and interests of the developing countries ... shall" be taken into particular account.[159] Equity here seems to be called upon to provide a basis for sharing resources already exploited by those having the ability to do so that the sharing concept meets with competing views.[160]

Thirdly, the Remote Sensing Principles call for disclosure of remote sensing environmental "information" concerned with environmental harm in general,[161] and "processed data and analysed information" concerned with the protection of humankind from natural disasters.[162] There is no mention made of cost in either of these principles, so it must be understood that data

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[156] *See* Gerd Winter, *Access of the Public to Environmental Data from Satellite Remote Sensing*, 6 J. ENVTL. L. 51-52 (1994).

[157] Remote Sensing Principles, *supra* note 6, at princ.V.

[158] *Id.* at princ. IV; *see also* Outer Space Treaty, *supra* note 5, at art. 1.

[159] Remote Sensing Principles, *supra* note 6, at princ. XII.

[160] Christol, *supra* note 132, at 273.

[161] Remote Sensing Principles, *supra* note 6, at princ. X.

[162] *Id.* at princ. XI.

and information obligations are established at no cost to the States concerned. Information and data promoting environmental protection is, thereby, given special status, i.e. that of a public good.[163] Additionally, the Remote Sensing Principles provide that regarding general environmental harm States "that have identified information in their possession that is capable of averting any phenomenon harmful to the Earth's natural environment shall disclose such information to States concerned."[164] Regarding the protection of humankind, "States ... that have identified processed data and analyzed information in their possession...shall transmit [them] to the States concerned...."[165] These appear to take a precautionary approach, though not explicitly stated as such.

The term "remote sensing" is defined as "the sensing of Earth's surface from space ... for the purpose of improving natural resources management, land use and the protection of the environment."[166] There is still room for discussion as to whether this is a comprehensive notion that includes such areas as intelligence activities, commercial activities, or various other applications using particularly high-resolution satellite data and information. Moreover, since the Remote Sensing Principles are contained in a U.N. General Assembly Resolution, the question of whether or not they are legally binding is still controversial. Most States, including Japan, have not yet established domestic legal frameworks to secure compliance to the Remote Sensing Principles.

The Remote Sensing Principles provide an attractive context for access to Earth observation data, especially for less developed countries. However, the rights of the sensed State and cost terms under non-discriminatory access must be specified. Any other terms for environmental information should also be clarified. In many cases, higher capacity buildings are still needed to enable users, both in developed and less-developed countries, to benefit fully from Earth observation data. It may

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[163] Wiinter, *supra* note 156, at 52.
[164] Remote Sensing Principles, *supra* note 6, at princ. X.
[165] *Id.* at princ. XI.
[166] *Id.* at princ. I.

be observed, however, that the Remote Sensing Principles are limited in scope, lag behind on the level of technology and only find limited implementation. Practical experience has shown that access to Earth observation data is ultimately subject to the political, strategic and military considerations of the most powerful States. Access to Earth observation data should be improved and broadened, especially in favour of the less-developed countries, since these countries are essential to achieve the full coverage of the globe as required for worldwide research programs on climate and global change.

B. National Earth Observation Data Policies

Policies for Earth observation differ among countries and regions. The issues of managing data derived from Earth observation satellites, in terms of access, pricing, data rights and other aspects is collectively referred to as Earth observation data policy. It also includes significant implications as to the relationship between the public sector and the emerging private sector. Many countries follow the rules provided by the Remote Sensing Principles in practice, while some do not have expressly written policies for the operation of their satellites. The following is an overview of the major policies and relevant legal instruments, with some issues for discussion highlighted.

1. The United States of America[167]

The U.S. was undoubtedly the State that opened the remote sensing era, with the 1972 launch of the first civil satellite designed to collect images of the Earth: the Earth Resources Technology Satellite (ERTS), its progeny better known as the

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[167] *See* John F. Hall, Jr., Esq., *United Sates Laws, Regulations, and Policies Concerning Commercial Remote Sensing Activities, in* PROJECT 2001 WORKING GROUP ON REMOTE SENSING: LEGAL FRAMEWORK FOR COMMERCIAL REMOTE SENSING ACTIVITIES, PROCEEDINGS OF THE PROJECT 2001- WORKSHOP ON LEGAL REMOTE SENSING ISSUES 24-32 (Toulouse, 1998); Joanne Irene Gabrynowicz, *Defining Data Availability for Commercial Remote Sensing Systems under United States Federal Law*, XIII ANNALS OF AIR AND SPACE L. (1998); and Lisa Shaffer, *US Data Policy for Earth Observations from Space, in* III SPACE IN THE SERVICE OF THE CHANGING EARTH 1477-81 (T.D. Guyenne and J.J. Hunt eds., ESA SP-341, ESTEC, 1992).

Landsat missions. At the end of the 1970s, the *Landsat* program was transferred from NASA to the National Oceanic and Atmospheric Administration (NOAA) in the U.S. Department of Commerce with a view to ultimately transferring operations to the private sector.[168] In 1984, the Land Remote Sensing Commercialization Act[169] was passed. Further, commercialization was accelerated by the government's announcement of its intention to terminate government remote sensing subsidies.[170]

However, it was soon to be realized that the remote sensing market was not ready for the commercial activity envisioned by the law, and the prices of data products became intolerably expensive, ruling out the possibility that the commercial program would continue.[171] This lead to the statute which currently governs U.S. commercial remote sensing activities under the Land Remote Sensing Policy Act of 1992[172]. The new law reaffirmed commercialization of land remote sensing as a long-term U.S. policy goal, but recognized the infancy and limitations of the market.[173] It provided for continued government procurement and support of remote sensing systems, including *Landsat 7* and its successor, if necessary.[174] The Policy Act also sought to make scientific remote sensing data available to the widest spectrum of users, particularly data acquired from government-owned systems.[175] This open access approach is consistent with U.S. laws and procedures that recognize taxpayer-funded data as a public good; the open exchange of scientific and technical gov-

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[168] Presidential Directive 54, Civil Operational Remote Sensing, at 14 (Nov 16, 1979), *available at* http://www.jimmycarterlibrary.org/documents/pddirectives/pres_directive.phtml (last visited Dec. 15, 2005).

[169] Land Remote Sensing Commercialization Act, 15 U.S.C. §§4201 – 4292 (2000).

[170] White House Fact Sheet, Presidential Directive on National Space Policy (Feb. 11, 1988), *reprinted in* U.S. COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, SPACE LAW AND RELATED DOCUMENTS 569 (1990).

[171] Joanne Gabrynowicz, *The Perils of Landsat from Grassroots to Globalization: A Comprehensive Review of US Remote Sensing Law with a Few Thoughts for the Future*, 6 CHI. J. INT'L L. 45 (2005); *see also*, Lisa Shaffer & Peter Backlund, *Towards a coherent remote sensing data policy*, SPACE POLICY 45-50 (February 1990).

[172] Land Remote Sensing Policy Act, Pub. L. 102-555, 15 U.S.C. §§5601 - 5642 (2000) [hereinafter Policy Act].

[173] *Id.* § 5601(6).

[174] *Id.* §§ 5612, 5641.

[175] *Id.* §§ 5621(e), 5651.

ernment information fosters excellence in scientific research; and promotes the effective use of funds.[176] In the United States, unenhanced data from government-owned satellites are distributed for the cost of fulfilling user requests, while value-added data is provided by the private sector. Consistent with the Remote Sensing Principles, the Policy Act further requires that unenhanced data from such systems should be made available to a sensed state as soon as it becomes available.[177]

The U.S. approach to regard government-owned Earth observation data as a public good offers a straight-forward policy based on non-rival and non-excludable use of data. In particular, for public applications such as disaster monitoring and environmental monitoring, this approach has great importance. On the other hand, in relation to the commercial activities, various efforts have been made to balance interests and define the territories of government-commercial activities. For commercial systems, practice shows that the U.S. government has been granting licences to high-resolution remote sensing systems, while the government-owned Earth observation systems provide moderate to low resolution data. In addition, the Commercial Space Act of 1998[178] requires that NASA acquire its Earth science data from commercial providers as much as possible. The Commercial Space Act requires NASA to treat such data "as a commercial item," at the same time permitting the government to acquire "sufficient rights in data to meet the needs of the scientific and educational community or the needs of other government activities."[179]

When there are conflicting interests with open access to information, access is restricted under certain circumstances. For instance, for national security reasons, there is a vaguely worded prohibition on collecting and disseminating imagery of Israel "unless such imagery is no more detailed or precise than

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[176] Paperwork Reduction Act, 44 U.S.C.A. § 3501 (2004).
[177] Policy Act, *supra* note 172, at § 5622(b)(2).
[178] Commercial Space Act, 42 U.S.C. §14701 (2000).
[179] *Id.* § 107(a).

satellite imagery of the country or geographic area concerned that is routinely available from commercial sources."[180]

2. Europe and Canada

By contrast, in Europe, the fact that government information is a valuable resource often leads to an interest in ensuring that there is an explicit return on the investment made in creating that value.[181] The prices are defined by the categories of use, while at the same time data of higher levels are also given to the hands of the private sector.[182] Canada also has taken a similar position.[183]

The European Space Agency (ESA) data policy for the European Remote Sensing Satellite (*ERS-1amd 2*) and its successor *Envisat*, is as follows[184]:

> 1. The respect of the widest availability of data to all interested users each of whom has free access to the data on an open and non-discriminatory basis, in conformity with the U.N. Remote Sensing Principles;
>
> 2. It is still an open question whether there exist clear provisions in the European legal system recognising an ownership *erga omnes* over the Remote Sensing data. However, in practice, through contracts concluded for those who submit data requests, it is recognized by the user that the full title of data is held by ESA.

In some European States there is a legal framework for space activities in general[185] and in all European States a gen-

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[180] National Defense Authorization Act for Fiscal Year 1997, Pub. L. No. 104-201.

[181] *EOPOLE Earth Observation Data Policy and Europe; Final Report*, ENV4-CT98-0760, 4.3.2 (Sept. 30 2000), *available at* http://www.geog.ucl.ac.uk/~eopole/final-rep.html#4.2.1 (last visited Dec. 15, 2005).

[182] *See* the table of user categories in Marco Ferrazzani, *ESA Rules and Practices*, *in* PROJECT 2001 WORKING GROUP ON REMOTE SENSING: LEGAL FRAMEWORK FOR COMMERCIAL REMOTE SENSING ACTIVITIES, PROCEEDINGS OF THE PROJECT 2001-WORKSHOP ON LEGAL REMOTE SENSING ISSUES 52 (1998).

[183] Canadian Space Agency, RADARSAT Data Policy, RSCA-PR0004, CSA, July 13, 1994.

[184] Ferrazzani, *supra* note 182, at 44-45.

[185] For example, Sweden, Act on Space Activities (1982:963), *available at* http://www.oosa.unvienna.org/SpaceLaw/national/sweden/act_on_space_activities_1982

eral body of national legislation exists, which on some points, for example, intellectual property rights, trade issues, liability, private involvement, is of relevance for Earth observation data policies or certain important aspects thereof.[186] The general European Community legal structure acts as the only coherent and comprehensive legal machinery on a European level, albeit with only indirect relevance for Earth observation, for example, competition law, intellectual property rights and databases.[187] In the *Envisat* Data Policy,[188] it is stated that ESA "shall retain title to and ownership of all primary data originating from the *Envisat* payload together with any derived products generated under ESA contract as well as other products to the extent that the contribution of *Envisat* is substantial and recognizable. ESA shall protect these data through applicable legislation, including law on databases, copyright and other appropriate forms of intellectual property."[189]

France has a national Earth observation program SPOT, now in its fifth generation, SPOT-5. ESA for *ERS-1* and Canada for *RADARSAT* followed the empirical approach of data protection set by SPOT Image, the company that distributes SPOT data. The French distribution policy for space-based Earth observation data[190] states that the basic principle is the distribution of Earth observation data should produce a return on the investment, because of the scale of government effort in the development of the earth observation systems, and to guarantee the durability. Thus it implies "control" of the data, and the le-

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E.html (last visited Dec. 16, 2005); *and* United Kingdom, Outer Space Act 1986 (1986 Chapter 38), *available at* http://www.bnsc.gov.uk/assets/channels/about/outer%20space%20act%201986.pdf (last visited Dec. 16, 2005).

[186] Paperwork Reduction Act, *supra* note 176, § 4.6.2.

[187] Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 O.J. (L77) 20, *available at* http://europa.eu.int/ISPO/infosoc/legreg/docs/969ec.html (last visited Dec. 16, 2005).

[188] European Space Agency, ESA Envisat Data Policy, ESA/PB-EO (97), rev. 3, Paris, (Feb. 19,1998) (on file with author).

[189] *Id.* § 1.5.

[190] See a summary of the April 1995 interdepartmental report presented by Phillipe Clerc. Phillipe Clerc, *Distribution policy for space-based Earth observation data, in* PROJECT 2001 WORKING GROUP ON REMOTE SENSING: LEGAL FRAMEWORK FOR COMMERCIAL REMOTE SENSING ACTIVITIES, PROCEEDINGS OF THE PROJECT 2001-WORKSHOP ON LEGAL REMOTE SENSING ISSUES 41-42 (1998).

gal mechanisms relating to "reservation" (copyright and other forms of intellectual property) must allow control of unenhanced and processed data for the benefit of the satellite operator.[191] The Remote Sensing Principles of non-discriminatory access to data are also reaffirmed, and this does not contradict the idea of a return on investment. Further, in the context of the protection of the environment and humankind against natural disasters, reference is made exclusively to the Remote Sensing Principles. However, there may be restrictions on the dissemination of and access to data for national security reasons.[192] In practice, ESA, France and Canada all adopt an approach to categorize users into several groups, and to distribute data either free of charge or at marginal cost to selected research users, while operational data should be provided in exchange for payments on a non-discriminatory basis.

In Canada, an Act governing the operation of Canadian remote sensing space systems was proposed to the parliament in November 2004.[193] The bill establishes a licensing regime for remote sensing space systems and provides for restrictions on the distribution of data gathered by these systems, Additionally, the bill gives special powers to the Government of Canada to order priority access or the interruption of service when it is deemed necessary to protect national security, defence or international relations interests and to observe international obligations.

3. Japan and Other Countries

The Law Concerning the Japan Aerospace Exploration Agency (JAXA Law)[194] is the general legislation that governs space activities in Japan. The distribution of JAXA's Earth observation satellite data is carried out pursuant to the JAXA

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[191] *Id.* at 41.

[192] *Id.* at 42.

[193] Bill C-25: An Act Governing the Operation of Remote Sensing Space Systems (Dec. 20, 2004), *available at* http://www.parl.gc.ca/common/Bills_ls.asp?Parl=38&Ses=1&ls=C25 (last visited Dec. 16, 2005).

[194] Law Concerning Japan Aerospace Exploration Agency, Law No. 161 (Dec. 13, 2002) [hereinafter JAXA Law], *available at* http://www.jaxa.jp/about/gaiyo/law/law_e.pdf (last visited Dec. 16, 2005).

Law.[195] It states that "the development and promotion of the use of space" is now the objective of JAXA,[196] whereas previously under NASDA, it was limited to "development."[197]Additionally, the promotion of results and their utilization have become the responsibility of JAXA.[198] With these developments, the basis for data distribution has become clearer. Data distribution to the general public through the distributor, using a JAXA facility, is regarded to be under Art. 18.4 and 9[199], which provides for the development of facilities and equipment necessary for the development of satellites by JAXA, and that it may execute activities incidental to such development activities. It is also important to note that the JAXA Law requires JAXA activities to be exclusively for peaceful purposes.[200] Consequently, JAXA's Earth observation activities are limited as well, to only peaceful purposes. Legally, there is no restriction specifically on remote sensing activities in Japan other than the Remote Sensing Principles. Commercial operators do not have an obligation to receive licences from the government for their activities in Japan, nor to report to the government in any event.

JAXA retains any applicable legal form of intellectual property rights to its Earth observation data.[201] Copyright in particular is not necessarily applicable to Earth observation data, unless the data is highly processed so that the copyright would obviously apply. Generally, data rights are protected under the conditions agreed to in the respective contracts, in a way similar to copyright. Under the respective agreements, there are some specific restrictions for data use. Reproduction or redistribution of the purchased, or "un-enhanced" data to third parties is not

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[195] *Id.* at arts. 4, 5, 9, 18.1.4.

[196] *Id.* at art. 4.

[197] Law Concerning the National Space Development Agency of Japan, Law No. 50 (June 23, 1969), *available at* http://www.oosa.unvienna.org/SpaceLaw/national/japan/nasda_1969E.html (last visited Dec. 16, 2005).

[198] JAXA Law, *supra* note 194, at art. 18.1.5.

[199] *Id.* at arts. 9, 18.1.4.

[200] *Id.* at art. 1.

[201] For the Japanese data policy, *see* Masami Onoda, *Japanese Earth Observation Program and Data Policy, in* PROCEEDINGS, THE FIRST INTERNATIONAL CONFERENCE ON THE STATE OF REMOTE SENSING LAW 11-20 (2002). There has been no announcement by JAXA of fundamental change in Earth observation data policy since then.

allowed.[202] Special arrangements and payment of royalty are required for this purpose.[203] When the data is processed, or "enhanced," by the user (so that the products do not retain the original pixel structure and by no means can lead back to standard products which retain the original appearance) the user has its own right for copy, reproduction and distribution of the enhanced data.

The Law Concerning Access to Information Held by Administrative Organs[204] is applicable to public independent administrative organizations such as JAXA. In light of this legislation, the principle of open and non-discriminatory access to Earth observation data is supported. Nevertheless, where commercial activities are involved, measures are to be taken so that the dissemination of data by JAXA will not interfere with those activities.[205]

The Japanese data policy is close to the European approach in that different approaches are taken depending on the purpose of data use. However, with the U.S. policy diverting from a pricing policy for government-owned satellites based on the categorization of users – it has become increasingly difficult to maintain conformity in data policy internationally. On the other hand, there has been a growing requirement that JAXA should be able to show the benefit of its investment in space activities: effective use of data acquired, including widespread data dissemination and utilization, in particular for environmental research. The satellites' missions have shifted from land and resources observation to environmental observation. These changes have shown the inefficiency of the current data policy. For example, international projects such as the Tropical Rainfall Measuring Mission (TRMM), or the Advanced Earth Observing Satellite (ADEOS) series, in which satellites carry instruments provided by several countries have the problem that different data policies result in a user receiving the same data

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[202] *Id.*

[203] *Id.*

[204] Law Concerning Access to Information Held by Administrative Organs, Law No. 42 (1999), *available at* http://www.soumu.go.jp/gyoukan/kanri/translation3.htm (last visited Dec. 16, 2005).

[205] Onoda, *supra* note 201.

on different terms and cost bases depending on the country where the request is submitted. Individual measures have been taken to address these problems. However, as the international networking and processing/archiving/distribution system becomes more and more global, as is planned with the Advanced Land Observing Satellite (ALOS) data node system, it will become necessary to fundamentally examine the existing data policy.[206]

There are various countries participating in remote sensing activities, including Russia, China, India and many others who receive and use data.[207] However, there are not many with a significant operational satellite program that disseminates data. The Russian Federation, successor to the long remote sensing tradition of the former Soviet Union, has its own remote sensing satellite program mainly for meteorology, the environment, and monitoring resources and other features of its vast land. However, aside from meteorological imagery, satellite data was not made available outside the Soviet Union until the late 1980s. Several firms now market Russian remotely sensed data and multi-spectral images are available in photographic form with resolutions as fine as 2 meters. Russia has broad federal legislation, including schemes for licensing, certification, liability, safety, insurance and government control.[208] Intellectual property and commercial secrets of foreign entities operating under the Federations jurisdiction is protected. In principle, high resolution images by Russian satellites are available openly. However, the conflict between intelligence and commerce have lead to the present situation that requests for available images and image orders have been denied, delayed and cancelled due to national security.

Other countries operating their own satellites often manage data distribution through contractual agreements between dis-

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[206] *See infra* 5.1.2 for further proposal on the data policy needed.

[207] *See* Committee on Earth Observation Satellites, Earth Observation Handbook, 2002, *supra* note 14.

[208] Law of the Russian Federation "About Space Activity", Decree No. 5663-1 of the Russian House of Soviets, *available at* http://www.oosa.unvienna.org/SpaceLaw/national/russian_federation/decree_5663-1_E.html (last visited Dec. 16, 2005).

tributors and the countries providing ground station services. It is often the case that the rules of the previous satellite program that the company has been operating are applied.

In sum, States operating Earth observation programs, in principle, follow the rules of the Remote Sensing Principles, and are trying to foster commercialization of the field often through licensing or contractual agreements. Protection of data rights under applicable legal terms include copyright, database protection (*sui generis* rights), confidentiality clauses, or non-redistribution clauses, and extra legal means such as encryption or secrecy. There have been various types of policies applied to Earth observation data, and there is no international standard or formalized universal approach. Although the policies had the same starting point, they have diversified in the course of their development, mainly due to the different attitudes toward the nature of the activity, and in particular, commercialization.[209]

There have been a number of attempts to bring standardization and harmonization to the issue, such as in the CEOS, the WMO or EUMETSAT, particularity in view of the growing importance of global environmental data needs. However, these efforts have often been adopted as informal recommendations or decisions of informal international groups, reaching agreement based on the "lowest common denominator" among different national policies. This failure - at least in the attempt of bringing different national policies together - is natural, since different countries have different interests in space programs that require large governmental investments. As a result of the efforts, the international community has made recent efforts to establish a system that is global in its origination.

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[209] The different approaches have relevance to the lead government department for Earth observation. In the U.S., it is the Department of Commerce (or NASA for science); in Sweden and the UK, it is Trade and Industry; in Italy and Germany, it is Research and Technology Development; in the Netherlands, it is Transport; while in Japan and many other Asian countries, it is Science and Technology.

C. Emerging International Frameworks

1. Multilateral Coordination

Since Earth observation has become a major space program, and with the requirements worldwide to use the data acquired from these systems, there have been several multilateral initiatives to coordinate the various national programs and policies. Among these are the intergovernmental programs including the WMO Global World Weather Watch (WWW)[210], the United Nations Environment Programme(UNEP) Earthwatch[211], intergovernmental but informal voluntary groups/partnerships such as the CEOS and the IGOS-P, and a number of other initiatives. These initiatives are mostly interrelated in their activities, but still there is a long way to be systematically coordinated with one another.

The earliest efforts of multilateral coordination in remote sensing were with meteorological satellites. The WWW, the principal activity of the WMO, is a cooperative program for collecting, processing, and disseminating meteorological data from satellites and other sources, aiming to maximize the utilization of meteorological data from satellites.[212] The Coordination Group for Meteorological Satellites meets annually to coordinate technical standards among satellite operators.

CEOS, established in 1984 in response to a recommendation from a panel under the aegis of the Economic Summit of Industrialized Nations, encompasses a broader range of coordination among international civil space-borne missions designed to observe and study planet Earth. Comprising 43 space agencies and other national and international organizations, CEOS works on a "best-effort" basis, and is recognized as the major international forum fro the coordination of Earth observation

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[210] World Meteorological Organization, *World Weather Watch, at* http://www.wmo.ch/web/www/www.html (last visited Oct. 30, 2005).

[211] United Nations System-Wide Earthwatch, *at* http://earthwatch.unep.net/ (last visited Oct. 30, 2005). The Global Resource Information Database (GRID) under the framework of Earthwatch integrates satellite remote sensing data and data collected by the Global Environment Monitoring System (GEMS).

[212] World Meteorological Organization, *supra* note 210.

satellite programs and for interaction of these programs with users of satellite data and information worldwide. The IGOS Partnership was established in 1998, and as of 2005 consists of fourteen partners including international organizations, research programs and CEOS.

Intergovernmental agencies affiliated with the United Nations play a significant role in these initiatives for multilateral coordination of Earth observation and research for the protection of the environment. Among these are the World Climate Research Programme, which studies physical aspects of climate change; the International Geosphere-Biosphere Programme, which studies biogeochemical aspects of global change and their relationship with climate change; and the International Human Dimensions Programme, which studies socioeconomic processes and their interaction with the global environment. The International Council of Scientific Unions is an organization of national scientific academies around the world. The Intergovernmental Oceanographic Commission, UNEP, the United Nations Educational, Scientific, and Cultural Organization, and the WMO also help in planning these international research efforts. Funding agencies, such as the International Group of Funding Agencies for Global Change Research, also play an important role. To respond to the need for long-term monitoring, the scientific community is developing plans for the GCOS, the Global Ocean Observing System, and the proposed Global Terrestrial Observing System. A central purpose of these research programs is to inform and influence national policies and international agreements on environmental management.

The IGOS Partnership was established in 1998 based on a 1994 proposal of the Japanese Government for a "Global Observing System." It seeks to provide a comprehensive framework to harmonize the common interests of the major space-based and in-situ systems for global observation of the Earth. Based on the CEOS pilot projects, it is being developed as an overarching strategy for conducting observations relating to climate and atmosphere, oceans and coasts, the land surface and the Earth's interior. There are currently 14 IGOS Partners includ-

ing the international cooperative bodies introduced above.[213] Again, IGOS is a voluntary "partnership"[214], each partner cooperating on a "best-effort" basis. IGOS-P develops "themes," as specific categories or domains of the global observation strategy. This thematic approach has been a useful layout in the planning of GEOSS, which will be discussed later.

Thus, it is rightly said, "[e]xisting international programs of global change research depend almost entirely on informal mechanisms to persuade national governments to support research agendas developed by the international scientific community."[215] The major reason for this development should be that it is often much easier to establish a consensus in building such mechanisms, without the time-consuming procedure of gaining financial commitment or national or organizational authorization, but through loose cooperation on a "best-effort" basis. This approach has been regarded with increasing importance such as in the partnership approach adopted at the WSSD. The effective use of knowledge achieved and collected in such manner, requires an institutional mechanism to assess the state of understanding of environmental problems and inform policy makers.[216] It is with this need that nations have started to organize themselves to build a new mechanism, calling for cooperation to protect the environment based on national plans and at the same time responding to international obligations.

2. International Harmonization of Data Policy

As an essential part of their initiatives, the international bodies indicated above have made efforts in harmonizing the data policies. It is a general agreement, at least within the re-

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[213] Integrated Global Observing Strategy Partnership, *supra* note 16. *See also*, Integrated Global Observing Strategy Partnership, *IGOS Brochure* (July 2003).

[214] For the discussion on "Partnerships", *see* Tatsuro Kunigi, *Challenge of Globalization and Synergistic Response*", presented at the 3rd International Symposium at Kagawa University: Compliance with Environmental Agreements and Free Trade Regimes (December 2001).

[215] U.S. Congress, Office of Technology Assessment, *Remotely Sensed Data: Technology, Management, and Markets, OTA-ISS-60*, 135 (Washington, DC: U.S. Government Printing Office, September 1994) [hereinafter *Technology, Management, and Markets*].

[216] *Id.* at 139.

spective forum, that Earth science data should be made readily available for global change research.[217]

CEOS adopted its data principles in 1992,[218] as a "[r]esolution on Satellite Data Exchange Principles in Support of Global Change Research."[219] It is limited to global change research, and consists of very general rules on data exchange, including: preservation of all data needed for long-term research and monitoring; easily accessible information for data archives; use of international standards; maximization of use through an exchange/sharing mechanism; non-discriminatory access by non-members; and harmonization of priorities. CEOS further adopted in 1994 a set of general rules for operational environmental data.[220] WMO[221] and Eumetsat also have established data principles for meteorological data.

It could be said that these efforts have, to some extent in general, promoted data exchange and standardization, and the improvement of accessibility, especially for environmental data. However, there is still a significant gap from establishing cooperative bodies and achieving a functioning mechanism. Initiatives are rapidly raised but it is a long way to reach consensus on a substantial set of rules for data exchange. This should be the fundamental issue and should not have been left aside, as, in reality, has been the case to date. These initial attempts ended in generic statements. However, the difficulty in harmonizing data principles is an indicator of the poor integration of

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[217] Resolution on Satellite Data Exchange Principles in Support of Global Change Research, Dec. 1992, CEOS Yearbook, 1995 [hereinafter Resolution on Satellite Data Exchange Principles]; WMO Resolution 40, WMO Policy and Practice for the Exchange of Meteorological and Related Data and Products Including Guidelines on Relationships in Commercial Meteorological Activities, Oct. 26, 1995 [hereinafter WMO Resolution], *available at* http://www.nws.noaa.gov/im/wmocovr.htm (last visited Dec. 16, 2005); Second Report on the Adequacy of the Global Climate Observing Systems for Climate in Support of the UNFCCC, GCOS-82, April 2003, WMO/TD No. 1143, *available at* http://www.wmo.ch/web/gcos/gcoshome.html (last visited Dec. 16, 2005); EUMETSAT, Resolution EUM/C/RES.IV, adopted at the 38th meeting of the EUMETSAT Council on 1-3 July 1998 on EUMETSAT Principles on Data Policy.

[218] Resolution on Satellite Data Exchange Principles, *supra* note 217.

[219] *Id.*

[220] Resolution on Principles of Satellite Data Provision in Support of Operational Environmental Use for the Public Benefit, Sept. 1994, *available at* http://www.ceos.org/pages/satellite_2.html.

[221] WMO Resolution, *supra* note 217.

the technical programs. In reality, most data users have difficulty in being directed to satellite operators that give out data on different terms in cost and accessibility. Bringing rules together should not be an obstacle if it is a prerequisite to bring about the system required by treaty. Thus, any attempt to realize a global Earth observing system in response to the "systematic observation" required by international legal instruments, demands that the fundamental issue of coordinating national laws and policies must be solved.

3. World Summit on Sustainable Development and the Global Earth Observation System of Systems

The importance of the above multilateral initiatives to the protection of the environment has been recognized at an intergovernmental level. CEOS and IGOS, through the work of GCOS[222] have provided input to the IPCC.[223] At the 2002 World Summit on Sustainable Development in Johannesburg, IGOS-P was registered as a WSSD Partnership.[224]

The Plan of Implementation,[225] adopted by the WSSD, had negotiations in which Japan, the U.S., the EU and other States made proposals regarding sustainable development and the need for Earth observation. As a result, the Plan includes: international joint observation and research for the water cycle

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[222] *GCOS Second Adequacy Report*, *supra* note 20.

[223] IPCC Third Assessment Report, WG1 Summary for Policy Makers, IPCC 17th Session (2001) *available at* www.ipcc.ch/pub/spm22-01.pdf (last visited Dec. 16, 2005). Further research is required to improve the ability to detect, attribute and understand climate change, to reduce uncertainties and to project future climate changes. In particular, there is a need for additional systematic and sustained observations, modeling and process studies [...] The following are high priority areas for action. Systematic observations and reconstructions: [...] - sustain and expand the observations foundation for climate studies by providing accurate, long-term, consistent data including implementation of a strategy for integrated global observations." *Id.* at 17.

[224] Commission on Sustainable Development (CSD) Partnerships Database, *at* http://webapps01.un.org/dsd/partnerships/public/partnerships/229.html (last visited Oct. 30, 2005). *See also* The Implementation Track for Agenda 21 and the Johannesburg Plan of Implementation: Future Programme, Organisation and Methods of Work of the Commission on Sustainable Development, May 14, 2003, ¶¶ 21-24, *available at* http://www.un.org/esa/sustdev/partnerships/csd11_partnerships_decision.htm (last visited Dec. 16, 2005).

[225] World Summit, *supra* note 19.

and disaster management;[226] promoting systematic observation[227] and the development and wider use of Earth observation technologies, including satellite remote sensing, global mapping and geographic information systems, and strengthening coordination for integrated global observations[228]. Though not considered a legal statement, these actions represent worldwide agreement at the intergovernmental level on the need to promote Earth observation for sustainable development. It has become the foundation for the development of GEOSS.

As an endorsed resolution of an intergovernmental body, the Global Earth Observation System of Systems 10-Year Implementation Plan[229] is of particular importance in relation to satellite Earth observation and systematic observation. The Plan is based upon the negotiations held at three ministerial Earth Observation Summits. The first Summit was held in Washington D.C. in July 2003, and the second Summit was held in Tokyo in April 2004. The Plan was endorsed at the Third Earth Observation Summit held in Brussels in February 2005. About 60 countries including the G-8, South Africa, China, Indonesia, Thailand and India, and the EC, and thirty international organizations participated. GEO was established at the third Summit to implement GEOSS.

The Plan is supported by detailed Reference Document. Its purpose is to "summarize the essential steps to be undertaken, over the next decade, by a global community of nations and intergovernmental, international, and regional organizations, to put in place a Global Earth Observation System of Systems (GEOSS),"[230] whose vision is to "realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information."[231] The purpose of GEOSS is to "achieve comprehensive, coordinated and sustained observations of the Earth

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[226] *Id.* ¶¶ 28, 37(c).
[227] *Id.* ¶ 38(g).
[228] *Id.* ¶ 132.
[229] *GEOSS 10-Year Implementation Plan*, *supra* note 123.
[230] *Id.* at 1.
[231] *Id.*

System".[232] "GEOSS will be a 'system of systems' consisting of existing and future Earth observation systems, supplementing but not supplanting their own mandates and governance arrangements."[233] It is the aspiration of GEOSS to "encompass all areas of the world, and to cover *in situ*, airborne, and space-based observations."[234] GEOSS will also "promote capacity building in Earth observation."[235]

It is recognized that "the current situation with respect to the availability of Earth observations is not optimal," particularly in "coordination and data sharing among countries, organizations and disciplines, and meeting the needs of sustainable development."[236] The intended benefit of GEOSS is to be the "targeted collective action" that it would bring about. The societal benefits of GEOSS are quite widespread. They include: disaster mitigation, health, energy, climate, water, weather, ecosystems, agriculture, and biodiversity. The aforementioned IGOS "themes" is an approach similar to these nine areas of societal benefits of GEOSS. The IGOS-P themes are processes to develop a global observing strategy integrating space and ground based observations in selected fields of common interest among a group of Partners. The IGOS themes are currently: the Global Carbon Cycle, Geohazards, Ocean, Water Cycle and Atmospheric chemistry, and others are being proposed. It is expected that these existing attempts will be incorporated to the development of GEOSS and its nine societal beneficial areas.

The Plan also refers to the GEOSS data sharing principles: (1) full and open exchange; (2) minimum time delay and minimum cost; (3) free of charge or no more than cost of reproduction encouraged for research and education. There is also a statement for a phase-development of capacity building. Funding of GEOSS is to be made mainly through existing national and international mechanisms, not through GEO, which will be run by

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[232] *Id.*
[233] *Id.* at 2.
[234] *Id.*
[235] *Id.*
[236] *Id.* at 3.

voluntary trust funds for baseline secretariat activities and other agreed GEO activities.

While there are not many analytical studies on the GEOSS yet, an early discussion in 2004 by Macauley[237] argues that "[b]y way of its supranational reach in earth observation... GEOSS could permit closer monitoring of information that is self-reported by parties around the world and supply information for adjudicating disputes. The system could figure prominently as a means of monitoring compliance...."[238]

It is indeed an achievement that a single system of systems is to be formulated, under the strong auspices of participating governments and international entities, with interfaces to major environmental conventions, such as UNFCCC. It is also consistent with the call for systematic observations or monitoring through multilateral treaties, responding to the general obligation for States to cooperate in the protection of the environment. However, the Plan is still very general in nature and is still far from being operational. Bearing in mind that there have been numerous international initiatives of this nature, there is always a possibility that this may end up in an effort to build just another "system", no more functional than the previous ones. The GEO Secretariat is being hosted by WMO in Geneva, and the new GEO plenary met for the first time to agree its Executive Committee and to make arrangements to appoint its Director and subsidiary committees. This is certainly an initiative which is worth watching, and a few considerations will be given in the next section.

V. TOWARDS EFFECTIVE IMPLEMENTATION

The discussion so far indicates that, as a major undertaking of international law, States are enjoined to cooperate in protecting the environment, and one of the procedural obligations to this is promoting systematic observation in climate change, or more broadly, monitoring of the global commons. Thus, the in-

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[237] Molly K. Macauley, *Is the Vision of the Earth Observation Summit Realizable?*, 21 SPACE POL'Y 29-39 (2005).

[238] *Id.* at 38.

ternational community is now striving to gather existing efforts with a vision to develop an integrated systematic observation system that would respond to the requirement of international law. In the meantime, technology develops and commercial activities are taking off. Whether this vision of States is realizable depends on various factors, including: (1) establishing reliable and independent institutional frameworks on the global, international and national level, (2) enforcing the treaty procedures by Earth observation, while achieving adequacy and cost effectiveness, also taking in commercial data; and thus leading to (3) appropriate management of the global commons.

A. Reliable and Independent Institutional Frameworks

In order to protect the environment, or more specifically, to establish effective procedures on developing accurate and adequate information that would be the basis for the operation and implementation of treaty regimes, it is important that the source of information is reliable and independent of national authorities. The framework for this would involve global participation, not only from advanced countries but also of developed countries, and even from those concerned with the potential adverse effect to their economy or development. This should be supported by international and national institutional frameworks of each participating country, for the identifications of observation requirements and effective dissemination of data and information.

1. Global Participation

Global participation is not easily achieved, since as long as governments act on behalf of a sovereign State, each would have its own and possibly different interests to protect. Thus, the recent approach of multilateral environmental treaties is to give a "common concern" status to the protection of the environment, as "common legal interest" of all States, whether directly injured or not.[239] However, the inability of nations to enjoin them-

[239] BIRNIE, *supra* note 23, at 503.

selves in such a manner shows the shortcomings of this approach in securing global participation.[240]

So far, there has been no expressed objection to the need for international cooperation for systematic observation of the environment. The U.S. took leadership in Earth observation efforts, hosting the first Earth Observation Summit and releasing a ten-year Strategic Plan for the U.S. components of the integrated Earth Observation System.[241] Some observe this as a response to criticism of having "done nothing" about global warming, or with the motivation to exercise leadership and possibly, control over an increasingly large number of Earth observation organizations.[242] There might be a certain degree of truth in this, while there are other factors that should not be overlooked. That is the *mutual* interest in participating in this system at different levels.

Research and systematic observation provide the benefit to all countries of a means to access information on the state of the global commons, at reasonable cost terms. To industrialized countries this means: 1) the rationale to proceed in development; 2) opportunity to gain support in research and observation activities, for which cooperation in acquiring ground-truth data is essential from the observed countries. On the other hand, for developing countries this means: 1) opportunity to enjoy the benefit of systems constructed by industrialized countries, in disaster management, land-use management, agriculture and other applications; 2) possible participation in part of the system, with support of other countries for the rest of the system. Supported with appropriate policy and legal instruments that enable these benefits to effetely function as incen-

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[240] U.S. President, George W. Bush, in his letter to Senators of March 13, 2001, explained the reason of opposition to the Kyoto Protocol that "it exempts 80 percent of the world, including major population centers such as China and India, from compliance, and would cause serious harm to the U.S. economy." The White House, President George W. Bush, Text of a Letter from the President to Senators Hagel, Helms, Craig, and Roberts (March 13, 2001), *available at* http://www.whitehouse.gov/news/releases/2001/03/20010314.html (last visited Dec. 16, 2005).

[241] *See* U.S. Climate Change Policy, Fact Sheet Released by the White House, Washington D.C., November 19, 2004, *available at* http://www.state.gov/g/oes/rls/fs/2004/38641.htm (last visited Dec. 16, 2005).

[242] Macauley, *supra* note 237, at 7.

tives, this is an effective and important motivation to realize global participation to the treaty procedure.[243]

At the international level, these benefits are mutual, not common, and the level of participation is different. As long as a state acts as a sovereign power, the benefits must be mutual and reciprocal in theory at the international level, in order to achieve the incentive for participation.

2. International and National Institutional Procedures

To address the global common concern, institutional procedures on the international and national level should be established. This is important in two ways: for identifying the national requirement and contribution to global observations, and to effectively disseminate the data of the global system. The overall adequacy of existing observations to respond to the international requirements is to be identified based on reviews of contributions of national plans.[244] The status of national contributions is to be reported through the state representatives to various international organizations as well as by the government. Unless there is an effective process at the national level to identify and coordinate the requirements and existing plans, this is not workable. Therefore, it is crucial for a global system that every state has a working institutional system at the national level to coordinate the national input to the global system.

For data sharing, the simplest approach to international data management is to build on national and regional data systems and plans by establishing basic requirements for compatibility and interoperability.[245] For example, the Japanese Advanced Land Observing Satellite (ALOS) data policy will allow different agencies to handle their regional data according to its

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[243] Indeed, the author was assured by a US government official at a seminar in February 2005 that data of GEOSS is open to be used for the activities under the Kyoto Protocol.

[244] *See* UNFCCC, Report on the Adequacy of the Global Climate Observing Systems, GCOS-48, Oct. 1998, *available at* http://www.wmo.ch/web/gcos/Publications/gcos-48.pdf (last visited Dec. 16, 2005).

[245] *Technology, Management, and Markets*, *supra* note 215.

own data policy, with an agreed inter-region distribution policy defining an interface where the respective regional policies will meet. The whole mechanism will be a combination of decentralized research and non-research data distribution. A private consortium may be established for promoting commercial data use. This approach has the advantage of flexibility, allowing different agencies to meet their various needs in the manner they deem appropriate. Whether this system is technically and politically operable is to be demonstrated once the satellite is launched and operated.

An alternative approach, which has been in part the effort of GEOSS and CEOS, is for the international community to collaborate on the definition of data management rules and its implementation. GEO in particular could consider this approach in developing plans for GEOSS. The problem is that this effort has been made by the international community for decades but, lacking strong political support, has not reached much more than a lowest common denominator. States tend to find the effort troublesome with less achievement.

In the author's view, in order to respond to the international calls for improved environmental information, it would be best to give limited but effective authority to an international organization, or rather, an international body, such as GEO, to take an approach similar to that of the voluntary "best-effort" cooperation of a Partnership such as IGOS-P. By adding more political, and possibly legal, authority and leadership it will be possible to reinforce the weakness of the voluntary nature of the Partnership. Such authority should be limited to environmental aspects, at least when it concerns direct links with environmental treaty frameworks. The management of other information is not achieved in the same way – it might be that other approaches such as strong data protection or closed information policies apply, and this may not be the task for an international body.

The international body could choose from the above mentioned alternatives of data handling. While the former approach to build on existing systems and policies is much easier to achieve, certain categories of data with limited scope, such as the handling of environmental data on climate change, or on

specific parameters could be defined with more specific data policies. It is essential to limit the scope again, since in this way it is possible to avoid conflicts of interests concerning sovereign rights over natural resources, security, or commercial values. Thus, for the protection of the environment, in particular starting with ozone and climate change, it is important to establish a reliable and independent source of information that would contribute to the understanding of the effects and to reducing scientific uncertainties, and possibly to other procedures such as reporting and compliance monitoring. In other areas, careful consideration such as done in this paper should take place in defining the appropriate approach of development. Thus the author proposes that, as IGOS-P has done in the development of "theme" strategies, GEO should provide such studies on the respective societal beneficial areas of GEOSS in the coming years, in order to define the appropriate information management and institutional procedures.

In this way, at the global level, the requirements and general principles for data management should be defined, with a flexible international system based on different national frameworks that address each national concern. At the respective levels of global, international and national, legal instruments should be defined to the extent appropriate, with respect to the degree of technical development. Without this, in a few years there would be left an enormous empty system with no substance, the effort for GEOSS being just another system, existing merely to provide work for the ones involved but no effective output.

On the national level, there is a need to establish national policies and plans, and relevant legislation where required, to ensure domestic implementation and fulfill national contributions to the system. These could include legislation on the range of intellectual property rights applicable to Earth observation data, licensing of commercial satellites operation, and national plans for technology development and data sharing.

B. Enforcing Treaty Procedures by Earth Observation

The second point towards effective implementation of the vision is how the information gathered by Earth observation could enforce treaty procedures. In the context of international environmental law, the primary role of global Earth environmental observation is to provide systematic observation as a general principle of a treaty, as discussed in the previous parts of this paper. Nonetheless, there are also other potential applications. The overall role of Earth observation in enforcing treaty procedures can be described as the followings:

a) Information for decision making (including systematic observation);

b) Monitoring damage or harm to other States (including disaster monitoring);

c) Monitoring compliance (such as supporting reporting capability of States).

Among these three points, only the first is explicitly provided for in international treaty. However, for instance, GEOSS will in part contribute to systematic observation and also has the purpose to support other applications as cited above. Thus, in practice, Earth observation data may be used in various areas of the treaty process.

A recent study on remote sensing and environmental treaties suggests the five potential beneficial uses of remote sensing technology in environmental policy making: multilateral environmental agreement negotiation, implementation review, compliance and dispute resolution, broader political process (demonstration to the government and public), and environmental assessment.[246] There are also studies on the use of satellite data for possible contributions to the Kyoto Protocol compliance.[247] Possible areas of remote sensing application under the Protocol were identified such as in the provision of systematic observations of relevant land cover; support the establishment of a 1990

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[246] Karen Kline, *supra* note 8.

[247] MONITORING TREATY COMPLIANCE, *supra* note 8.

carbon stock baseline; detection and spatial quantification of change in land cover and biomass stocks therein, supporting national accounting of Afforestation, Reforestation and Deforestation (ARD); and mapping and monitoring of sources of anthropogenic CH_4, under the provisions of the Protocol.[248]

These studies on the political and technical aspects concerning the use of Earth observation technology for contribution to an environmental treaty is important in considering the role of Earth observation. For effective implementation of Earth observation for environmental protection, it is essential that they be identified, and effectively incorporated in the international procedures. In this process it is necessary that Earth observation technologies develop in a manner to serve effectively the requirements of the frameworks, such as aiming at parameters and quantitative accuracy as well as products that meet the international requirements, and developing appropriate data sharing and dissemination policies in collaboration with national authorities and other users.

Cost effectiveness is also a major issue. Presently, the space-based Earth observation systems are mostly operated by governmental funds. One satellite system could easily cost several hundred million U.S. dollars for its development including ground systems and launch, and millions a year for its operation.[249] It is not only difficult for many countries to commit to such an amount but it could also be an obstacle to fulfill the adequacy of global observation systems and ensure effective use for important environmental requirements. The following are possible measures to achieve cost-effectiveness:

- Streamline the system as expressed in treaty provisions for implementation and focus on priority parameters required;

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[248] Kyoto Protocol, *supra* note 82, at arts. 3, 5, 10, 12.

[249] NASA Earth Science budget in FY2004 President's request was 1613.2 million USD. *See* National Aeronautics and Space Administration, FY 2005 Budget Summary, *available at* http://www.nasa.gov/pdf/55395main_12%20Earth%20Science.pdf (last visited Dec. 27, 2005). The ESA budget for the Earth and Environment Monitoring from Space Programme in FY 2004 was 320.9 MEuro. *See* European Space Agency, ESA Annual Report 2004, *available at* http://www.esa.int/esapub/annuals/annual04/ar4_finance.pdf (last visited Dec. 27, 2005).

- Establish a globally coordinated Earth observation system, avoiding gaps and overlaps of observations by States;
- Ensure continuity and inter-operability to minimize the cost of ground systems;
- Develop a satellite system that is cost-effective and that adopts appropriate technology in its hardware development, which does not cause damage to the Earth or outer space environment itself.

It should also be essential to involve commercial funds in this process, and to achieve a system that could provide data in a self-financing manner to the largest possible extent.[250]

C. Commercial Remote Sensing

As seen in the formulation of the U.S. Alliance for Earth Observations,[251] there is a rise of industrial activities today. Although commercialization of remote sensing activities has been considered by policy makers since the very early stages of governmental space remote sensing programs, this is a relatively new development. For the implementation of a systematic Earth observation system, it is essential that these players be involved. For this, effective policy and legal instruments should be organized at the national level.

The first purely private Earth observation spacecraft was launched by a U.S. company in 1995.[252] Before this, because of the cost involved in developing the system, most Earth observation satellite programs were developed and operated, or supported by government agencies. There have been more than 5,000 satellites launched to date, and most were either military or governmental satellites. Only a small portion of those are satellites developed and operated by private companies, and most of these were communication satellites. In contrast to the

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[250] *See supra* Section IV.

[251] The Alliance for Earth Observations, *Homepage, at* http://www.strategies.org/alliance/ (last visited Oct. 30, 2005).

[252] *See* OrbImage, *Low-Cost, High-Value Weather Information, at* http://www.orbimage.com/corp/orbimage_system/ov1/ (last visited Oct. 30, 2005) (Orbview-1 launched by OrbImage).

rapid commercialization of communication satellites, the development of Earth observation business has been relatively slow: even now, it is only beginning.

Following the U.S. *Landsat,* the SPOT program was developed by the French government with the aim of commercialization was started in 1986. The Indian IRS was initiated in 1988, and the European, Japanese and Canadian governments followed. These all had in common that the government developed the satellite system, and then had a contract with a private or quasi-private company to operate and/or distribute the satellite data. This is mainly because of the large cost involved in developing the satellite and ground system, and the relatively low income that was expected from the sales of the data acquired from the system. Another reason is that a large part of data users are researchers or in the public sector. In other words, the data applications have been rather focused on scientific research including global change research or public use such as meteorology, environment, disaster management or surveillance. For this reason in most cases governments have not intended to recover the cost for system development, but have designated a "private" distributor to develop their own pricing policy in accordance with "market" price. It had been the case with the U.S. that the government found the market immature for rapid commercialization and altered the course of their policy to a more moderate approach. However, during this process one of the earliest private companies, Eosat, formed by Hughes and RCA entered an agreement with the U.S. government to operate the Landsat program. This continued until *Landsat-7* was taken back to the U.S. government as a result of the 1992 Land Remote Sensing Policy Act. On the other hand, several companies offering value-added services emerged in the U.S., such as ERDAS and ESRI (Environmental Systems Research Institute). Since these companies initiated the use of Geographic Information System (GIS) combined with satellite imagery, many other companies have entered this business.

In 1998, the high resolution data of the Russian KR-1000 camera images came into sales in the world market. Around this time purely-commercial – that is, companies that not only operate and distribute satellite data but also develop their own

system and commercially procure launch services – have emerged in the U.S., namely, Space Imaging Inc. (formerly Eosat)[253] operating the IKONOS series, DigitalGlobe (formerly EarthWatch) operating the Quickbird satellite, and OrbImage operating the Orbview series. These companies developed their businesses particularly through the 2003 war between the U.S. and Iraq, and now are launching a series of their own commercial satellites.

The situations in other countries have not moved so fast. Europe, France, Japan, Canada, Korea, India, China, Brazil, and Russia also have civilian systems whose data are (in some cases in principle) open to the public through distributors, often commercial, while the satellite system remains governmental.

As a whole, there are varying speculations for the future of the commercialization of Earth observation, including optimistic ones[254] and others with a more cautious view[255]. Based on the optimistic view, governments are welcoming private partnerships in hope that it would enhance the opportunities, continuity and range of data acquisition, and assist the development of the sector. Should the government wish to involve the commercial sector in its efforts at systematic observations, e.g. purchase data for GEOSS or subsidize a private company for contributing to the system, there must be a clear-cut policy and legal framework for the public-private relationship, including licensing and data policy issues.

International law, as well as the U.N. General Assembly resolutions including the U.N. Remote Sensing Principles, consists of agreements of nations. The activities of private entities (on Earth) are therefore left to be regulated through municipal law, in line with the international agreements. When the public and private sector have rivalry in the sales of a product, espe-

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[253] It has recently been agreed that Space Imaging will be purchased by OrbImage. CEO Statement, Press Release, *ORBIMAGE Agreement to Purchase Assets of Space Imaging*, SPACE IMAGING, (Aug. 16, 2005), *at* http://www.spaceimaging.com/newsroom/2005_ceoStatement.htm (last visited Dec. 16, 2005).

[254] *See generally* William E. Stoney, *Remote Sensing in the 21st Century: Outlook for the Future*, *available at* http://www.fas.org/irp/imint/docs/rst/Sect21/Sect21_1.html (last visited Dec. 16, 2005).

[255] The move in U.S. legislation reflects this view. *See* Hall, *supra* note 167, at 32.

cially with the dissemination policy in intellectual rights or pricing policy, the conflict needs to be solved through appropriate interface coordination. If there is need of legal instruments, that should be addressed.

For Earth observation to protect the environment, as discussed earlier, the applicable legal instruments are the Outer Space Treaty and related instruments, and the U.N. Remote Sensing Principles that are followed by most governmental data policies. Also, the obligation for international cooperation for research and systematic observation or its equivalent in environmental treaties is applicable. These obligations imply the open access and sharing of environmental data, while for commercial purposes this is not acceptable. Commercial activities imply protection of rights to sell and for Earth observation, protection of data rights. Thus there is a sharp contrast to what is required of States by international environmental law and the interests of private industry.

In this respect, as previously indicated, the U.N. Remote Sensing Principles include a definition for remote sensing as being "for the purpose of improving natural resources management, land use and the protection of the environment."[256] Once commercial data is in effect utilized in the framework of international environmental protection, it would be regarded as a "public good" guided by the Principles. It is therefore necessary to reach agreement on how to deal with the commercial interest in the data in terms of redistribution and pricing.[257] The same should be said of government owned quasi-private Earth observation programs. As environmental monitoring is foreseen to become an increasingly important global activity, there is a need to address such issues in the near future.

D. Defending the Global Commons

With a reliable and independent framework established, and technical programs streamlined under such frameworks, the grounds for effective information management for the pro-

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[256] Remote Sensing Principles, *supra* note 6, at princ. I.

[257] *Expanding Global Remote Sensing Services, supra* note 148, at 97-124.

tection of the global commons would be formulated. Therefore, it is important to construct a procedure to effectively link this information with the environmental guidelines and rules, in order to take appropriate measures in the face of environmental risk.

There are discussions for the establishment of international organizations for supervising the compliance to and implementation of environmental treaties, or even representing the rights of the global commons. Stone, in his argument on the establishment of the global commons guardian, who would be legal representatives for the natural environment, proposes its first chore to be providing monitoring; second, to exercise legislative functions as part of the complex web of policy-making institutions; and, third, to act as a special intervenor-counsel for the unrepresented environmental "victim" in bilateral and multilateral disputes.[258] Somewhat far-fetched as it may have seemed at the time this proposal was initially made, as seen today, at least the first phase of monitoring would be observed to have become reality, at least for the atmosphere and climate change. It is a matter of time and political-will that the second and possibly the third phase would become functional. Of course, this is an extremely complex task to achieve, and it is essential that the first phase of monitoring – or information management in the broader sense – succeeds in becoming operational.

The envisioned global Earth observation system would be a precursor framework for this. It should be noted that its foundations are on the principles of free exploration and use set in the Outer Space Treaty. The rules provided in the U.N. Remote Sensing Principles, including open and non-discriminatory access to data and reasonable cost terms is also the basis for these practices.[259] The view of Earth from outer space has given significant impact to the world in facing environmental issues, and is to serve a crucial role in environmental protection, only because the activity itself is conducted from a broader global

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[258] *See* CHRISTOPHER D. STONE, DEFENDING THE GLOBAL COMMONS IN SANDS 34-49 (Philippe, ed. Greening International Law, London: Earthscan Publications Ltd., 1993).

[259] *See supra* Section IV.A.2.

commons.[260] Thus, human activities in outer space have enabled States to perform in a way impossible on the ground under territorial sovereignty. This implies that in responding to the requirements of environmental treaties, it is important to enable States to act on legal principles different from those originating from the conventional territorial rights. This may lead to significant advance in the legal framework concerning the global commons. Specifically, the approach of space law in promoting free exploration and use of the global commons,[261] and the practice of applying space law to "space objects" even when they are in airspace, and open and non-discriminatory access to environmental information[262] could be regarded as principles applicable to the management of the global commons, such as the atmosphere, ocean and biodiversity.

Another key is that the mutual benefit of States in Earth observation involves incentives for development, and for a substantial subject – in this case, "data" or "information" – to be gained, not directly implying finance. Environmental frameworks could also take this point into consideration. On the part of Earth observation, what is needed for the effective implementation of an environmental treaty is not the ultimate enhancement of accuracy, not the perfect understanding nor the entire coverage of environmental parameters, but the construction of procedures whereby an international system would provide adequate information required by States to comply to their international obligations. Not to mention that the system itself does not undermine the efforts of the international community with adverse environmental effects. Such points could be mutually considered between environmental and space law, as both have in common the objective of protecting and regulating human activity with respect to the global commons.

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[260] It would not be inappropriate to use the term "global" commons for these areas of outer space, since the Low Earth Orbit or Geostationary Earth Orbit where most satellites are orbiting are in fact just hundreds or thousands of kilometers away from Earth, and could be regarded as the physical extension of the atmosphere in some respects.

[261] Outer Space Treaty, *supra* note 5, at art. I.

[262] Remote Sensing Principles, *supra* note 6, at princs. IV, X, XII, XIII.

VI. CONCLUSION

Today, States regard the global environment as a matter of common concern, which should be protected and sustained for the next generation. To protect this interest, numerous new legal instruments have been concluded, and some general legal principles originating from the features of the environment have emerged. Thus, there is a general obligation at international environmental law for States to cooperate in the protection of the environment. In this regard, particularly in multilateral frameworks for the protection of the atmosphere, there is an obligation for States to cooperate in research and systematic observation to further the understanding and to reduce or eliminate the remaining uncertainties.[263] Satellite Earth observation has been developed as an integral part of systematic observation, and based on this it should be regarded as an international obligation, insofar as the object of observation concerns ozone and climate change, and with the condition that differentiated capabilities are taken into account.

In protecting the global commons, it is essential to establish a foundation of reliable and independent environmental information management. In this, an international organization or body would play a significant role. In the ozone and climate change regime, systematic observation is being developed as a precursor system for such information management. In the author's view, it would be best to give limited but effective authority to an international body, such as GEO, to take an approach similar to that of the voluntary "best-effort" cooperation of a partnership. Such authority should be limited to environmental aspects, at least when it concerns direct links with environmental treaty frameworks. In order to define the appropriate information management and institutional procedures, he author proposes that GEO should conduct studies – including the legal and political aspects examined in this paper – on the respective societal benefit areas of GEOSS in the coming years. Traditionally, States operating Earth observation programs follow the principles and rules under the Outer Space Treaty. The

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[263] UNFCCC, *supra* note 3, at art. 4(1)(g).

traditional legal frameworks governing space activities and national practices include several important rules concerning the environment, but have not been sufficiently updated to correspond to the environmental information needs. Conflicts in States' rights involving equity and equality, natural resources and security, and information regarding those are yet to be solved. Although there have been a number of attempts to harmonize national programs, data laws and policies, this has led to an initial failure to establish something more than the lowest common denominator. This failure has been an obstacle to effective information management, especially in the field of environmental protection. The fundamental issue is coordination of national law and policies. Synergy between space and environmental law is important, as both have in common the objective of regulating human activity within the global commons.

To achieve this, the first phase should be to provide systematic observation from space for the protection of the atmosphere, as has been addressed in this paper. It will be necessary to take advantage of the nature of satellite orbits as a common area adjacent to the Earth's atmosphere, and carefully guiding appropriate international and national procedures under general principles and rules of international environmental law and conventional space law. To ensure the effectiveness of data, national and international data policies as well as global principles are essential, and harmonization at respective levels should be achieved. Further steps would involve, in the author's view, eventual crystallization of norms surrounding such activities in space law. This might involve incorporating environmental provisions concerning responsibility and other general principles for protecting the space environment including the Moon and celestial bodies, as well as activities to protect the Earth environment. At the same time, it would involve developing legal procedures to implement environmental principles to protect the Earth environment, in part guided by the achievement of space law in directing space development by nations.

There should be different approaches for different areas of the global commons. Nevertheless, the crucial point is how the international community will effectively understand and use the information about the commons. It will be the task of the inter-

national community for the coming decade to streamline policy and technology through the principles and procedural rules of environmental and space law. With this said, the many issues faced by such initiatives should be addressed at a realistic level. The effort has just started, and there is a long way for humankind until it learns how to view the Earth, decide the appropriate next steps, and then, to take action.

SPACE LAW IN ITS SECOND HALF-CENTURY

Glenn Harlan Reynolds[*]

It has now been 55 years since the publication of John Cobb Cooper's seminal article on space law, credited by many as being the first serious scholarly treatment of the subject.[1] Space law has gone through many phases since then, and appears to be entering yet another today. This brief commentary will look at where we have been, and where we just might be heading.

PHASE ONE

The earliest years of space law were years of purest speculation, as the field predates spaceflight itself. For a decade or so after Cooper's article, the questions ranged from basic to speculative: Where did airspace end, and outer space begin? Could nations claim territory on the Moon and other planets? Were spacecraft like ships, or like aircraft? How would space societies be governed? How would Earth nations deal with alien intelligences?

The end of Phase One more or less coincided with the publication of two books: Myres McDougall, Harold Lasswell, and

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[1] John C. Cooper, *High Altitude Flight and National Sovereignty*, 4 INT'L L.Q. 411 (1951). For a good history of space law's early days, see WALTER MCDOUGALL, . . . THE HEAVENS AND THE EARTH: A POLITICAL HISTORY OF THE SPACE AGE 177-94 (1985).

Ivan Vlasic's magisterial *Law and Public Order in Space*,[2] and Andrew Haley's *Space Law and Government*.[3] These two books – each, in its own way, surprisingly magisterial for works in a field barely a decade old – marked the endpoint of the speculative era of space law. The earlier space lawyers had mapped the contours of the territory (though, as with the old maps of Earth, those maps were sometimes inaccurate, or over-elaborate, or both). The next stage was the creation of hard-edged law that could guide nations in their day-to-day activities.

PHASE TWO

The ten years or so following the publication of the McDougall and Haley books were a period of explosive growth – what Barton Beebe has called the "golden age" of space law, that began to take hold as actual space-flight became possible.[4] During this period, law wasn't just talked about, but made, as various international agreements began to delimit the bounds of acceptable behavior by nation-states in and relating to outer space.

The Limited Test Ban Treaty of 1963 barred nuclear explosions in orbit.[5] This had the side effect of killing the American *Orion* project, a large spacecraft propelled by nuclear explosions whose developers (including such luminaries as Ted Taylor and Freeman Dyson) considered so promising that they coined the slogan "Saturn by 1970."[6] Had *Orion* proceeded, we might have seen spacecraft of the sort imagined in 1950s films, massive craft complete with rivets. In its absence, space travel took a different path.

The most significant achievement of the Golden Age, of course, was the 1967 Outer Space Treaty, which established the

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[2] MYRES MCDOUGAL ET. AL., LAW AND PUBLIC ORDER IN SPACE (1963).

[3] ANDREW HALEY, SPACE LAW AND GOVERNMENT (1963).

[4] Barton Beebe, *Law's Empire and the Final Frontier: Legalizing the Future in the Early Corpus Juris Spatialis*, 108 YALE L.J. 1737 (1999).

[5] Multilateral Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and Under Water, *entered into force* Oct. 10, 1963, 14 U.S.T. 1313, 480 U.N.T.S. 43 [hereinafter Limited Test Ban Treaty].

[6] GEORGE DYSON, PROJECT ORION: THE TRUE STORY OF THE ATOMIC SPACESHIP (2002). George Dyson is Freeman Dyson's son. For Freeman Dyson's firsthand account, *see*, FREEMAN DYSON, *Saturn by 1970, in* DISTURBING THE UNIVERSE 107 (1979).

framework for space law that obtains to this day. In language somewhat less sweeping than the Limited Test Ban Treaty (which forbids any "nuclear explosions" in orbit)[7] the Outer Space Treaty[8] forbade placing "nuclear weapons or any other kinds of weapons of mass destruction" in orbit or on celestial bodies.[9] The Outer Space Treaty also established straightforward rules regarding spacecraft registry and legal personality, national jurisdiction over spacecraft and space travelers, liability for accidents involving spacecraft, environmental responsibility relating to the Earth and to other planets, and a ban on "national appropriation" of celestial bodies such as the Moon and Mars.[10]

These provisions were later fleshed out by such later agreements as the 1968 Astronauts Agreement,[11] the 1972 Liability Convention,[12] and the Registration Convention.[13] And by 1975, when the Registration Agreement was finalized, this explosion of space lawmaking came to an end. The *Apollo* program, and the stillborn Soviet moon program, had their last hurrah with the *Apollo-Soyuz* mission that same year, and the space boom turned into a space bust. Not surprisingly, the space law boom was also over, and the space law bust began.

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[7] The Limited Test Ban Treaty prohibits any "nuclear weapons test explosion, or other nuclear explosion" in outer space. Limited Test Ban Treaty, *supra* note 5, at art. I

[8] Multilateral Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *entered into force* Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[9] *Id.* at art. IV.

[10] For considerable discussion of these provisions, see GLENN H. REYNOLDS & ROBERT P. MERGES, OUTER SPACE: PROBLEMS OF LAW AND POLICY 62-93 (2d ed. 1997), BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 215-264 (1997).

[11] Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched Into Outer Space, *entered into force* Dec. 3, 1968, 672 UNTS 6577, 19 UST 7570 [hereinafter Astronauts Agreement].

[12] Convention on International Liability for Damage Caused by Space Objects, *entered into force* Sept. 1, 1972, 961 U.N.T.S. 187, 24 U.S.T. 2389 [hereinafter Liability Convention].

[13] Convention on Registration of Objects Launched Into Outer Space, *entered into force* Jan. 14, 1975, 28 U.S.T. 695, 1975 U.S.T.552 [hereinafter Registration Convention].

PHASE THREE

The next phase of space law was, like the next phase of space activity, much less exciting. Except for the largely meaningless 1979 Moon Treaty, which entered into force among a few countries but to no great effect,[14] there was very little activity on the international front.

On the American domestic law front, things were somewhat more active. The passage of the 1984 Commercial Space launch Act, and its later post-*Challenger* amendments, was part of a general move in favor of commercial space activity. The gradual erosion of monopolies in both international and domestic satellite telecommunications was another part of this process.

Scholars also continued to discuss farther-out issues, like the governance of space societies and contact with extraterrestrial life. There were even draft agreements drawn up on both subjects, and those, at times, attracted significant attention. Nonetheless, the third phase of space law development was less exciting than the ones that preceded it. Fortunately, it is coming to an end.

THE CURRENT PHASE

We are now, by my reckoning, at least, in the fourth phase of space law's development, and it promises to be far more exciting than what has come before. That is because this phase is one in which space activity is once again picking up. This is not so much the result of government - though there are some new government initiatives - as it is the result of the technology and economics of space travel reaching the point at which private enterprises can do things that are interesting and important.

The year 2001 is now behind us, but we're a long way from the space stations, lunar bases, and missions to Jupiter that Kubrick and Clarke made so plausible way back when. The good news is that some people are doing just that. In fact, pri-

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[14] *See generally* Glenn Harlan Reynolds, *The Moon Treaty: Prospects for the Future*, 11 SPACE POL'Y 115 (1995).

vate foundations, private companies, and even NASA itself are waking up to some new approaches.

The X-Prize Foundation, organized by space supporters who were frustrated by the slow progress of government programs, decided to resurrect an approach used in the early days of aviation: a prize. The X-Prize, a $10 million private award for the first team that privately finances, builds and launches a spaceship, able to carry three people to 100 kilometers (62.5 miles), returns safely to Earth, and repeats the launch with the same ship within 2 weeks.[15]

Now that that has been accomplished (by Burt Rutan's Scaled Composites, with its *SpaceShipOne* spacecraft),[16] there are further prizes for orbital accomplishments. The X-Prize approach is based on the historic role played by privately-funded prizes in developing aviation (Charles Lindbergh crossed the Atlantic to win the $25,000 Orteig Prize).[17] Its founders and organizers hope that private initiative, and lean budgets coupled with clear goals, will produce more rapid progress than the government-funded programs organized by space bureaucrats over the past five decades or so. (Full disclosure: I was a pro bono legal advisor to the X-Prize foundation in its early days).

In particular, they're interested in bringing down costs, and speeding up launch cycles, so that space travel can benefit from aircraft-type cost efficiencies. And so far it looks as if they're having some success.

Scaled Composites, though it won the prize, wasn't the only competitor. In fact, 27 competitors, from a number of different countries, competed for the prize. The ten million dollar prize generated a lot more than ten million dollars worth of investment.

Which is, of course the point. Ten million dollars in a government program won't accomplish much. (By the time paper is

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[15] X-Prize, *Homepage*, *available at* http://www.xprize.com/ (last visited Jan. 10, 2006).

[16] Michael Coren, *SpaceShipOne Captures X-Prize*, CNN, Oct. 4, 2004, *available at* http://www.cnn.com/2004/TECH/space/10/04/spaceshipone.attempt.cnn/ (last visited Jan. 10, 2006).

[17] X-Prize Foundation, *Fact Sheet*, *available at* http://www.xprizefoundation.com/about_us/fact_sheet.asp (last visited Jan. 10, 2006).

pushed and overhead is allocated, it may not accomplish anything). A ten million dollar prize, however, can attract much more – driven as much by prestige as by the chance of making a profit.

Unlike a government program, too, a prize-based program allows for a lot of failure. By definition, if 27 teams go for the prize, at least 26 will fail. And that's okay. Government programs, on the other hand, are afraid of failure. The result is that they're either too conservative, playing it safe so as to avoid being blamed for failure, or they're stretched out so long that, by the time it's clear they're not going to do anything, everyone responsible has died or retired (in government, or big corporations, it's okay not to succeed, so long as you aren' t seen to fail).

Since we usually learn more by taking chances and by failing than by playing it safe or avoiding clear outcomes, in the right circumstances a prize program is likely to produce more and faster progress. This isn't by accident. As X-Prize cofounder Peter Diamandis noted in recent Congressional testimony:

> The results of this competition have been miraculous. For the promise of $10 million, over $50 million has been spent in research, development and testing. And where we might normally have expected one or two paper designs resulting from a typical government procurement, we're seeing dozens of real vehicles being built and tested. This is Darwinian evolution applied to spaceships. Rather than paper competition with selection boards, the winner will be determined by ignition of engines and the flight of humans into space. Best of all, we don't pay a single dollar till the result is achieved.[18]

Bureaucracies are good at some things, but doing new things quickly and cheaply isn't one of them. Prizes like the X-Prize offer a different approach. I wonder what other government programs could benefit from this kind of thing?

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[18] *NASA Contests and Prizes: How Can They Help Advance Space Exploration, Hearings Before the Subcommittee on Space and Aeronautics, Committee on Science, U.S. House of Representatives*, 108th Cong. (2004) (testimony of Peter Diamandis), *available at* http://commdocs.house.gov/committees/science/hsy94832.000/hsy94832_0.htm (last visited Jan. 10, 2006).

Here's one example, involving two cool things. One is that space elevators and power-beaming are coming. The other is the way that they're coming.

Alan Boyle reports:

> Borrowing a page from the playbook for the X Prize spaceship competition, NASA has set aside $400,000 over the next two years for competitions to encourage the development of wireless power transmission systems and super-strong tethers.
>
> The Beam Power Challenge and the Tether Challenge, announced here Wednesday, are the first two of NASA's Centennial Challenges, which aim to provide incentives for technological achievements that could be applied to future space exploration.[19]

It's not a lot of money, but – as the X Prize demonstrated – you don't need a lot of money to accomplish a lot if you spend it well, something that NASA hasn't done, historically. And in some ways, that's the real news here. The space field appears to be heading toward a period of dynamism akin to what aviation experienced in the 1920s. Since the last time space activity underwent a period of dynamism, it produced a period of legal dynamism as well, it seems likely that this new wave of activity may produce new legal changes in its wake.

The space law of the 1960s and 1970s was an artifact of the Cold War. Implicit (and sometimes explicit) in its structure and provisions was the belief that space activity would be conducted mostly by nation-states, and in an atmosphere of nuclear-armed hostility. The Outer Space Treaty, for example, was in part a sort of non-compete agreement, particularly with regard to Article II, which bans national appropriation of celestial bodies, and which by itself put an end to the "space race."

Both the United States and the Soviet Union, it appears, were more fearful of their adversary's success than optimistic about their own, and as a result both nations were happy to enter into an agreement that shut down the competition. This

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[19] Alan Boyle, *NASA Announces Prizes for Space Breakthroughs*, MSNBC, Mar. 24, 2005, *available at* http://msnbc.msn.com/id/7280483/ (last visited Jan. 10, 2006).

provision of the Outer Space Treaty – in many ways its most important – was thus a sort of Cold War collusion, in which both nations agreed to throw the race, or at any rate to forfeit the prize. And, indeed, although the United States continued on to the Moon, the Soviet Union gave up, and the United States' behavior in continuing was almost entirely the result of momentum and general public support; the United States government no longer had any great strategic interest in the Moon.

This may have spared us from a superpower collision that could have produced a nuclear holocaust, which is surely justification enough for Article II. But there is some question whether that provision has the same utility today, when the concern isn't so much a space race as space torpor. Likewise, it isn't clear whether things like the notion that astronauts should be treated as "envoys of mankind," as commanded by Article V will continue to have as much resonance now that astronauts are increasingly likely to be fare-paying tourists, as opposed to bold explorers. It may be that future space law will look more like the private law of maritime commerce and aviation than like the public law of years past.

At the very least, it's time to reconsider those aspects of space law, formed in a different era, that might hold back space development, and to think about ways in which the space law framework, so much a child of the Cold War era, can be adapted to fit the needs of a new century, and a new world.

Article II, after all, bans only "national appropriation," and its impact on the acquisition of private property rights, by private actors, is dubious at best.[20] The status of private actors in such settings is thus not entirely clear; not forbidden, but not fully recognized, either. Explicit recognition of such endeavors, along with a not-too-intrusive regulatory scheme, would be very valuable.[21]

The uncertain line between spacecraft and missiles – John F. Kennedy, asked to explain the difference between *Atlas* mis-

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[20] For an extensive discussion of this topic see REYNOLDS, *supra* note 10, at 101-177.

[21] For more on this topic see Robert P. Merges & Glenn H. Reynolds, *Space Resources, Common Property, and the Collective Action Problem*, 6 N.Y.U. ENVTL. L. J. 107 (1997).

siles and the *Atlas* launcher that lofted *Mercury* astronauts into space, famously responded "attitude"[22] – will make the explosive growth of commercial launch capabilities that things like the X-Prize promise a source of some confusion. Launch technology is likely to follow the path of computer technology: from the preserve of big governments and big organizations to something far more ubiquitous. This, unfortunately, makes the delivery of nuclear weapons, or other weapons of mass destruction, easier.

Space tourism will raise other issues as well. Though it promises to bring useful economic forces to bear on the question of lowering space transportation costs and improving capabilities, it will also change the size and character of the humans-in-space realm. Space tourism is likely to bring issues of liability, contract, immigration, and other similar questions to the fore.[23]

Finally, increased interest in space elevators suggests that a core concept in the Outer Space Treaty – the notion of "space objects" that are "launched" – may need some refinement. With space elevators – a superstrong cable reaching from the surface of the earth to a counterweight at geosynchronous orbit – there is no "launch" as such, unless simply pressing the up button on an elevator counts as a launch. And the space elevator itself, being anchored to Earth (or to a floating base at sea) would arguably not be a space object at all, since it would never have been launched by even the broadest definition.[24] It would, instead, be analogous to a very (very) tall building.

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[22] *Quoted in* Jack H. McCall, *"The Inexorable Advance of Technology:" American and International Efforts to Curb Missile Proliferation*, 32 JURIMETRICS J. 387, 426 (1992).

[23] For examples of the sorts of issues that might be involved, see James A. Beckman, *Citizens Without a Forum: The Lack of an Appropriate and Consistent Remedy for United States Citizens Injured or Killed as the Result of Activity Above the Territorial Air Space*, 22 B.C. INT'L & COMP. L. REV. 249 (1999); Lauren S. B. Bornemann, *This is Ground Control to Major Tom ... Your Wife Would Like to Sue but There's Nothing We Can Do ... The Unlikelihood That the FTCA Waives Sovereign Immunity for Torts Committed by United States Employees in Outer Space: A Call for Preemptive Legislation*, 63 J. AIR L. & COM. 517 (1998).

[24] For more on space elevator technology, see Bradley Carl Edwards, *A Hoist to the Heavens, IEEE Spectrum*, Aug. 21, 2005, *available at* http://www.spectrum.ieee.org/aug05/1690 (last visited Jan. 10, 2006).

These kinds of issues – plus some others like the legal regulation of terraforming on Mars and elsewhere[25] – fit poorly within the Cold War framework, and are fertile ground for scholarly discussion over the coming years. I look forward to joining in the conversation.

[25] *See, e.g.*, Robert D. Pinson, *Ethical Considerations for Terraforming Mars*, 32 ENVIR. L. REP. 11333 (2002).

REPORT OF THE IISL SPACE LAW COLLOQUIUM IN VANCOUVER, CANADA, OCTOBER 2004

Patrick Salin, Macha Ejova, Ali Akbar Golrounia, Kenneth Weidaw, Martha Mejia

(edited by Tanja Masson-Zwaan)*

SESSION 1 - NEW DEVELOPMENTS IN NATIONAL SPACE LEGISLATION

Chairmen: Dr. Frans von der Dunk, The Netherlands, and Prof. Dr. Stephan Hobe, Germany

Rapporteur: Dr. Patrick Salin, Canada.

Sylvia Ospina, "National Space Legislation and the Digital Divide: Will National Laws on Space Activities Bridge the Gap?"

Most nations legislate some kind of space activity, whether it is large and of a full-size nature or small and restricted to their minimal technical obligations as a consequence of their ITU membership. The United States is so far the country with the most highly developed space-related legislation and regulations. Several Latin America countries have a space program but are quite dependent on developed countries' industries and

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agencies. Several preliminary measures should be taken before embarking on a national space program: (1) sign and ratify the space treaties in order to show their national commitment, (2) study and analyze the need for a national space legislation, including their liability and responsibility dimension, (3) carry a survey of the different national entities that will use satellite capacity, and (4) adequate funding must be secured before envisioning a space agency or program.

Lucy Stojak, "Regulatory Framework for Commercial Remote Sensing Satellite Systems: The Canadian Story".

The *Radarsat* program is the driver of the Canadian space data policy. It contributed to the adoption of a hybrid public-private funding and operational arrangement signed by the Canadian Space Agency (CSA) and its program partners, while a private company was created and granted exclusive distribution rights. Moving towards private ownership with *Radarsat*-2, in June 1999 the Government of Canada (GOC) announced a new commercial remote sensing satellite legislation, the Access Control Policy, to ensure authorization and continuing activities of its non-governmental entities. Hopefully, that legislation will be signed into effect prior to the launch of *Radarsat*-2 in 2005. The GOC reserves the rights of (1) review and approval of all systems owned, operated and registered in Canada, (2) interruption of normal commercial service and (3) priority access, both for national security interests. Requirements also have to be met for the operating of a commercial remote satellite system. This policy may be considered as a blueprint for a new legislation; it is also very much reminiscent of the US interim regulations on the licensing of private land remote-sensing space systems.

Rosa Maria Ramirez de Arellano, "Possible Consequences of the Lack of Secondary Legislation with Respect to Outer Space in Mexico".

The need for Mexican space regulations may arise from the occurrence of accidents caused by space objects or through the development of space applications. The states of the Mexican federation are internationally bound by the agreements taken by the Mexican federal government. Facing the current legal

vacuum and pending the occurrence of litigations that would involve space issues, the Judicial Power would have to undertake a big task in order to acquire the expertise in legal matters that are related to Outer Space. Endless discussions between the states of the federation and the government could be triggered by such new issues. This would not guaranty an optimum performance of work by the Mexican judges, no matter where they may have obtained their legal education. Coupled with potential disagreements that could occur between the courts themselves, this could impede on legal certainty in the Mexican Court System. Finally, it is the responsibility of the Mexican federal government to explain to all the Mexican people the obligations and rights that derive from Mexico's international agreements.

José Monserrat Filho, "Brazilian-Ukrainian Agreement on Launching Cyclone-4 from Alcantara: Impact on Brazilian Legislation".

This treaty was signed on 21 October 2003 by Brazil and Ukraine and ratified in both countries in February and September 2004 organizes a long-term cooperation in the use of the Cyclone-4 Launch Vehicle at the Alcantara Launch Center. It was completed by an MOU for future bilateral projects, both documents reflecting the commitment of top Brazilian and Ukrainian authorities to join efforts whenever possible to carry out a broad space cooperation program. This followed an always closer relationship with Ukraine that started with the establishment of diplomatic relations between the two countries in February 1992. The treaty's general objective is to define conditions for long-term cooperation between the Parties for the development of Cyclone-4 Launch site on the Alcantara spaceport. The immediate foreseen impact of the Treaty is to have Brazil adhere to the Registration Convention. Brazil also has to enact a specific tax law in order to comply with certain Treaty provisions, and, more generally, an all-embracing space legislation in order to take into account this treaty and other future space endeavours so as to address several crucial issues.

Alvaro Fabricio dos Santos, "Brazilian Law No 10.821: compensation for the Families of the Victims of the Alcantara Disaster".

The 2003 accident on the Alcantara site was the first Brazil ever had. All the victims were Brazilian government employees. In the absence of a national legislation for space activities, the Brazilian Space Agency's own regulations serve as a de facto Brazilian space legal regime. Direct compensation payments were awarded to all victims' spouses, but defendants claimed that was not enough to compensate for the loss of the victims. A supplementary indirect compensation package was later enacted. What is at stake here is the amount of compensation compared with other types of similar schemes. Compensation on the basis of the Brazilian air code would have been much less favourable, while under the provisions of the Montreal Convention of 1999, which Brazil is expected to ratify soon, compensation would have been larger. This compensation law is a step towards a national Brazilian space legislation. Together with the Brazilian Space Agency directives, all these legal provisions may be considered as placing Brazil as the ninth nation to establish a national space legislation in the narrow meaning of the word.

Steven Freeland, "The Australian Regulatory Regime for Space Launch Activities: Out to Launch?"

The Space Activities Act of 1998 is the principal Australian space law. It established a sophisticated licence system. It was also designed to extend international cooperation in space activities. The development of this legislation was made in order to provide a licensing framework for three projects that have not yet materialized. The Space Activities Act creates different licences for specific activities, including Australian launches outside Australia. This Act was amended in 2002 by a text which, *inter alia*, sought to define where does space begin by inserting a reference to the distance of 100 km above mean sea-level. It was also followed by a bilateral Cooperation Agreement with Russia, which came into force in July 2004, and is supposed to facilitate the development of the launch facility project at Christmas Island. Significant progress still has to be done in

order to have a viable Australian private launch industry. The latest space developments happened in relation with the US missile defence program to which Australia became a partner.

Toshio Kosuge, "New Developments in National Space: Law and Policy in Japan".

Due to the consequences of the Cold War of the 1950s, 1960s and 1970s, Japanese Self Defence Forces have been restricted in their development, equipped with US military satellite communication receiving stations and have not been directly involved in space utilization. It was not until the 1998 North Korea missile crisis that the Japanese government decided to develop a satellite system in order to collect information for crisis management purposes and national security issues. A Space Development Policy and an annual Plan have been initiated under the responsibility of a Space Development Committee. Various space programs have been initiated, including communication satellites, remote sensing satellites, weather satellites and launchers. Successes and failures have punctuated the implementation of these programs. Various scientific interministry committees are involved in the definition and the implementation of these space programs. From Professor Kosuge's presentation, we may conclude that no specific legislation seems to be in the planning for the near future.

Mehmood Pracha, "Indian National Space Legislative Developments".

India adopted its first domestic space resolution in 1958 in order to underline the importance of space science, at the time of the *Sputnik* launch. The 1960s, 1970s, 1980s and 1990s saw the creation of the Indian space organizations, mainly the Indian Space Research Organization (ISRO), the Space Commission, the Department of Space (DOS) and various other public bodies. The Charter of the DOS makes it clear the purpose of space science and technology is to assist in the all-round development of the nation. So far, no specific legislation has been enacted in order to cover the whole spectrum of possibilities arising from space activities. There is an acknowledged need for a comprehensive national space legislation that would set the rules of jurisdiction over national Indian space activities, set a

uniform and transparent licensing regime, set criminal jurisdiction over illegal space activities including accident litigation, set indemnity against liability incurred by private parties, encourage commercial space industry and address numerous other space-related issues.

Michael Gerhard, Kai-Uwe Schrogl, "A Common Shape for National Space Legislation in Europe: Summary and Conclusions of the Project 2001 Plus Workshop".

National space legislation have been enacted in eleven states. Because of the international public law basis of such legislation, already enacted or in the making, European space activities may come under the jurisdiction of more than one of those national laws. Space-related entities may thus be tempted to move their headquarters under any special jurisdiction of their choice. Harmonised space legislation might be preferable in order to foster national industries by ensuring legal security and comparable administrative requirements and thwart "licence shopping" tendencies. Based on the Project 2001 Building Blocks for National Space Legislation, four aspects of harmonisation might be identified: administrative procedure and fees for an authorization, technical safety evaluation, indemnification regulation and third party liability insurance. These aspects need to be dealt with at least on a European level. Since there is no competence of the European Union and since there will be no adequate competence within the draft European Constitution, a realistic approach might be seen in cooperation and coordination of legislating states, maybe through intergovernmental agreements.

Martha Mejia-Kaiser, "The 1989 Berlin Court Decision on Copyright to a Space Remote Sensing Image".

In 1988 the European Space Agency (ESA) sued a private company at the State Court of Berlin for having used an image of ESA's Meteosat archives for a local commercial advertisement. ESA claimed that no reference was made to its copyright. The court did not confirm ESA's claimed copyright. This case does not create a legal precedent but constitutes important legal material for space law. An individual or corporation may not define the terms and conditions of a copyright protection. The

State of which a person is a national or that grants him national protection is the only one to decide if a given work qualifies for protection. National legislators determine the terms of copyright protection and when an author may be the beneficiary of the protection. Unilateral or multilateral claims are not valid if they do not fulfill the requirements of applicable copyright legislation. There may be thousands of contracts on satellite images, which invalidly attempt to benefit from copyright protection. Such clauses can never substitute themselves to the applicable legislation, which requires direct human intervention and human creativity.

Sergio Marchisio, "Italian Space Legislation Between International Obligation and EU Law".

The Italian model of national space legislation is characterized on one hand by a *de lege ferenda* process concerning the first building block and, on the other hand, by a special law concerning the indemnification aspects. A draft bill has been recently submitted to the Council of Ministers concerning the authorization of the ratification of the 1975 Registration Convention, the enactment of norms regulating the registration of space objects and the authorization and supervision mechanisms for private national activities. The second building block is partially covered by Law 23 of 25 January 1983 on compensation of damage caused by space objects, which is largely inspired by the norms and procedures of general international law concerning diplomatic protection, broadening the State's obligation as for the indemnification of victims. Finally, the Italian situation cannot be assessed without making a reference to the legal framework of the European Union, since the ongoing involvement of the European Union in space matters would certainly affect the future prospects of national space legislation in European countries.

Gabriela Catalano Sgrosso, "Report on Changes in Space Law in Italy: Proposal of a Draft Legislation".

Italy ratified all the space treaties with specific laws or execution orders that simply refer to the content of the space treaties or agreements for direct implementation. The EU White Paper of 2003 contains proposals for harmonisation of the na-

tional policies of its member states, but does not detail a uniform formulation method. The Council and the Commission are supposed through community regulations to take care of this future community requirement. Since this action of the Council and of the Commission may take some time to be implemented, Italy should now issue a comprehensive national space legislation that would cover the whole spectrum of its space activities as other European states have already done. It would formally define the scope of space activities, the nature of compulsory authorization for the carrying out of such activities, the conditions requested for such authorizations. It would also identify what public entities would be entrusted with the registration registry, with the granting of authorizations and who is to exercise control and supervision of Italian space objects.

Philippe Achilleas, "The New French Legislation on Satellite Frequencies Assignments".

France has modified its Post and Telecommunication Code in order to introduce a clear legal framework dealing with the use of satellite frequencies. The 2004 Loi pour la confiance dans l'économie numérique (LEN) has defined procedures for the utilisation of space frequencies and provided for sanctions in case of non compliance with the new prescriptions. This document, which is mainly directed towards Internet applications, has its Title 4 devoted to satellite frequencies assignments. The LEN extends its provisions to any private radio-communications satellite system. Requests must be directed to the Agence Nationale des Fréquences (ANFr), which will check their compatibility with the National Frequency Board. Frequency assignment must also be authorized by the Minister after consultation with either the Audiovisual Regulatory Authority (CSA) or the Telecommunications Regulatory Authority (ART). Authorization may be refused for specific reasons. The authorization holder must avoid harmful interference and stop any broadcast upon request of the Ministry of telecommunications. He also must ensure control of the signal of each radio station.

Jean-François Mayence, "National Space Legislation: The Belgian Approach".

Belgium has a draft Space Act entitled Avant-projet de loi relative aux activités de lancement et de guidage d'objets spatiaux, which is expected to be approved as a law by the end of 2005. Its scope is restricted to the operation of space objects in the launching phase and during flight operations, and to their monitoring during their life cycle. It excludes application activities such as remote sensing and telecommunications or exploitation of payloads. The Belgian draft law clearly focuses on implementing Article VI, VII and VIII of the 1967 UN OS Treaty, and on a few other provisions. Essentially, this draft law provides for the setting-up of an authorization procedure, the setting-up and the maintenance of a national registry for space objects; and the opening of a legal action by the Belgian Government towards the operator, under detailed conditions, in the case of third party damage liability. Specific provisions also prevent any appropriation of fallen or landed space objects on the Belgian territory by derogation to civil law.

Frans G. von der Dunk, "Implementing the UN Outer Space Treaties: the case of the Netherlands".

Until recently, the amount of space activities that were undertaken on Dutch territory was not so important so as to justify a general and comprehensive action in the form of a national space law. These activities were limited to industrial projects that were subcontracted by the European Space Agency (ESA) to Dutch companies or projects that were undertaken by Dutch parties within the EADS consortium. This paradigm changed radically with the privatisation trend that affected all European telecommunications carriers. In 2001, the Government of the Netherlands approved the development of a national legal framework for space-related activities on its territory. A new law was to provide a licensing system, the accompanying general requirements taking in balance its bona fide interests and the interests of the public, national and international, an arrangement dealing with liability issues, and an arrangement for a national registry. A first draft law to be produced by a senior Ministry official was originally scheduled for September 2004 but was postponed until a later time horizon.

B) SESSION 2 - INTERNATIONAL LAW AND PRACTICE OF AGREEMENTS ON COOPERATION REGARDING SPACE ACTIVITIES

Chairmen: Mr. Marco Ferrazzani, ESA and Ms Indra Heed, Canada

Rapporteur: Ms Macha Ejova, Russia

This session enjoyed a wide variety of papers from many authors and many opinions were expressed on a topic of such general interest as space cooperation.

The article of *Thomas Reuter* analyzes *"The framework agreement (FA) between the European Space Agency and the European Community"*. The main idea of this paper is that framework agreement creates an efficient basis for European space Policy even if the agreement doesn't change a lot the relation between ESA and EU. In this article, the author also explains the aim of 3 models of cooperation mentioned in article 5 of FA.

The second presentation is about *"The cooperation of ESA and EU and the relationship of their legal regimes" by Katharina Kunzmann and Jürgen Cloppenburg.* This paper analyses the consequences of possibly conflicting obligations arising out of provisions of ESA-Convention and EC-Treaty. The author's conclusion is that the prevailing treaty is ESA-Convention according to the international public law.

The next presentation is a summary of a paper *"European Space Policy: a common future for ESA and EU" by Juan Manuel de Faraminan Gilbert.* This paper analyses the given institutional answer i.e. the Framework Agreement between EU and ESA and the Treaty establishing a Constitution for Europe will bring to the real European Space Policy.

The paper presented by *Eszter Pörneczi* is entitled *"ESA and EU cooperation for a better future of the European citizens"*. This paper analyses the relationship between ESA and the EU. Why should the EU be involved in space activities? There are different reasons for cooperation between ESA and the EU like commercial opportunities, benefits for the citizens, etc... The author's conclusion is that the consistent European Space Policy

will be achieved by the effective harmonization of both institutions.

The next paper *"Guaranteed access to Space: extension to countries without launcher?" by Alain Conde Reis* addresses the question how securing the access to space for space emerging countries without launcher. Because of the fact that the cooperation in launchers is close to the military area, there are difficulties to motivate such cooperation. The conclusion is the cooperation in launchers technology will be possible as the launchers move towards commercial exploitation and the United Nations is an appropriate framework for such cooperation in an equitable way.

The presentation of *Professor C. Heather Walker, "Bi-lateral agreements to facilitate launch projects and satisfy non-proliferation obligations"*, focuses on the following question: How the countries have to balance the concerns of missile technology proliferation and need to allow countries to utilize proven launch vehicle system. After giving an overview of the non-proliferation regimes like Missile Technology Control Regime and Wassenaar Arrangement and looking at the structure of sample space launch vehicle system transfer agreements, the author gives some potential alternatives to avoid problems by harmonizing the export license review criteria and creating the international launch consortium.

The paper of *Nathanael A. Horsley, "Justifying the Arianespace monopoly: the role of consolidation, subsidies, and preferences in the evolving global launch industry"* addresses the question on how the competition law could influence the structure of the space launch industry in the future years.

The paper written by *Margaret A. Roberts* is about *"Organizing for science participation on the International Space Station"*. It focuses on the life science missions of the ISS and the legal mechanisms being employed by several space agencies to maximize science opportunities and international cooperation. The author's conclusion is that the legal framework of the ISS program and the International Space Life Science Working Group (ISLSWG) provide a solid basis for a strong cooperation and may offer a model for planning future multinational programs.

The presentation by *John Hudiburg* on *"Techno-political space cooperation: a longitudinal analysis of NASA's bilateral and multilateral agreements"* analyses some of the techno-political conditions contributing to the amount of cooperation experienced and recorded in NASA's International Agreement Database. The author explains that by utilizing a cluster analysis approach, NASA's international cooperation can be understood along both aggregate and regional perspectives. According to the author a new era of international cooperation in space seems to be starting regarding the US space exploration vision which calls for international involvement.

The paper written by *Yun Zhao* focuses on *"Evaluation of space cooperation between China and Brazil: an excellent example of South-South cooperation"*. The cooperation between China and Brazil have as a legal basis the 2002 Protocol which provide a concrete framework for further cooperation in space projects. The cooperation between China and Brazil came with the first joint satellite, China–Brazil Earth Resource satellite (CBERS) which shows that such cooperation has the added benefit of ensuring a balanced share of interests and that no state monopolizes the space resources put in common. Also, the model of this space cooperation can be extend to other developing countries.

The paper written by *Macha Ejova* is about *"Legal aspects of Franco-Russian commercial and industrial cooperation in space"*. This paper describes and analyzes the legal framework of commercial cooperation between France and Russia regarding three different levels of cooperation: institutional, inter agencies and private i.e. between Russian and French space companies. The paper focuses in particular on the project Soyouz in Guyana with the first launch planned in 2007.

The presentation of *Atsuyo Ito* concerns *"The legal aspects of the International Charter on Space and Major Disasters"*. The purpose of this paper is to examine the legal regime of the Charter and to describe the Charter's principles, exposing the current limitations of the legal regime of Earth Observation. The author's conclusion is that the current legal regime of EO is insufficient because it does not cover all the potential operations of the Charter and the lack of a clear liability regime. Consequently, the author highlights the need to provide a proper li-

ability regime that protects both the victim and the helper in disaster monitoring and mitigation.

The last two papers have a more philosophical character.

The paper of *Liara M. Covert* is entitled *"The Post-human Era: a Time to Reduce Barriers to Intra-Professional Dialogue & Apply More Effective Policy Response"*. It analyses the notion of success and failure in emergence, expansion and enforcement of international space law using six case examples of global problems. The conclusion is that the leaders have to be less territorial in visions, law-making and actions, and have to cooperate to solve the current problems.

The paper of *Yasuaki Hashimoto* is entitled *"Asian Satellite Center – Promotion of Regional Peace and Security"*. It examines the feasibility on the establishment of an international (regional) organization like a satellite center which contributes to the regional peace and security in Asia. The author's conclusion is that the foundation of such an organization will be a common benefit in regard to the avoidance of international crimes, environmental pollution, disputes and effective use of resources.

C) SESSION 3 - A GENERAL CONVENTION ON SPACE LAW

Chairmen: Prof. Ram S. Jakhu (Canada) and Dr. Said Mosteshar (U.K.)

Rapporteur: Ali Akbar Golrounia (Iran)

Dr. Lotta Viikari (Finland) presented the paper *"Problems Related to Time in the Development of International Space Law"*. He noted that the time lag between the drafting, adoption, and entry into force of international space treaties are so long that by the time accords are implemented, the problems in question may have reached entirely new and different proportions and strategies. He proposed mechanisms such as interim agreements, self - correction treaties, nonbonding codes of conduct, *"Supranationally"* adopted technical standards, and international certification mechanisms, to over come this problem.

Mr. Kenneth M. Weidaw III (USA) presented the paper *"The General Convention on Space Law: Legal Issues Encountered in Establishing a Lunar and Martian Base"*. He proposed that A

General Convention on Space Law must be convened to address critical issues such as property rights on Lunar and Martian bases and environmental restrictions on Lunar and Martian Surface. He suggested voting delegates must be limited to those having active space programs that will directly participate in the Lunar and Martian Landing.

In the paper *"A Place for the Moon Agreement, in the General Convention on Space Law". Ms. Deirdre Ni Chearbhaill* (UK) argued that the General Convention on Space Law should ensure the inclusion of the Moon Agreement, so that human activities on the Moon can develop within a solid legal Framework and the space environment may be protected.

Dr. Ali Akbar Golrounia (Iran) presented the paper *"Private Sector Involvement in Space, a Need for Codification of Regulations".* He proposed in order to encourage the private sector to expand current and make new investments in outer space activities, as well as safe and standard operations. There is a need to establish international regulatory body, which can be achieved through a new convention to codify existing space law.

Prof. Maurice N. Andem (Finland), presented the paper *"The 1967 Outer Space Treaty (1967 OST) as the Magna Charta of Contemporary Space Law: A Brief Reflection".* He emphasized the importance of the Outer Space Treaty as the Magna Carta of contemporary space law and proposed that COPUOS should adopt procedural rules for the implementation of its provisions by all UN Members states.

With the paper *"Previewing a Series of Potentially Cataclysmic Events." Dr. E. E. Weeks* analyzed seven events which are problems of potential world conflict in outer space and recommends that IISL and COPUOS should consider the international rules concerning space tourism, space mining and space settlement and to what extent are private property rights permitted or prohibited in accordance with the wishes of the international community?

The paper *"Supranational or Stateless Incorporation for Space Traffic Management and Control"* was presented by *Mr. William O. Glascoe III* (USA). He commented that as a result of the growing success of space transportation there will be a need to establish a supranational corporation for space traffic control

and a regulatory paradigm of stateless authority for space traffic control must be created.

Discussion:

Mr. Mayence stated that it is very difficult to achieve an acceptable general Convention on Space Law in a short time.

Ms. Viikari held that international treaty development is too slow. She suggested other mechanisms such as interim agreements, non-binding codes of conduct, "supranationally" adopted technical standards, and self-correcting treaties.

Mr. Weidaw argued that a new general convention on space law must re-examine and determine private business right of ownership.

Ms. Deirdre Ni Chearbhaill said that the Moon Agreement should be included in the general convention on space law, so that human activities on the Moon can develop within a solid legal framework and the space environment may be protected.

Prof. Andem raised the importance of the 1967 Outer space Treaty and in order to enhance its effectiveness, he submitted that there is an urgent necessity for COPUOS to adopt procedural rules for the implementation of OST provisions by all UN Member States.

Ms. Weeks stated that COPUOS must place on its agenda, space tourism, space mining and space settlement and private property rights and specify to what extent these activities are permitted under existing international space law.

D) SESSION 4 - LEGAL ISSUES RELATING TO PRIVATE ENTERPRISE, PROPERTY RIGHTS AND SPACE APPLICATIONS

Chairmen: Dr. Sylvia Ospina, Colombia and Prof. Sergio Marchisio, Italy

Rapporteur: Mr Kenneth Weidaw, USA

Paul B. Larsen, Moon and Mars Exploration and Use.

The paper examines the legal basis for the United States announcement by President Bush of the Moon and Mars exploration initiative. Cooperation between the U.S. and Europe has

been difficult. However, such cooperation is crucial to current space initiatives. He recommends that careful international coordination and cooperation occur for most new outer space enterprises.

J. Triplett Mackintosh and Lizbeth C. Rodriguez, General discord and Bar Harmony: U.S. Export Controls in Space.

The paper provides an introduction to U.S. export regulatory controls and their application to the space and aerospace industries. A broad array of technologies are subject to regulation. Exports of some technologies require a license from the Department of State. Most exports of space and aerospace technology will require export authorization. If trading occurs with prohibited parties, there are criminal and administrative penalties. The paper advises what actions may be taken in the event of a violation - providing a step-by-step approach. National security is at the core of the regulations and the consequences of failing to comply may be costly.

Prof. Dr. Stephan Hobe and Jurgen Cloppenburg, Towards A New Aerospace Convention? - Selected Legal Issues of "Space Tourism"

The paper clarifies to which extent existing instruments of private international air law may apply to "space tourism." The authors argue that the applicability of international space law to "space tourists" must be analysed and amendments to existing law should be considered. Clear rules are required, as in an environment of legal uncertainty the industry is not likely to develop. Issues of passenger liability will likely be of highest importance.

Zeldine O'Brien, Liability For Injury, Loss or Damage to the Space Tourist.

With the potential for growth in the space tourism industry, concerns regarding the state of the law governing the liability for possible damage, loss or injury to tourists increase. The author believes that a legal regime governing liability of carriers and others for loss, injury to space tourists should be established. Such need has previously been recognized by other authors. A legal regime would be best established through a U.N.

convention on carrier liability. The author believes the new convention should roughly follow the Montreal Convention with a two tier system of liability, a review clause and a similar range of applicability.

Tanja L. Masson-Zwaan, A Practical Application of Egnos and Galideo: The Advantis Project.

This paper describes the *Advantis Project* - the first contract awarded in February 2004 by the Galileo Joint Undertaking, established by ESA and the EC to manage Europe's global satellite navigation system, *Galileo*, to a consortium of ten European companies. The author explains two key concepts of the system, namely, data concentration and Advantis Integrity. It is noted that the 25 EU Member States need to harmonize their national laws for the system to effectively operate in a harmonious regulatory environment.

Jakub Ryzenko, Explorers, Merchants and Envoys of Mankind.

This paper focuses on challenges directly created by extensive operations beyond low Earth orbit. He then discusses the use of *in situ* lunar resources and exploration of Mars in the search for living organisms. He notes that attitudes and interests towards space exploration divide states into three distinct groups - 1. Space-exploring nations; 2. Emerging space powers and potential exploration players and; 3. Other states. The issues discussed in the paper encourage the role and value of international cooperation. As the number of states involved with space exploration increases, more states will come to embrace space exploration - with a feeling of "ownership" which will minimize opposition and, thus, will limit possible conflicts of national interest.

Mahulena Hofmann, Recent Plans To Exploit the Moon Resources Under International Law.

The future exploitation of lunar resources is the subject of this paper. Lunar resources may be exploited according to the Outer Space Treaty so long as appropriation of the exploited areas does not occur. Concern is expressed in light of President Bush's January 2004 speech in which he stated that lunar re-

sources will be exploited in the future. Since the Moon Treaty was not signed by the U.S., only customary international law provides guidance. The author recommends that a regime be established to guide all parties in their plans to exploit lunar resources to be assured that they are in compliance with international law.

Ricky J. Lee, Transferring Registration of Space Objects: The Interpretative Solution.

In recent years it has been observed that the legal principles concerning the registration of space objects present a hindrance to some commercial transactions involving satellites. Specifically, the requirement that the State of registry has to be a launching State of the space object appears to prevent the effective commercial transfer of title in satellites. The paper discusses three means by which the effects of registration of a space object by a non-launching state may be achieved lawfully without the need to amend the Outer Space Treaty or the Registration Convention. Although amendment of the treaty or convention is preferred, the three means provide an interim solution to the dilemma.

Sreejith S.G., "When Sputnik Orbits Geneva": Legal Reflections on WTO Governance In Respect of Commercial Space Activities.

The author believes that World Trade Organization jurisprudence is applicable to space commerce; WTO law is a source of space law. When space law recognizes WTO law as a source, it will become broader in scope. The author believes that the GATT duties and numerous other enforcement procedures may not be of benefit to space law although it will have to deal with them in any event. However, the author cautions against allowing the WTO enforcement mechanism to dictate space industry decisions due to potential overreaching by WTO.

Prof. Dr. Maureen Williams, Dilemmas of Remote Sensing Data in National and International Courts.

The paper summarizes remote sensing activities and addresses issues such as distribution and commercialization of the data obtained by remote sensing technologies and their use.

Specific problems arising from the use of data collected by Earth observation satellites and its value before the courts is also considered. Digital maps have been used as evidence in litigation. An expert witness is required during trial to interpret the maps. The expert is allowed a wide margin in interpreting the digital maps. Judges or arbitrators must rely upon such testimony - the author considers this to be a source of trouble as evidenced by a recent case outlined in her paper.

Luis F. Castillo, Legal Issues Relating to Private Enterprise, Property Rights, and Space Applications.

The primary objective of the paper is to describe the mechanisms available to states and international organizations and corporations for dispute settlement. The author believes that the 1998 Final Draft of the Revised Convention adopted by the International Law Association of the original 1984 Convention adopted in Paris contains provisions that are current with the times, especially considering commercial space law developments. It is recommended that a specific tribunal be established to hear and render binding and non-binding decisions in disputes dealing with commercial space activities. The paper then presents a Declaration of Principles In Relation To Dispute Settlement In Commercial Space Activities.

Virgiliu Pop, Extraterrestrial Real Estate: Debunking the Myth.

The subject of the paper deals with the illegality of Dennis Hope, through his "Lunar Embassy," selling real estate on the Moon. The paper sets forth the specific reasons why the Lunar Embassy does not own the Moon, and, thus, cannot legally sell portions of it. With the advent of the internet, the illegal claims of the Lunar Embassy have been widespread and the public believes it could actually own a portion of the Moon. The author contends that lunar ownership claims are not only misleading but are false and the sale of real estate is fraudulent activity. Reference is made to the recent (2004) proclamation by the IISL Board of Directors stating that private ownership is forbidden under international law, specifically, the Outer Space Treaty of 1967.

E) SESSION 5 - OTHER LEGAL MATTERS, TELECOMMUNICATIONS, NPS AND MILITARY IMPLICATIONS.

Chairmen: Dr. Kai-Uwe Schrogl (Germany) and Dr. Lucy Stojak (Canada)

Rapporteur: Martha Mejia-Kaiser (Mexico)

Prof. Francis Lyall (UK) presented the paper *"The Protection of the Public Interest in the Light of the Commercialization and Privatization of the Providers of International Satellite Telecommunications"*. He reviewed the current trend in the privatized INMARSAT and INTELSAT organizations. He stated that there is a threat to the original aims of both institutions to serve international public interest. Prof. Lyall fears that adventure capitalists may overtake these organizations, who may put aside the public interest to the detriment of underdeveloped countries. He proposed to convert the International Mobile Satellite Organization to a general monitor of compliance with public service obligations.

The paper *"Digital Divide"* was presented by *Ms. Delphine Gomes de Sousa* (France). She commented that the gap between persons who "have" or "have not" access to information and communication technologies is a new form of inequality. She pointed out that this inequality is a result of terrestrial technologies being fixed to a certain area and of the commercial motives of the operators. She proposed to correct this gap through the establishment of wireless technology through a global broadband satellite infrastructure.

Mr. Sethu Nandakumar (India-UK) presented the paper *"Legal Impasse-Commercialization of Space through Reusable Sub-Orbital Launchers"*. Although there is no legal definition of space object, Mr. Nandakumar noted that the international community has accepted that they require at least one completed orbit around the Earth. Although sub-orbital flights may reach an altitude higher than 100 km, and may cross the orbits of some satellites, they describe a parabolic path, therefore can not be considered as space objects. At the present such flights are in the test phase and subject to domestic air law (in US), but

some international legal issues will arise with the commercialization of these flights, for example the status of passengers, remote sensing activities while ascending and descending, liability aspects in case of an accident, etc. He stressed that there is a need to create a new legal regime and to establish an international organization for the coordination of these activities.

With the paper *"Civil Liability in Space at Common Law"*, *Mr. Dermont Sheehan* (LL.B. student in Ireland) presented some hypothetical examples on space liability and examined them under the existing common law. He proposed to apply maritime law (admiralty law) – with modifications – to outer space activities and to develop specific space torts. He concluded that private disputes in outer space should be solved at private level and not at governmental level.

In the paper *"High Altitude Platforms and International Space Law"*, *Prof. Peter Haanappel* (Netherlands) analyzed the legal aspects of High Altitude Platforms which may be large stationary bodies, deployed between 30 and 50 km. altitude. Although such devices may use radio communication services allocated for outer space services, he commented that they are governed by (international) air law. Prof. Haanappel asserted that it is necessary to consider the interrelationships between the laws of air space and outer space, because the High Altitude Platforms may obstruct the access of space objects to outer space in the ascent or descent phase of space, thereby creating liability issues in case of an accident.

Dr. Carl Christol (US) presented the paper *"Gathering and Dissemination of Space-Based Data in Time of Armed Conflict"*. The author commented that at present, satellite remote sensing data collected by military agencies and private commercial companies are used in various ways in the war against terrorism and in the recent Iraqi wars. Prof. Christol reviewed the coordination of US governmental institutions and private satellite remote sensing companies in the areas of data acquisition, data analysis and immediate transmission to the war theater. Based on the legal viewpoint that States have the sovereign right to protect themselves against warlike adversaries, he affirmed that remote sensing satellites contribute to a more benign phase of international relations.

Mr. Sa'id Mosteshar (UK) presented the paper *"Militarization of Outer Space. Legality and Implications for the Future of Space Law"*. In his paper, Mr. Mosteshar analyzed the term "peaceful use" and concluded that it should mean "non-military" rather than "non-aggressive". He refereed to the Bush foreign policy which is directed to "...dominate the space dimension of military operations to protect US interests and investments...denying other countries access to space". He is of the opinion that any military use of outer space weakens international law of outer space.

Philippe Achilleas presented the summary of the paper written by Ms. *Yuri Takaya* (Japan) named *"The Usage of Space Weapons and International Law"*. Ms. Takaya reviewed the applicable international law to prevent the deployment of space weapons. She referred to the planned deployment of "interceptors" in outer space. Because such devices do not fall under the scope of the definition of weapons, as defined in the Outer Space Treaty and the Moon Agreement, she commented that it is necessary to establish appropriate measures to prevent their deployment in outer space.

General Discussion:

About the flight of *SpaceShipOne* and the legal implications of sub-orbital flights:

In respect to the status of sub-orbital tourists, Dr. van Fenema remarked that the Astronauts Agreement addresses the assistance to astronauts in case of accident and danger and that this treatment should also apply to sub-orbital tourists. However, he questioned if the status of "envoys of mankind" apply also to sub-orbital tourists.

About militarization and weaponization of outer space:

Mr. Salin commented that the legality of the "legitimate defense" argument in outer space must be analyzed. He stressed that the US uses this argument to impose their will without taking into account the rest of the international community. He commented that there is a link between militarization and commercialization in order to anchor investors through shares and bonds.

Mr. Mosteshar indicated that in pursuing its policy, the US is undermining its peaceful commitments and international law.

Dr. Stojak referred to statements of the US secretary of Defense, Donald Rumsfeld, which reflect the US policy of avoiding signing cooperation agreements, in order to have freedom in their non-pacific endeavors.

About the delimitation of air and outer space and an international space convention:

Dr. von der Dunk observed that although the 100 km limit was set as the goal for the X-prize, it may be necessary to go back to discussion of setting a limit between air and outer space, in order to have clarity which law applies to a certain segment of flight. He remarked that Australia is the first country having established the limit between air and outer space at 100 km by national law. He regarded this a good sign and pointed out that other more complex national legislations, as for example the US space legislation, have not yet gone so far.

Mr. Salin disagreed and was of the opinion that air space and outer space should be considered as a continuum. The setting of a formal delimitation would not solve the problem.

Dr. Schrogl informed that presently the United Nations prepare a draft resolution on the application of the legal principles of the launching State. This draft contains a recommendation to encourage implementation of national space legislations. Such topic may be an issue in the next meeting of the COPUOS legal subcommittee, where drafts models may be developed.

Dr. van Fenema added that discussions on a possible international space law convention show again the two contrary positions: countries who wish to set a limit between air and outer space, and countries, like US, who are reluctant to accept new rules which may limit their space activities. Before starting the discussion on a new international space law convention, he emphasized to identify the aspects which are not covered by the five existing space treaties. Subsequently, this would lead to the question, if national governments can be entrusted with establishing such rules at the national level in such a way to comply with the existing space law treaties.

Dr. Freeland pointed out that the 100 km delimitations set by the Australian government was done for practical reasons.

The government wanted to define if an object launched from its territory could reach this limit. The establishment of this limit was not intended to put Australia into the role of a pioneer concerning this delimitation.

Dr. Schrogl commented that countries like France, Germany and Netherlands must sit together with countries that already have national space legislations like the UK and Sweden, in order to draft national legislations which are harmonic at the European level. This may be the same in COPUOS, because some countries appreciate if they get some inputs on space law matters, not only from other countries but also from the IISL.

On the creation of an international space convention, Dr. Ram Jakhu was of the opinion that such convention should also contain new aspects not contained in the 5 existing treaties, for example, property rights and liability issues. Another aspect is who should be drafting this convention. COPUOS may be the obvious forum for such issues, but in this context also the militarization and weaponization of outer space will be addressed. Therefore some delegates of countries who interpret "peaceful" uses as "non-aggressive" uses will evoke the argument that COPUOS is restricted to discuss the peaceful uses of outer space only.

PREPARING WRITTEN BRIEFS FOR INTERNATIONAL LAW COMPETITIONS: A PRIMER

Stephen E. Doyle, BA, JD[*]

INTRODUCTION

This brief discourse offers advice for potential competitors in international moot court competitions, such as the Manfred Lachs Space Law Moot Court Competition or the Phillip C. Jessup International Law Moot Court Competition. As a participant, and later a judge in such competitions, I have found that preparation of written briefs is often a weak area of competitor performance, mainly because of lack of experience or lack of understanding of the administrative procedures and guiding principles of the Court. In these competitions, briefs are prepared on the model of briefs prepared for a case before the Interna-

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tional Court of Justice at The Hague, hereinafter referred to as the ICJ.

In the preparatory materials made available to competitors, usually there are: 1) an extended statement of the facts of the case, included in a *Compromis*, being the facts agreed to by the parties, 2) a stated series of issues agreed to be considered by the Court, 3) a prescribed brief format, with an assigned page length for arguments, and 4) the administrative procedures and rules applicable to the competition.

PREPARATIONS FOR BRIEF WRITING

Before beginning to write any part of the required brief, carefully and fully study the documentation provided. Often a complex fact situation can be significantly illuminated if a representative graphic is prepared. It is useful to make a drawing, if practical. Such a drawing, capturing the factual situation of the case, might even be included in a brief, or as an annex, for the information of the Court. In many cases, as a judge, I found a simple sketch helped considerably to clarify understanding of the facts and/or the physical or geographical relationships of the parties.

Do not spend a lot of time rehashing and restating the facts of the case. It is, in fact, undesirable to restate a condensed version of *the relevant facts* of the case, which are usually bodily contained in the *Compromis* of the parties. Be careful in your study to sort the relevant facts from the irrelevant. The Court may be assumed to have a working knowledge of the relevant facts. A lengthy or reworked presentation is unproductive and may be counterproductive. Do not rewrite the *Compromis*.

Include in your brief a *verbatim text* of the *Compromis*. A fault I frequently find in briefs is that students want to "improve" the *Compromis*. This document represents the agreement to the stipulated facts between or among the parties. Rewriting a *Compromis* to condense or sharpen it ignores the nature of the document. It is the agreed statement of the parties to the stipulated facts therein. The *Compromis* should be included in the brief *verbatim*, not in an amended, shortened, or improved form. As part of, or immediately following the *Com-*

promis presented, there will be an agreed list of issues for resolution by the Court. List these issues also *verbatim* in the brief, and proceed to argue them, whether for the applicant or respondent. You will be required to prepare a brief for both sides and to submit both for judging. Your orals may be for either side, or both.

CONDUCTING RESEARCH

Before beginning to write a brief, obtain as many relevant source documents as possible to draw upon as you set forth your arguments. Source materials vary in weight as to their probative value to the Court. Many students miss completely the relevance of whether they are working in primary sources, secondary sources, or tertiary sources. This is likely a manifestation of their lack of information or understanding of the relative weights assigned to sources.

In law, when one refers to "primary sources," one refers to the actual text of a constitution, treaty, statute, or an established regulation relevant to a case. These are sources of the controlling, binding, enforceable law. "Secondary sources" are those which include the interpretation of the law in primary sources. Principal secondary sources are the decisions of courts interpreting or explaining a primary source. In international law, the negotiating history of a treaty, particularly if there are verbatim minutes of the negotiation, may have high probative value. Well established and generally accepted interpretive documents, may by their reputation deserve consideration as secondary sources. Widely cited and quoted commentaries and administrative tribunals' findings or arbitration decisions may warrant consideration as secondary sources. "Tertiary sources" are the commentaries, journals, and works of scholars, pundits, journalistic reports, and practicing lawyers who write articles or papers arguing, interpreting or explaining a position on the law.

With reference to the status of "custom" as a source of law, a sitting member of the ICJ recently informed me that "The Court always treats international custom as a primary source along with a treaty. For some judges and international lawyers generally it stands, in principle, higher than a treaty. More-

over, they equate "general international law" with customary international law. On the other hand, constitutions and other national law are treated by the Court as "facts," rather than "sources" of international law. These remarks do not take away the importance of all documentary sources, which you correctly emphasize in your recommendations."[1]

It should be understood that citation to and quotation of a primary source presents *prima facie* evidence of "the law." In some cases, the language of the law may be vague and unspecific. In such cases, use of secondary sources is made to argue for the interpretation of the law desired by a party to a dispute. Secondary sources will show how other courts, tribunals, administrators or arbitrators have viewed or interpreted the law. Bear in mind that arguing secondary sources does not decide a matter, it merely presents arguments in favor of one or another interpretation of a primary source. Courts generally consider relevant prior judgments or decisions significant indications of the meaning of a primary source. The ICJ may be expected to give significant weight to earlier judgments of the Court.

Students make a serious error when they conclude that because they have found one tertiary source that argues a particular position, that position should be persuasive to the Court. Generally, it is not so. Description of one tertiary source reciting a position is evidence of the position of that source originator. If one can find five or six or more reputable or qualified writers in tertiary sources who hold a common position on the interpretation of a law, this is more likely to have an impact on the view of the Court. If commentators in different countries with different languages and different legal systems can be shown to have a common position, it can be even more persuasive to the Court. The existence of a single advocate of a position in a tertiary source does not constitute any compelling argument to the Court.

Therefore, in conducting research it is important to know the resources you have available to discover and clarify the law, as manifest in primary, secondary, and tertiary sources. This is

[1] E-mail from Judge Vladlen Stepanovich Vereshchetin, International Court of Justice, to the author (Sept. 13, 2005) (on file with author).

the substance of the first year law student's legal research class. Many students choose to minimize their effort in this course and, by doing so, handicap themselves for their entire legal career, because they never learned well the resources available to them. Good brief writing is at least 80 percent research and not more than 20 percent composition.

In the United States, for example, in 1877, John L. Cadwalader, Assistant Secretary of State, prepared a Digest of the Published *Opinions of the Attorney-General, and of the Leading Decisions of the Federal Courts, with Reference to International Law, Treaties and Kindred Subjects.*[2] In 1886, Francis Wharton, Chief Examiner of Claims, Department of State, prepared an *International Law Digest*, in three volumes.[3] In 1906, John Bassett Moore's *International Law Digest* was published in eight volumes.[4] Beginning in 1940, Judge Green H. Hackworth's *Digest of International Law* began to be published, and it concluded with eight volumes.[5] In 1963, the last in the State Department's *Digest* series, Marjorie M. Whiteman's *Digest of International Law,* began to appear.[6] The Whiteman *Digest* concluded with volume 15 in 1973. Subsequently, in the United States and in other countries, appropriate government agencies involved with legal aspects of foreign relations have published annual summaries of practices in international law, like the US Department of State's *Digest of Practice in International Law*, first published in 1973.[7]

A student researching a current case in international law would want to look first for the relevant primary and secondary sources, being treaties, laws, agreements and related decisions interpreting them. When arguing a case before the ICJ, it is

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[2] JOHN L. CADWALADER, DIGEST OF PUBLISHED OPINIONS OF THE ATTORNEYS-GENERAL AND OF THE LEADING DECISIONS OF THE FEDERAL COURTS, WITH REFERENCE TO INTERNATIONAL LAW, TREATIES, AND KINDRED SUBJECTS (1877).

[3] FRANCIS WHARTON, DIGEST OF THE INTERNATIONAL LAW OF THE UNITED STATES (covers 1776-1886) (1886).

[4] JOHN B. MOORE, DIGEST OF INTERNATIONAL LAW (covers 1776-1906) (1906).

[5] GREEN H. HACKWORTH, DIGEST OF INTERNATIONAL LAW (covers 1906-1939) (1940-1944).

[6] MARJORIE M. WHITEMAN, DIGEST OF INTERNATIONAL LAW (covers 1940-1960) (1963-1973).

[7] DIGEST OF UNITED STATES PRACTICE IN INTERNATIONAL LAW (1973-1988, 2000-).

particularly relevant to look at the prior decisions of that Court on relevant topics. Then look into the recent annual compilations of international practice produced in any states party to the dispute. Similarly, the student would want to consider the relevant contents of the periodical *International Legal Materials*, published by the American Society of International Law. The *Journal of the American Society of International Law* is a significant source of commentary on international law, and it should be researched carefully in cases involving international law.

With reference to space law, there are similar compilations of relevant laws and commentary. Nandasiri Jasentuliyana and Roy S. K. Lee compiled and edited a *Manual on Space Law*, published by Oceana in 1979-80, in 4 volumes.[8] Professor Stephen Gorove, of the University of Mississippi, compiled *United States Space Law: National and International Regulation,* published by Oceana in 1982.[9] The United Nations Office of Outer Space Affairs (OOSA) makes available, on line, many of the primary sources of international law generated through the United Nations. Kuo Lee Li compiled a comprehensive *World-Wide Space Bibliography*, published by the Carswell Company in 1978,[10] with a later second volume.[11] A student looking through the Li bibliography can immediately discover which commentators have produced the most prolific commentary on selected subjects in space law, and thereby guide the research necessary to discover commentary on a particular topic.

One of the most fertile sources of informed commentary on space law is found in the annually published *Proceedings of the International Colloquium on the Law of Outer Space*, which is the compilation of papers presented by legal writers from various countries, before an international audience, addressing is-

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[8] MANUAL ON SPACE LAW (Nandasiri Jasentuliyana & Roy S.K. Lee eds., 1979).

[9] STEPHEN GOROVE, UNITED STATES SPACE LAW: NATIONAL AND INTERNATIONAL REGULATION (1982).

[10] KUO LEE LI, WORLD WIDE SPACE LAW BIBLIOGRAPHY: VOLUME I (1900-1976) (1978).

[11] KUO LEE LI, WORLD WIDE SPACE LAW BIBLIOGRAPHY: VOLUME II (1977-1986) (1987).

sues of currency in international space law.[12] The meetings at which the papers are presented are the annual colloquia on the law of outer space sponsored and organized by the International Institute of Space Law of the International Astronautical Federation. Following presentation of the papers, there are provisions for exchanges of views and discussion of the papers. Summaries of the discussions are also included in the *Proceedings*. Unfortunately, many law libraries fail to subscribe to this singularly valuable commentary source. It is available by subscription through the American Institute of Aeronautics and Astronautics, readily locatable on the internet. An excellent bibliographic analysis of the Proceedings from 1960 to 1990, organized by authors and titles, has been prepared and published by the UN's Office of Outer Space Affairs.

Students should understand that it is not by discovery of a book or an article on the topic of relevance to a case, that they will have a good grasp of the law, or of a reasonable position under the law. It is by comparison of various scholars' views, various pundits commentaries, that they can assemble a "body of commentary" which would have persuasive influence on the Court. The commentary of one or two individuals is neither impressive nor compelling. Examination of one or more of the earlier winning written briefs will show readily how extensive the research was in preparation of the brief's arguments.

For a student located at a school with limited space law or international law library materials, the internet provides an exciting window on the world of legal commentary. Also, students should inquire of their librarian about possible interlibrary loans of particular sources or materials. In addition, a trip to a larger city with a better equipped library may well be a useful exercise for a week-end during brief preparation. Finally,

A student may find help from one of the existing centers of excellence in the world for space law studies and research.

Several academic institutes are dedicated to the study of air and/or space law. At least five major centers are:

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[12] PROCEEDINGS OF THE 47TH COLLOQUIUM ON THE LAW OF OUTER SPACE (2005).

1) The National Remote Sensing and Space Law Center, established at the University of Mississippi in 2000. This center addresses the legal aspects of emerging remote sensing, geographical information systems, and related geospatial information technologies. It is an internationally recognized research, advisory, and training resource. The Center hosts visiting scholars, publishes the *Journal of Space Law*, and has published a number of major books on space remote sensing and related issues. It also sponsors a wide variety of activities including live webcasts, workshops like A Legal Assistants' Guide to Legal Applications of Geospatial Information and the 1st International Conference on the State of Remote Sensing Law.

2) In 1951, McGill University established the Institute of Air & Space Law (IASL) in Montreal, Canada, to provide graduate legal education for students from around the world. In the ensuing half century, IASL has educated some 800 students from 120 countries. The McGill Institute's missions include: to help educate the next generation of air and space lawyers to serve the needs of the air and space community worldwide; to publish interdisciplinary research valuable to governmental and multinational institutions, the airline and aerospace industries, and the legal profession; and to create a thriving intellectual environment and professional global network for faculty, students, graduates, and experts in the related fields.

3) The Leiden University International Institute of Air and Space Law, founded in Holland in 1986, is also a leading international academic research and teaching institute, specializing in legal and policy issues regarding aviation and space. Its objective is to contribute to the development of aviation and space law and related policy by conducting and promoting research and teaching at the graduate and post-graduate levels. The relevance and topicality of its work is guaranteed by an extensive exchange of information with the air transport and space industries. The Institute possesses a modern library and organizes courses and conferences on all aspects of aviation and space law and policy. The Leiden Institute forms an integral part of the Faculty of Law of Leiden University. It cooperates with the Leiden University School of Management and many other academic institutions, both within the University and outside. The Institute maintains close contacts with re-

lated national and international organizations in Europe and beyond, both private and public.

4) The Indonesian Center for Air and Space Law (ICASL) was set up in Bandung in December 1988 to conduct and promote research and teaching in the fields of air and space law; to enhance interdisciplinary cooperation between universities, governmental agencies, and private entities dealing with air and space law affairs; and to provide educational and research services and facilities for the development of air and space activities at national, regional and international level. The ICASL sponsors and engages in education and training, research on air and space law affairs, seminars, workshops, symposiums, and conferences, produces publications and maintains a library. Finally,

5) The main objective of the European Centre for Space Law (ECSL) is to build up and spread, within Europe and elsewhere, an understanding of the legal framework relevant to space activities. ECSL does this by fostering the exchange of information among interested stakeholders and by helping to improve and promote the teaching of space law. Its aim is to provide updated information on Europe's contribution to space activities beyond Europe, and therefore to enhance the European position in the field of space law practice, teaching and publications. The ECSL, which is housed at offices of the European Space Agency in Paris, maintains general and specific relevant bibliographies, a survey of space law teaching in Europe and educational support tools, and a general repository and record for relevant events and documents of the European Space Agency and the European Union.

WRITING THE BRIEF

When writing begins, make an outline using the "agreed issues." Topically outline the arguments you intend to elaborate on each issue. Develop arguments targeted at the "agreed issues," with appropriate support. Judges will be looking for the evidence of knowledge of the law and understanding of its applicability to the case, proper and articulate analysis, the extent and use of the research conducted, clarity, organization, grammar, style and persuasiveness. In fact, one can go to the web

sites of the competitions and find the scoring factors used to evaluate the written briefs.

While these factors may differ slightly in wording in the different competitions, they are essentially the same. Persuasiveness and original thought might well be embraced in consideration of proper and articulate analysis, clarity, and organization. Can you present well formed, articulate and convincing arguments on the agreed issues? Your arguments must all be based on clear evidence of knowledge of the facts and the applicable law.

Jessup scoring factors:	Lachs scoring factors:
Knowledge of facts & law	Knowledge of facts & law
Proper & articulate analysis	Proper & articulate analysis
Extent and use of research	Use of authorities & extent of research
Clarity & organization	Clarity & organization
Correct format and citation	Logic & reasoning
Grammar & style	Grammar & style
	Persuasiveness
	Evidence of original thought

Be sure to cite and quote the primary sources containing the applicable law. Briefly declare how this law applies to the case at issue. Use secondary and tertiary sources to reinforce your arguments. Do not rely on single source commentators. Search until you find several qualified commentators to support your desired position. The more support you show, the more convincing you will be. Judges are favorably impressed by research, but only when it is gainfully applied. A student editor's comment in a law journal or a single judge's dissenting opinion should not be considered "authority' for a position. When writing, always seek brevity and clarity. Short, declarative sentences are clear. Long, convoluted sentences, with several subordinate clauses, are rarely helpful.

Consider carefully the weighting of the scoring factors in your competition. Recognize where the principal scoring effort will be directed by the judges. Read your rules carefully. Follow the format required. Do not try to reinvent the table of contents. Conclude your brief with recommended decisions by the Court on the agreed issues. I am continually amazed that students want to bring in issues not listed, because they think they are important. That is not the kind of "original thinking" judges will be looking for.

About twenty percent of the briefs I have graded over the past ten years contain rather embarrassing spelling and grammatical errors. There is no excuse for misspelling. Run a spell check! For grammar, ask another student to review and critique your writing. You are not sacrificing your authorship of your work by asking someone to critique it. It is important that you write it, not the reviewer.

CONCLUDING THOUGHTS

Many of the foregoing thoughts may appear to be self evident. Based on my experience as a judge of briefs for more than ten years, I am convinced that this paper may be a valuable contribution to the effort of some who have not heard these points before. They may have been exposed to many of them, but they may not have *heard* them. Whether judges are considering the written briefs or the oral presentations, they will be most impressed by a well demonstrated effort to conduct extensive research. This is an effort requiring several tens of hours. It cannot be done effectively in a weekend.

If you decide to enter one of these competitions, I applaud your effort and dedication. It is not an easy thing to maintain studies in law school and work on a competition requiring written briefs and oral presentations, but it can be enormously educational and fun. Just remember: a job worth doing is worth doing well.

MAKING SPACE HAPPEN: PRIVATE SPACE VENTURES AND THE VISIONARIES BEHIND THEM

By Paula Berinstein,
Published by Plexus Publishing, Inc. (2001)

Reviewed by Diane Howard*

Almost ebullient in tone, Ms. Paula Berinstein's book tells the story of the individuals working to "make space happen" as well as how they propose to do it. This approach, though it can be hard to follow, effectively communicates the spirit of today's space industry to the reader.

Ms. Berinstein formats her book into twenty chapters, an epilogue, and 5 appendices. She includes a cast of characters, a glossary, a useable index, and sprinkles the text with sidebars that supplement the surrounding text with ancillary, but pertinent, facts and figures. Each chapter addresses either an issue related to a commercial effort to utilize or travel to outer space, or to a personality involved in the same. Ms. Berinstein ends each chapter with her concisely labeled opinion. The book

* Diane Howard is a staff attorney at the Fourth District Court of Appeal in Florida. She participated in the United Nations/Brazil Workshop on Space Law in November 2004; lobbied the U.S. Congress on national space law issues with the ProSpace organization in March 2004, and attended the Institute of Air and Space Law, McGill University, Montreal, Quebec during the summer of 2003.

makes no effort at high-mindedness or objectivity, and always remains accessible to the lay person.

From the preface forward, Ms. Berinstein makes no secret of her fascination with space and her belief that private efforts will prevail. She states that her book purposely does not include discussion of NASA, nor does it only deal with efforts to commercialize space. Instead, she concentrates on the "underdog", believing these intrepid individuals have a better chance of getting people into space and utilizing the resources found in space back here on Earth. As she succinctly declares, her mission is to "inform and astonish", and she expresses the thought that it is her status as an outsider that affords her the latitude necessary to write this book.

Rather than base the book upon dry issues, this author instead focuses on the individuals themselves. Moreover, instead of merely stringing together a series of chapters on different approaches to privatizing space, she relies upon the words of these space visionaries, both through interviews and emails. As a result, the book is somewhat choppy in tone. Still, once the reader gets accustomed to the change in perspective from the interviewee to the interviewer and back, this format works to display the personalities of the people involved. The book definitely bears the imprint of Ms. Berinstein's style while conveying the enthusiasm and attitudes of her subjects.

She begins by discussing the various reasons for human expansion into space. These justifications range from ensuring human survival, through an argument that space utilization will enable us to survive our rapidly depleting resources, to a conviction that it is "manifest destiny" to explore space in search of other life and other habitats. Along the way she includes such esoteric rationales as recreation and the "search for beauty".

Tourism emerges as the strongest contender in the arena of potential privatization endeavors. The first five chapters (of twenty) discourse upon the possibility of getting people in space for some good, old-fashioned fun. Beginning with Tom Rogers, the "granddaddy of space tourism in the United States", the author first gives us the man's resume, and then moves into Mr. Rogers' story in his own words. He tells us about his days with

the Department of Defense and how he first became convinced that space tourism was a viable use of outer space technology. A participant in the space program after *Apollo* but before *Challenger*, Mr. Rogers discusses his personal observations of governmental involvement hindering progress in space. Part of Mr. Rogers' contribution to the privatizing space movement is a survey about the viability of space tourism conducted with NASA in the late nineties. This study represented the first time that NASA treated the subject with any credibility. Further, the study marked a joint project between NASA and Mr. Rogers' private organization, the Space Transportation Association. The study, like other market surveys exploring the subject, indicated that there is a sizeable segment of consumers willing to go up in space for fun. However, the size of the segment varies from study to study, and the studies don't factor in the enormous complications involved in spending time in space. In fact, chapter Three is devoted to discussion of such pedestrian challenges as showering in space, cooking in space, and properly disposing of human waste in space. Further, there are psychological ramifications in space travel not faced in travel on earth. Air rage occurs on short, intra-Earth hops but emergency landings are feasible. Dealing with recalcitrant passengers or passengers who cannot handle the prolonged confinement when the vehicle is weeks from landing is a recurring concern.

To bring home the logistics of placing ordinary civilians in space, either orbiting in zero gravity hotels or living in habitats with either no gravity or simulated gravity, Ms. Berinstein then turns her attention to a psychologist named Harvey Wichman. Dr. Wichman's involvement in space runs to design of showers for the space station, and training programs for crew members. He submits that training and screening of potential space passenger/tourists will prove to be the keys to success. He further postulates that design of facilities will be a crucial factor in accomplishing successful tourism ventures. Dr. Wichman suggests that health issues, physiological and psychological, hold the greatest risk. Ms. Berinstein chooses to temper some of the logistical nightmares with her opinion that people will be so hyped up to get into space that they will risk comfort and well-being to get there. As long as people are properly informed of

the risks, she feels that the excitement of getting there will outweigh the potential downside.

Ms. Berinstein tells us that, as a matter of fact, the chance to enjoy space as a tourist already exists, and for decidedly less than the millions spent by first space tourist, Dennis Tito. Enter Space Adventures, an American company using Russian facilities and technology to fly civilians to the edge of space on a MIG-25 for the view and also offering zero gravity flights, each for under $13,000 (a flight to the edge of space carries a price tag of $12,600, while a zero gravity flight comes in at a mere $5,400). Though the author concedes that this sounds pricey, and the cost does not come close to the proposed price tag for a week in space. The problem revolves around money. How much do people spend on vacations? How much can they spend on a space vacation? And without volume, how does a private company, driven by the bottom line, keep the costs down to an accessible price for consumers?

Further, we are told that the problem of money appears to be the major obstacle in developing the next generation of vehicles to get us into space. Money, and also the time value of money – it takes a long time to see a return on investment in space, and that assumes that there will be a return someday. Not only does transport need to be cost effective, it must also be safe. Now we are talking about testing the craft – test flights and certification. This can take a long time, particularly since conversation about getting out into space often involves conversation about alternative propulsion systems.

We are next introduced to Peter Diamandis. In an effort to pump up enough excitement to circumvent the almost crushing weight of the obstacles (cost, time, government certification), Mr. Diamandis modeled a competition on the aviation contests that abounded in the early twentieth century and called it the X-Prize. At the time Ms. Berinstein's book was published the X-Prize was only an offer. At the time of this writing, the X-Prize had become the Ansari X-Prize and was handily won by Burt Rutan and Paul Allen's team, *SpaceShipOne*. The potentials that this accomplishment made possible created excitement that spilled over into all international communities, both civilian and aerospace.

Diamandis believes that healthy competition between teams from different countries is the way to go. After all, wasn't it competition between the U.S. and the U.S.S.R. that originally fueled the race to space? The competition offered a $10 million dollar prize to the first team that designed a private space vehicle that could successfully launch three people to a sub-orbital altitude of 100 km on two consecutive flights within two weeks. Teams had to be privately financed. The competition raised the funds for the prize through private donations, a credit card, sponsorships, a sweepstakes, and selling the book and film rights.

Former astronaut Buzz Aldrin and his partner Ron Jones offer another approach to making space travel accessible to the masses. These two think that the X-Prize focus on small transport vehicles is missing the mark. They want transport big, like buses, capable of carrying eighty to 100 tourists at a time. Further, they want to re-work already existing NASA technology, sort of like re-inventing the wheel, into reusable rockets. Actually, their ideas come across as a somewhat practical application of what already exists. Part of what makes present space flight (*Shuttle*) so very expensive is the fact that it is expendable. Once used, the rocket is done. Aldrin and Jones propose that existing rockets be used as boosters, and that transport be approached as a sort of modular system that can evolve into other uses as our space involvement develops. They are big fans of public-private partnerships and see these as the only practicable means of getting unstuck from the rut that holds space travel trapped.

Once the vehicle exists, where will it take people? Some enthusiasts want to go to Mars, some will accept the Moon, others are content to orbit in space "cruise ships". Berinstein introduces us to a number of people who, in turn, introduce their version of the next, best thing in space. Some of these versions do not factor in human transport. There are marketing companies like Applied Space Resources, headed by Denise Norris. Berinstein appears somewhat fascinated with Norris, a computer programmer turned entrepreneur. Norris' efforts lie in the realm of robotics – using interactive technology to allow paying customers to scoop their own Moon dirt, later to receive it

via FedEx or the like – and marketing these space applications to the consumer. Norris embodies the spirit of the private space community. She is a hearty libertarian and an Ayn Rand devotee; the fact that she employs an ethicist certainly has positive impact upon Berinstein's view of her.

Finally, two thirds of the way through the book, Berinstein tackles the tougher issues, most notably, legislation. Domestic law requires an inter-agency licensing process. That means that an application to launch moves from one overloaded desk to another, subject to more than one set of specifications and approvals. Here lies a source of frustration for many. Property rights in space are also a huge grey area. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (hereinafter Outer Space Treaty) clearly articulates that no State can appropriate space or anything in it. Berinstein is not trying to solve any problems here. She introduces us to Alan Wasser, who has his own theories about this big gap in international space law, and though she allows him to make his case, she keeps the book light. She gives her own reasonably developed opinion and she ties ownership to actual human presence in space; for her, it is not enough to simply send out a probe to identify and catalog.

The "financial issue" is a constant theme. Cost overruns, cost shortages, cost justification, all factor into the challenge of making space accessible. Research and development cost a lot. Where will the money come from? Ms. Berinstein tells us that traditional venture capital does not appear to be an option because of the time lapse between money spent and money recaptured and the tremendous uncertainty regarding markets and return of investment. She, and others in the industry, seem to be hoping for a fairy godparent to come along, get bitten by the space bug, and wave a magic checkbook. Perhaps a Bill Gates or a Warren Buffet will step up to the plate. This is called "Angel Funding", and though it may seem a tad unrealistic, it remains indicative of the incredible, unbuoyed optimism in the space community. As a point of fact, one such dot.com success story, Jim Benson of SpaceDev, did start his company with a windfall from the software industry. Paul Allen's in-

volvement in the Ansari X-Prize certainly adds credence to this mode of funding.

Insurance costs money, also, and insurance becomes very necessary. In order to satisfy the national requirements for launch certification, applicants must show financial responsibility as per the Outer Space Treaty, the Convention on International Liability for Damage Caused by Space Objects, and the Convention on Registration of Objects Launched into Outer Space. State members are responsible for all parties involved in space, whether public or private. Money is important on both sides of the equation – research and design and also funding and risk allocation. Ms. Berinstein almost dismisses these concerns with a flippant toss, stating that insurance is "an incredibly boring subject". Maybe so, but it is a necessary subject, made more so because of the international treaties that we ratified many years ago. Perhaps her prioritizing of subject matter flows from tactical choice. Her goal may be to inflame the reader with such passion for space that the barriers just crumble from grass roots pressure. She doesn't even address the regulatory climate until the appendices of the book.

Ms. Berinstein begins her book by stating that she only wants to inform her readers. She does not offer hard science or political agendas or strategies to navigate through the existing international and domestic law relevant to her issue. This book can only be viewed as an introduction to the idea of a privatized space industry, and that introduction is appropriate only for those with little to no background in either space or law. It reads like a pep talk. It can be difficult to follow, but then so can conversations. And that is basically what this book remains – a series of conversations and press releases. Although a good read, it causes some frustration at the paucity of real life practical solution-oriented information. However, the book definitely engages, and the zeal of both the interviewer and the interviewed infect the reader with the space bug. Read this book and one is ready to either sign up for the next flight, invest some money, or at the very least, participate in some interactive exploration ala Denise Norris. It will leave you wanting more.

SPACE LAW AND RELEVANT PUBLICATIONS

Keishunna Randall[*] *& Katrina Sandifer*[**]

LAW REVIEW ARTICLES

Evan Chuck, *Checklist for International Due Diligence*, SL054 ALI-ABA 815 (2005).

Steven Freeland, *Up, Up and . . . Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space*, 6 CHI. J. INT'L L. 1 (2005).

Joanne Irene Gabrynowicz, *The Perils of Landsat from Grassroots to Globalization: A Comprehensive Review of US Remote Sensing Law with a Few Thoughts for the Future*, 6 CHI. J. INT'L L. 45 (2005).

Michael V. Hayden, *Balancing Security and Liberty: The Challenge of Sharing Foreign Signals Intelligence*, 19 NOTRE DAME J.L. ETHICS & PUB. POL'Y 247 (2005).

Albert C. Lin, *Beyond Tort: Compensating Victims of Environmental Toxic Injury*, 78 S. CAL. L. REV. 1439 (2005).

Allyson Phillips, *A Portal to Reliable Real Estate Data or a Door to Nowhere? A Look at How State and Local Dissemination Policies Have Impacted the Development of the National*

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[**] Katrina Sandifer is a third-year law student at the University of Mississippi School of Law, and serves as a Student Editor for the *Journal of Space Law*.

Spatial Data Infrastructure and Geospatial One-Stop Portal, 34 REAL EST. L.J. 9 (2005).

Rosanna Sattler, *Transporting a Legal System for Property Rights: From the Earth to the Stars*, 6 CHI. J. INT'L L. 23 (2005).

NOTES AND COMMENTS

Steven A. Mirmina, Note and Comment, *Reducing the Proliferation of Orbital Debris: Alternatives to a Legally Binding Instrument*, 99 AM. J. INT'L L. 649 (2005).

Paul Tobias, Note, *Opening the Pandora's Box of Space Law*, 28 HASTINGS INT'L & COMP. L. REV. 299 (2005).

BOOKS

Julian Hermida, *Space Law, in* 6 ORGANIZATION AND STRATEGIES IN ASTRONOMY (Andrew Hecht, ed., Dordrecht: Springer 2005).

M.J. PETERSON, INTERNATIONAL REGIMES FOR THE FINAL FRONTIER (2005).

Kay-Uwe Horl, *Problems Related to Change of Ownership with Respect to Registration, in* CURRENT ISSUES IN THE REGISTRATION OF SPACE OBJECTS (S. Hobe, et. al, eds., Univ. of Cologne 2005).

UNITED STATES EXECUTIVE OFFICE PAPERS

Memorandum from John H. Marburger III, Director, Office of Science and Technology, to Policy Landsat Data Continuity Strategy Adjustment, to U.S. Cabinet, et al., (Dec. 23, 2005), *available* at www.fas.org/irp/news/2005/12/ostp122305.pdf (last visited Jan. 19, 2006).

UNITED STATES PROPOSED AND ENACTED LEGISLATION

Human Space Flight Requirements for Crew and Space Flight Participants; Proposed Rule, 70 Fed. Reg. 77261 (proposed Dec. 29, 2005) (to be codified at 14 C.F.R. pt. 401, 415, et al.).

Iran Nonproliferation Amendments Act of 2005, S. 1713, 109th Cong. (2005).

National Aeronautics and Space Administration Authorization Act of 2005, S 1281, 109th Cong. (2005).

Providing for Consideration of the Bill (H.R. 3070) to Reauthorize the Human Space Flight, Aeronautics, and Science Programs of the National Aeronautics and Space Administration, and for Other Purposes, H.R. 370, 109th Cong. (2005).

Source of Income from Certain Space and Ocean Activities, 70 FR 54859 (proposed Sept. 19, 2005).

To establish an interagency aerospace revitalization task force to develop a national strategy for aerospace workforce recruitment, training, and cultivation, H.R. 758, 109th Cong. (2005).

UNITED STATES' PENDING CASES

Space Exploration Technologies Corporation v. The Boeing Company and Lockheed Martin Corporation, Case CV05-7533 (D. Cal. filed Oct. 19, 2005).

AGREEMENTS

Asia-Pacific Space Cooperation Organization, Oct. 31, 2005, China, Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Peru and Thailand.

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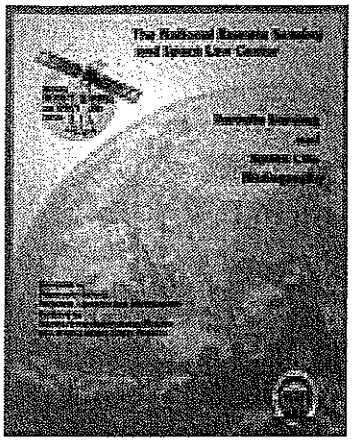

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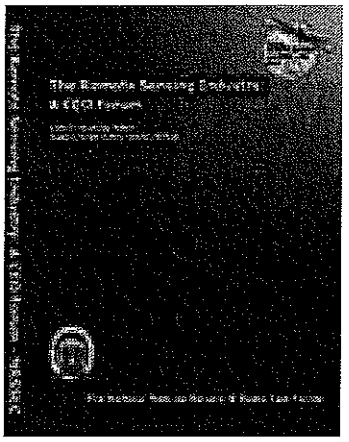

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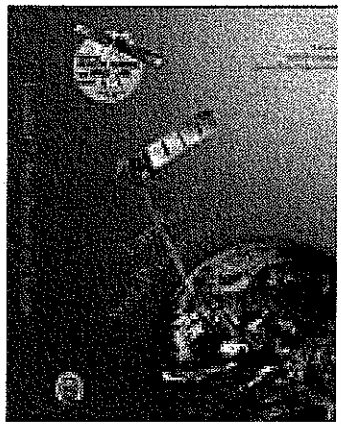

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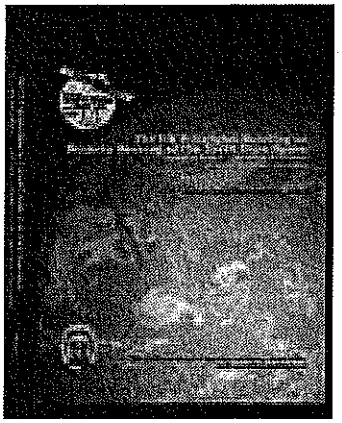

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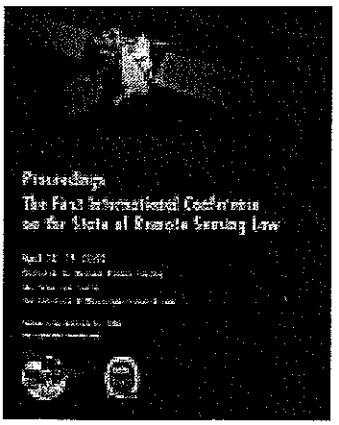

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