LAW AND POLICY IN THE SPACE STATIONS' ERA

by

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This thesis is dedicated to:

My mother in honour;

My fiancée Lucy for love; and

My niece Lisa and nephew Christopher in hope.

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ABSTRACT

Space stations represent a watershed in man's exploitation and utilization of the space milieu. The several factors of: array of hardware; proliferation of space capability; constant presence of man in orbit; variety of activities; and multiplicity of participants, all coalesce to create an unprecedented era in man's conquest of space.

In addition to these scientific and technological developments, this thesis addresses the policy implications for all the current participants in the Space Stations' Era. This is then applied to the US/International Space Station project to assess the legal implications which this precedental co-operative venture provokes. Thus, the status of the co-operative instrument, structures for the efficient management of the project and the commercial law applicable to the venture are all dealt with.

The shift of focus from the specific to the general is completed through a treatment of the military realities of space station utilization, the protection of the environment through the medium of the NPS issue, and the operation of global space law in this era as exemplified by the Registration Convention. The thesis concludes with a call for patience, foresight and vigilance to ensure and promote space democratization to the betterment of mankind.

RÉSUMÉ

L'établissement de stations orbitales représente un point tournant dans l'exploitation et l'utilisation par l'homme du milieu spatial. De multiples facteurs tels que : la diversité des technologies; la prolifération des puissances spatiales; et la multiplicité des participants, contribueront à créer une époque sans précédent en ce qui a trait à la conquête de l'espace par l'homme.

Outre ces développements scientifiques et technologiques, cette thèse se penche également sur les implications d'ordre politique, qui pourraient surgir et affecter tous ceux qui participeront à l'ère des stations orbitales. Ces données sont ensuite étudiées dans le cadre du projet de station orbitale US/International.

Dans un premier temps, l'auteur analyse les implications juridiques que peut provoquer une coopération de telle envergure. Ensuite, il discute la structure nécessaire pour assurer la gestion efficace dudit projet, ainsi que le droit commercial applicable à une telle entreprise.

Après l'étude de ces points bien précis, la thèse termine en traitant des sujets d'ordre plus général tels que : les utlisations militaires possibles de la station orbitale; la protection du milieu spatial et les implications découlant de l'utilisation des sources d'énergie nucléaire (SEN); et, finalement, l'application du droit international de l'espace aux stations orbitales, notamment, la Convention sur l'immatriculation des objets lancés dans l'espace. L'auteur conclut en faisant appel à la patience, prévoyance et vigilance des États, afin d'assurer et de promouvoir la démocratisation de l'espace dans l'intérêt de l'humanité entière.

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LIST OF ACRONYMS

ABM	Anti-Ballistic Missile
AEC	Atomic Energy Commission (USA)
A & R	Automation and Robotics
ASAT	Anti-Satellite
ASET	Aeronautical Services Earth Terminal
BMD	Ballistic Missile Defence
BMFT	Federal Ministry for Research and Technology (FRG)
BNSC	British National Space Centre
CD	Conference on Disarmament
CELV	Complementary Expendable Launch Vehicle
CNES	Centre National d'Études Spatiales
COPUOS	Committee on the Peaceful Uses of Outer Space (UN)
COSPAR	Committee on Space Research
COSPAS	Space System for the Search of Vessels in Distress
CRS	Congressional Research Service
CSA	Canadian Space Agency
CSCG	COSPAS - SARSAT Coordination Group
CSSC	COSPAS - SARSAT Steering Committee
CTS	Canada Treaty Series
DOC	Department of Communications
DOD	Department of Defence (USA)

DOE	Department of the Environment
DND	Department of National Defence (Canada)
EEC	European Economic Community
EIF	Entered into Force
ELDO	European Launcher Development Organisation
ELT	Emergency Locator Transmitter
ELV	Expendable Launch Vehicle
EMR	Department of Energy, Mines & Resources (Canada)
EPIRB	Emergency Position Indicating Radio Beacon
ERIS	Exoatmospheric Re-entry Vehicle Interception System
ESA	European Space Agency
ESRO	European Space Research Organisation
EVA	Extra-Vehicular Activity
FAA	Federal Aviation Administration
FOC	Faint Object Camera
FY	Fiscal Year
G-7	The Group of Seven
G-77	The Group of Seventy-Seven
GEO	Geostationary Orbit
GTO	Geosynchronous Transfer Orbit
HEDI	High Endoatmospheric Defence Interceptor
IACG	Inter-Agency Coordinating Group
ICAO	International Civil Aviation Organization

ICSU	International Council of Scientific Unions
IDO	International Disarmament Organization
INF	Intermediate-Range Nuclear Forces
IOC	Initial Operating Capability
IOCWG	International Operational Concepts Working Group
IOI	In Orbit Infrastructure
ISAS	Institute for Space and Aeronautical Sciences (Japan)
ISF	Industrial Space Facility
ISPM	International Solar-Polar Mission
ISSO	International Space Station Organization
ISTF	Integrated Servicing and Test Facility
ITAR	International Traffic in Arms Regulations
ITSA	Italian Space Agency
ITU	International Telecommunications Union
IUCWG	International Utilization Coordination Working Group
IUWDS	International Ursigram and World Days Service
IVA	Intra Vehicular Activity
JEA	Joint Endeavour Agreement
JEM	Japanese Experiment Module
JRMSWG	Joint Remote Manipulator System Working Group
JSLWG	Joint Space Laboratory Working Group
LDEF	Long Duration Exposure Facility

LEO	Low Earth Orbit
LUT	Local User Terminal
MAD	Mutual Assured Destruction
MCB	Multilateral Coordination Board
MDAC	McDonnell Douglas Astronautics Corporation
MITI	Ministry of International Trade and Industry (Japan)
MLV	Medium Launch Vehicle
MMSL	Microgravity Materials Sciences Laboratory
MOL	Manned Orbiting Laboratory
MORFLOT	Ministry of Merchant Marine USSR
MOSST	Ministry of State for Science & Technology (Canada)
MPS	Materials Processing in Space
MSC	Mobile Servicing Centre
NAM	Non-Aligned Movement
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency (Japan)
NATO	North Atlantic Treaty Organization
NESS	National Environmental Satellite Service (USA)
NOAA	National Oceanic and Atmospheric Administration (USA)
NPS	Nuclear Power Source
NRC	National Research Council (Canada)
NTMs	National Technical Means of Verification

OEA	Office of Export Administration (USA)
OFS	Opened for Signature
OMC	Office of Munitions Control (USA)
OMV	Orbital Manoeuvring Vehicle
OTA	Office of Technology Assessment
OTV	Orbital Transfer Vehicle
PRC	Peoples Republic of China
R & D	Research and Development
RMS	Remote Manipulator System
RTG	Radioisotopic Thermoelectric Generator
SAC	Space Activities Commission (Japan)
SARSAT	Search and Rescue Satellite-Aided Tracking
SBKKV	Space Based Kinetic Kill Vehicle
SDI	Strategic Defence Initiative
SDIO	Strategic Defence Initiative Organization
SL	Spacelab
SOP	System Operations Panel
SPAR	Space Processing Application Rocket
ST	Space Telescope
STA	Science & Technology Agency (Japan)
TEXUS	Technological Experiments under Microgravity
TIAS	Treaties and Other International Acts Series
UK	United Kingdom of Great Britain and Northern Ireland

UNGA	United Nations General Assembly
UNSG	United Nations Secretary General
UNTS	United Nations Treaty Series
UOP	User Operations Panel
USA	United States of America
USAF	United States Air Force
USSR	Union of Soviet Socialist Republics
UST	United States Treaties and Other International Agreements
WIPO	World Intellectual Property Organization
ZLW	Zeitschrift fur Lüft und Weltråumrecht

REQUIRED STATEMENT AS TO ORIGINALITY

It is hereby declared that this thesis is original in conception, scope, and execution, and is entirely the work of the attributed author.

The general theory outlined in the Introduction is a culmination and distillation of six years of work across the spectrum of Space Law and related fields both in the United Kingdom and Canada. This marked a progression from work on the legal, political and military implications of the US Space Shuttle, to dealing with world space transportation systems, and their logical conclusion - Space Stations.

Chapter I is an individual presentation of the political and technological rationales of the major participants in the Space Stations' Era. A number of writers have discussed one or other of these, but none have considered them all together in this detail or with this level of currency and keyed specifically to space stations. Subjective conclusions are also given *in extenso*.

Chapter II concerns the constitutional law underlying the treaty-making power of States. It has been suggested by the work of Dr. Michel Bourély and W.M. Thiebaut in Europe. However, the comparative analysis and application to the space context has not been performed before by anyone to this author's knowledge.

The third chapter, a discussion of management structures for international co-operative space projects is unique and long overdue in this field.

Chapter IV treating commercial activities is an extension of this author's Masters' thesis work on space transportation systems and is an application of extant space law and doctrine and relevant municipal laws to the specific problems provoked by the US/International Space Station. It is believed that this chapter is an unprecedented comprehensive legal analysis in this context. Furthermore, subjective and original conclusions or suggestions punctuate this chapter.

Part Three of the thesis commences with Chapter V dealing with military space station activities. This is the product of four years of periodic work on military space activities as a member of research teams at the Centre for Research of Air and Space Law, at McGill University. During this time, I have researched and written significant portions of annual reports on arms control in outer space, submitted to the Canadian Department of External Affairs (DEA).

Chapter VI concerns the use of Nuclear Power Sources in outer space and is a continuation of work done pursuant to a private contract with the DEA. This resulted in the eventual submission of a text of principles to the UN Committee on Peaceful Uses of Outer Space by the Canadian Delegation. This also appears as an article of the same title in 12 Rutgers Computer and Technology L.J. 305-337 (1987).

Chapter VII, the demonstration of the theory through the prism of an analysis of the Registration Convention, is a personal revival and reapplication of the work of the founding space law jurists to propound the original theory. It also appears substantially as an article entitled 'A Decennial Review of the Registration Convention', XI Ann. Air & Space L., 287-308 (1986).

The concluding chapter contains the views of this author on the optimum and realistic progress, together with the obstacles thereto, of space activities during the Space Stations' Era.

It is submitted that this thesis as a whole is a unique contribution to space law doctrine and is "a distinct contribution to knowledge."

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PART ONE

THE MOTIVATION

It is difficult to say what is impossible. The dream of yesterday is the hope of today, and the reality of tomorrow.

Robert H. Goddard(1)

(1) As quoted by D.M. Cole & D.W. Cox in Islands in Space, (1964, Chilton Books), ix.

INTRODUCTION - THE SPACE STATIONS' ERA CONCEPTUALIZED

> *[T]he drive into space is being conducted... for reasons which are largely materialistic - prestige, defense, the development of new industries. But in the long run (and perhaps the short run) these things will be utterly unimportant; for the illusions of our day cannot survive the fierce, hard light that beats down from the stars.*
>
> Arthur C. Clarke.[1]

A manned space station, regardless of nationality, has many connotations. In order to launch and maintain one, there must be a concatenation of numerous factors. Arguably the most important of these is the multi-faceted political will. Its achievement, to a sufficient level of commitment, involves a precarious balancing of interests which are often in direct conflict, including: the pursuit of national prestige versus co-operative activities, within foreign policy-making; an estimation of the investment required and the returns therefrom, within the context of a national economy with myriad priorities; the all-pervasive influence of strategic defence versus the oft-cited and woolly

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1. Voices from the Sky (1965, Harper & Row Publishers) 184.

'peaceful purposes' concept; and, recently, the pursuit of altruistic scientific goals, which is coming into direct conflict, at least in the USA, with a commercial/industrial budgetary orientation.

Probably the best definition to date of a space station, is the functional one offered by former National Aeronautics and Space Administration (NASA) Administrator James M. Beggs, who has observed that:

> [P]roperly conceived, a station could function as:
> - a laboratory in space, for the conduct of science and development of new technologies;
> - a permanent observatory, to look down upon the Earth and out at the universe;
> - a transportation node where payloads and vehicles are stationed, processed and propelled to their destinations;
> - a servicing facility, where these payloads and vehicles are maintained and if necessary repaired;
> - an assembly facility where, due to ample time on orbit and the presence of appropriate equipment, large structures are put together and checked out;
> - a manufacturing facility where human intelligence and the servicing capability of the station combine to enhance commercial opportunities in space; and
> - a storage depot where payloads and parts are kept on orbit for subsequent deployment.[2]

Another paragraph has been added to this official definition

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2. Civil Space Station - Senate Hearing 98-523, before the Sub-Committee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 98th Congress, 1st Sess. 15 November, 1983, serial No. 98-48, (US G.P.O. Washington D.C., 1984), 43.

which broadens the scope of a space station considerably. Thus, in each of the Memoranda of Understanding concluded between the USA and the European Space Agency, and governmental agencies in Japan and Canada, respectively, for Phase B (Detailed Definition and Preliminary Design) of the US/International Space Station,[3] the following appears in addition to the foregoing definition as the final element comprising a space station. Thus, the latter may also serve as

> a staging base for possible future missions, such as a permanent lunar base, manned mission to Mars, a manned survey of the asteroids, a manned scientific and communications facility in geosynchronous orbit, or unmanned planetary probes.

However, as we shall see, particularly in the first chapter and periodically throughout this thesis, there are several space stations as such, both in existence and envisaged, together with a host of associated instrumentalities indispensable to their assembly, maintenance and the fulfillment of their objectives. It is this wider perspective that represents the first element of the triadic Space Stations' Era concept. To expand, space stations are a collective metaphor for whole ranges of activity which both render them possible and to which they will, in turn, give rise. In

3. These Memoranda are discussed in greater detail in chapter I and in part two of this thesis, *infra*, *passim*.

absolute terms, they mark a watershed between passive and active space development, between limited exploitation and industrialization, and between being Earth-bound and establishing the first foot-hold in the "final frontier".

The second element comprising this concept is itself tripartite. Perhaps its most significant component is the multiplicity of States which are actively involved in this Era. We shall see that this level of commitment is far-reaching, pragmatic and unparalleled. It marks a culmination of a process which began, in earnest with space transportation, though was undoubtedly influenced by a gradual expansion in familiarity with telecommunication and remote sensing technologies also.[4] This widening 'space-power' base will reach maturation with the initiation or consolidation, as appropriate to each nation, of an open-ended manned space programme, which is the second component. For the first time in the history of space exploration, representatives from non super-power nations will participate in space activity on an equal basis, not as "political" guests or for brief, limited and infrequent scientific visits. The third component is a corollary to the latter one of man's permanency in space and relates to what he or

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4. See A.J. Young Space Transportation Systems (unpublished LL.M. Thesis, McGill University, 1984 341 ff)., passim.

she does there. In addition to the panoply of activities which US and Soviet "Envoys of Mankind" have performed over the past generation, there will be added the pursuit of commercially useful technology and products for both spatial and terrestrial application. This finds its most powerful expression in the concerted research and development drive by many nations under the materials processing in space (MPS) rubric.[5]

The third element of this triadic concept is the one to which most time and energy will be devoted throughout this thesis, but which would not exist without the two preceding elements. It is this writer's contention that the fact of several manned space stations, with all their associated instrumentalities, incorporating the active involvement of all the world powers (by any definition of that phrase), will inevitably and irrevocably precipitate a host of legal and regulatory measures. These will be promulgated at all legislative levels, both municipal and international, the latter including bilateral, regional and global. They will be both responsive to and anticipatory of technological developments, according to the context and the operative legislative philosophy. As we shall see, this process has already begun and will be illustrated by a

5. See infra Chapter IV A.

multi-tiered progression from the national, through the bilateral and multilateral, to the global.

Thus, the thesis is divided into three parts. Part one, The Motivation, assesses both the motivations of this writer and those of the States (and International Organizations) involved in space station activity. The second part, The Mechanism, is a detailed attempt to evaluate the legal problems associated with an international co-operative venture of the magnitude, multiplicity and specificity of the US/International Space Station. This concentration is motivated by the belief that this could be the first of many such projects and it is extremely important to monitor its development closely. In this process,this particular project will be distinguished from all that has gone before in this field. At the same time, there will be a search for elements of past activities that may prove useful or, more importantly, which are to be avoided to ensure the emergence of a valuable precedent. In particular, the forms of agreement, management and utilization will be studied. In contrast to this relatively microcosmic perspective, part three, The Macrocosm, deals with global issues. These include: military activities in space; the environment of near-Earth space; and the operation of extant international space law in this Era.

It is hoped that this shift of focus from the specific to the general will highlight the most important legal issues. In particular, there will be a concentration on those areas considered to be most immediately in need of attention. Inevitably, it will be impossible to deal with all the relevant matters provoked by the 'Space Stations' Era, for it will impact upon all extant space law, much general international law and a significant proportion of the municipal law of the various participants. The ensuing activation, interpretation and extension in these respective legal regimes, will collectively transform what has been a somewhat esoteric and eclectic discipline into one which is in the legal mainstream.

The crux of this process will be the tension between the desire to perpetuate the rationales which have motivated mankind in his successful exploitation of the Earth, and the equally strong belief in the radical 'Province of all Mankind' concept, notable as much for its ambiguity as its emotivity. It may well be that the space frontier cannot be opened up without the spirit which has brought us to this threshold, with all its nationalistic acquisitiveness, being given a free rein. Yet, to do so may subject the tentative space regime, which has been so painstakingly established, to the danger of obsolescence. Realizing the latter regime, may involve the primacy of the former frontier spirit, and they may ultimately prove mutually exclusive.

These developments will be manifested in the Space Stations' Era by a jurisdictional struggle between the international *qua* global on the one hand and the national and international *qua* bilateral on the other. The less global legislative activity there is, the more national and bilateral activity there will be, backed up by State practice and ultimately becoming customary international law. Judging from the last decade, this trend has already begun.[6] The best that can be hoped for is to balance both the division of legislative responsibility and the permissive/prescriptive continuum, to produce a regime marked by its flexibility and equity. This will demand the utmost perspicacity on the part of legislators and the utmost vigilance on that of their observers.

These themes will be reprised in the conclusion to this thesis,[7] in the light of the findings which emerge en route. Being one of the first forays of its kind into this field, it must be appreciated that it is as experimental and innovative as its technological counterpart. Bearing this in mind, and motivated both by pragmatism and the innate desire of the lawyer for legal certainty, each

6. See *infra* Chapter VII.

7. See *infra* Chapter VIII.

chapter is intended to be as complete as possible in its own right, while comprising a significant expression of the unified theory just outlined.

I. THE POLITICAL CONTEXT OF SPACE STATIONS' TECHNOLOGY

> *It has long been recognized, of course, that throughout history scientific-technological accomplishments, or the lack of them, have been among the main determinants of the relative power and influence of nations in the world arena. Thus, there has been no lack of emphasis on the relation of science-technology to military power, to economic wealth and viability, to foreign trade capabilities, to the general prestige and influence of particular states. But that science-technology in itself represents a distinctive component in international relations, as well as a powerful resource for use in foreign policy, was an aspect long ignored.*[1]
>
> Foy D. Kohler
> Former US Ambassador to the Soviet Union

This chapter will attempt to delineate the several national programmes of those States and International Organizations most actively involved in the development of space stations' technology. Furthermore, there will be an assessment of the motivations which have prompted them to embark upon such a course. The order in which the discussion will proceed is deliberate, commencing with the Soviet Union which was the first nation to launch a space station

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1. In Foreword to L.H. Dodd and L.C. Ciccoritti, US-Soviet Co-operation in Space (1974, Center for Advanced International Studies, University of Miami), vii.

and is the only one which currently has such a facility. The participants in the US/International Space Station are then dealt with in turn, in order of precedence gauged by the scale of their space programmes as a whole and their contributions to this project in particular. This will conclude with a brief presentation of the possibilities for and problems inherent in international co-operation in space station activities.

A. THE SOVIET UNION - TOWARDS KOSMOGRAD

> The first step in the Soviet plan is the establishment of permanently occupied space outposts orbiting just beyond the atmosphere. The goal has been an officially acknowledged one for years, and is explicitly expressed in a near-religious litany which is repeated after each new Soviet space success (and there have been a lot of them lately): "We believe that continuously inhabited space stations in near-earth orbits will be humanity's main road out into the universe".[2]

1. THE SALYUT PROGRAMME

Soviet space station development can be traced to the January 1969 link-up of Soyuz 4 and 5. This was

2. J.E. Oberg, Red Star in Orbit (1981, Random House) pp. 223-224.

described by the USSR as "the first experimental space station in near earth orbit.[3] This rather overstates the case, however, since cosmonauts Yeliseyev and Khrunov had to perform an extra-vehicular manoeuvre in pressurized suits to transfer from Soyuz 5 to 4 since there was no connecting hatch.[4] Nevertheless, according to the Office of Technology Assessment (OTA) of the US Congress, "the experience gained in the Soyuz 4 and 5 complex was valuable in the design and development of larger space station configurations".[5]

The Salyut programme has been a three-stage process marked by a steady incremental progression towards a mature capability. The first phase commenced with the launch on 19 April, 1971 of Salyut 1. It weighed some 18,600 Kg and had

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3. UN Doc. A/Conf.101/NP/30 2 September, 1981 National Paper: USSR to the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE '82), 11.

4. _SALYUT: Soviet Steps Toward Permanent Human Presence in Space - A Technical Memorandum_ (Washington, D.C.: US Congress, Office of Technology Assessment, OTA-TM-STI-14, December 1983), 13.

5. _Ibid._

a volume of 100 cubic metres.[6] Four similar Salyuts were launched over the next five years, though only three were successfully manned and utilized.[7] Due to the mission characteristics of Salyut's 3 and 5 and their all-military personnel, it is believed that they performed reconnaissance and other military activities.[8] The operational altitude of Salyut 4 and the other "civilian" Salyuts which followed in phase two was in low earth orbit (LEO) between 362 and 338 kilometres above the Earth's Surface, at an approximately 52° inclination.[9] Manned transportation was performed by Soyuz vehicles, launched aboard A-2 expendable launch vehicles (ELVs) from Baikonur Cosmodrome, also called Tyuratam, in Khazakhstan.

Phase two began with the launch of Salyut 6 on 29

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6. M.S. Smith, Space Activities of the United States, Soviet Union and Other Launching Countries/Organizations 1957-1983 - Report No. 84-20 SPR of the Congressional Research Service, Library of Congress, Washington D.C., 15 January, 1984, 17.

7. The launch dates of these stations are as follows: Salyut 2 - 3 April, 1973 (failed); Salyut 3 - 25 June, 1974; Salyut 4 - 26 December, 1974; Salyut 5 - 22 June, 1976.

8. Oberg, Op.cit., supra, note (2), pp. 129-130.

9. Op.cit., supra, note 4, 15. The "military" Salyuts operated 100 km below this.

September, 1977. What distinguished this vehicle from those which had gone before, was the addition of a second docking port. This permitted multiple configurations, involving several manned Soyuz vehicles and automated Progress re-supply vehicles, extending the life of the orbital station. The activities of Salyut 6, which was on orbit for 54 months, prompted Soviet leader Leonid Brezhnev to aver in April 1978 that it was

> difficult to overestimate what was achieved during the manned flight of the scientific research orbital complex. With their 96-day flight, comrades Romanenko and Grechko surpassed the world record for a continuous stay in space. Two spacecrafts docked to an orbiting station is also unprecedented in the history of cosmonautics, and for the first time as well an automatic envoy from earth (Progress-1) arrived at the orbital station - a cargo ship, with new reserves of fuel, materials, instruments, and even with the latest mail.[10]

Under the auspices of the Interkosmos programme, Salyut 6 became a major foreign policy instrument of the Soviet Union. Initiated in 1967, Interkosmos became an international organization in 1976 with the signing of the "Agreement on Co-operation in the Exploration of Outer Space

10. Soviet Space Programs 1976-80. Committee on Commerce, Science and Transportation, United States Senate, 97th Congress, 2d sess. Part I, December, 1982, 199.

for Peaceful Purposes".[11] Its ten member States ratified the Agreement over a two year period.[12] Article 2 of the Agreement specifies five areas of co-operation:"Study of the physical properties of outer space"; "Space meteorology"; "Space biology and medicine";"Space communications"; and "study of natural environment by means of space devices". Although manned activities are not specified, article 4 leaves a wide discretion to the Contracting Parties to "determine other areas and forms of co-operation". The most notable result of this programme was the series of guest cosmonaut missions to Salyut 6. Representatives from all the Interkosmos member States were accompanied by Soviet Cosmonauts aboard successive Soyuz vehicles, to visit and

11. Signed at Moscow, 13 July, 1976, text reproduced in N. Jasentuliyana & R. Lee, Manual on Space Law (1979, Oceana Publications Inc.) Volume II, 253 et seq.

12. Czechoslovakia - 18 August, 1976; USSR - 9 September, 1976; Hungary - 17 September, 1976; Mongolia - 26 November, 1976; German Democratic Republic - 11 January, 1977; Bulgaria - 25 March, 1977; Poland - 9 August, 1977; Romania - 21 December, 1977; and Cuba - 17 April, 1978. Vietnam is also a signatory to the Agreement.

work aboard the space station.[13] There is a divergence of opinion concerning the nature of this programme. On the one hand, noted commentator on Soviet space activities James Oberg is sceptical of its motives and utility, decrying it as a "propaganda sop to political realities".[14] On the other hand, a US Senate Committee report on Soviet Space Programs,[15] gives a detailed account of each Interkosmos manned mission[16] and states the following:

> The impression that countries of Eastern Europe and other members of Interkosmos appear to have been deeply involved in a broad range of experiments under Soviet aegis in Interkosmos is fortified by their participation in Soviet manned space-flights. Involvement has taken on two aspects: The actual participation of Interkosmos cosmonauts as crew members, and their contribution in experiments to be flown aboard Salyut 6.[17]

This more favourable viewpoint is corroborated by the

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13. Thus, the following "cosmonaut-researchers" visited Salyut 6: Remek (Czechoslovakia - Soyuz 28, 2 March, 1978); Hermaszewski (Poland - Soyuz 30, 27 June, 1978); Jahn (GDR - Soyuz 31, 26 August, 1978); Ivanov (Bulgaria - Soyuz 33, 10 April, 1979); Farkas (Hungary - Soyuz 36, 26 May, 1980); Pham Tuan (Vietnam - Soyuz 37, 23 July, 1980); Tamayo Mendez (Cuba - Soyuz 38, 18 September, 1980); Gurragcha (Mongolia - Soyuz 38, 22 March, 1981); and Prunariu (Romania - Soyuz 40, 14 May, 1981).

14. _Op.cit._, _supra_, note 8, 184.

15. _Op.cit._, _supra_, note 10.

16. _Ibid._, pp. 272-282.

17. _Ibid._, 272.

comments of analysts from non-Soviet members of Interkosmos.[18]

This second phase continued with the launch on 19 April, 1982 of Salyut 7. The latter hosted the first representatives from non-Interkosmos member States. Thus, Jean-Loup Chrétien became the first French "spationaut" when he accompanied Soviet cosmonauts Dzhanibekov and Ivanchenkov aboard the upgraded Soyuz-T vehicle to dock with Salyut 7.[19] This marked the culmination of many years of Franco-Soviet co-operation in space.[20] It was echoed by the later visit of an Indian cosmonaut, Rakesh Sharma, to Salyut 7. Accompanied by Soviet cosmonauts Malyshev and Strekalov aboard Soyuz T-11, the trio docked on 2 April, 1984.[21] Another highly significant event which occurred

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18. See H. Kautsleben, "Some Remarks on US and Soviet Strategies Concerning Manned Activities in Outer Space", in Jasani (Ed.), Outer Space - A New Dimension of the Arms Race (1982, Taylor and Francis) 249 et seq.

19. Soyuz-T-6. See "European Space Ventures of the Future", Hubert Curien, Air et Cosmos #100, 5 mai, 1984, 262.

20. See the USSR Paper to UNISPACE '82, op.cit., supra, note 3, 109.

21. "Joint Soviet/Indian Crew Docks With Salyut Station", Aviation Week and Space Technology (AW & ST), 9 April, 1984, 19.

during the continuing lifetime of Salyut 7[22] was the 237 day endurance record set by cosmonauts Leonid Kizim, Vladimir Solovyev and Oleg Atkov.[23]

Phase three of this programme comprised a series of automated missions to dock vehicles to Salyut 7. Resembling an upgraded progress vehicle, Kosmos 1443 docked with Salyut 7 and was joined by the manned Soyuz T-9 on 28 June, 1983, to form the first orbital complex of its kind.[24] This was repeated with Kosmos 1669 on 19 July, 1985, which was described by some sources as being a prototype free-flying experiment platform.[25] Finally, Kosmos 1686, launched on

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22. See: "Soviets Plan to Keep Salyut 7 in Orbit", AW & ST 14 July, 1986, 142. Although Salyut 7 was salvaged in August 1985 ("Soviets Describe Mission to Salvage Crippled Salyut 7" - Space Commerce Bulletin, 16 August, 1985, 5), its last crew had to leave when one of its members became ill, Washington Roundup, AW & ST 25 November, 1985, 13.

23. "237 Day Space Record" AW & ST 8 October, 1984, 17.

24. See N.L. Johnson, The Soviet Year in Space: 1983 (1984, Teledyne Brown Engineering) 40 et seq.

25. See "Soviets Dock Free-Flying, Unmanned Platform to Salyut 7 Space Station", AW & ST 29 July, 1985, 19. However, Nicholas Johnson, a noted expert on Soviet space activities, is more equivocal, the designation depending upon whether the vehicle had solar panels for independent power generation or not, which ordinary Progress vehicles do not possess, see N.L. Johnson, The Soviet Year in Space: 1985 (1986 Teledyne Brown Engineering), 56.

27 September, 1985 provoked speculation that it was a possible modular extension to the Salyut station.[26] It followed the first ever crew rotation on orbit by any space power, doubling the size of the station for its new crew.[27]

In evaluating the Salyut programme as a whole, the OTA has concluded that

> [t]he Soviet Union's Salyut space stations have formed the backbone of an ambitious and expansive program involving human beings in space. The ideological underpinning of Salyut is the desire to project and maintain an image of scientific, technological, and industrial world leadership in space. Overall, the Soviet approach toward implementing these goals has been one of cautious advance - a step-by-step evolution consistent with an often-stated, long-term goal of spreading Soviet influence into near-Earth space and beyond.[28]

Impressive as the Salyut programme was, and although Salyut 7 remains on orbit, they have been rendered obsolete by recent developments.

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26. "Successful Module Launch Expands Soviet Space Station", AW & ST, 14 October, 1985, 19.

27. Ibid.; see also Johnson, op.cit., supra, note 25, 57.

28. Op.cit., supra, note 4, 35.

2. THE MIR MODULAR SPACE STATION

Launched on 20 February, 1986,[29] the MIR (meaning peace in Russian) station incorporates six docking ports. In addition to a single port at one end of the station there is a ball-shaped docking hub at the opposite end with five ports.[30] Estimated to be 56 feet long and 13.6 feet wide,[31] MIR is believed to contain upgraded electronics and computer systems, in addition to providing a more comfortable working environment than its predecessors.[32] MIR became operational following the 13 March, 1986 televised launch of veteran cosmonauts Kizim and Solovyev aboard Soyuz T-15 from Baikonur Cosmodrome.[33] The duo docked

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29. "Russians Launch a Space Station", Serge Schmemann, New York Times, 21 February, 1986, A13; "Soviets Launch a Space Station with Down-to-Earth Comforts", The Gazette, Montreal, 21 February, 1986, A1.

30. "Age of Space: A Soviet Step", J.N. Wilford, New York Times, 14 March, 1986, A1.

31. Ibid.

32. "Mir, une station orbitale véritablement nouvelle", La Presse, 8 March, 1986, F3.

33. "TV-Star Cosmonauts Soar into Space-Live", The Gazette Montreal, 14 March, 1986, A6; "2 Soviet Astronauts Lofted Toward New Space Station", Serge Schmemann, New York Times, 14 March, 1986, A10.

with MIR two days later and activated the stations systems, giving a televised tour to Soviet viewers.[34] Although it has been described as the "world's first permanently-manned complex in space",[35] the first mission ended on 16 July, 1986 with the departure of its crew without immediate replacement.[36] However, a number of important events occurred during the 125 day mission: two Progress resupply vehicles docked with MIR, proving the new docking hub;[37] cosmonauts Kizim and Solovyev shuttled between MIR and Salyut 7 aboard their Soyuz T-15 vehicle "the first station-to-station transfer in the history of astronautics";[38] a 50 foot tower was constructed in preparation for creating large structures in space;[39] and a new Soyuz vehicle,

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34. Space Commerce Bulletin, 28 March, 1986, 10.

35. "Glimpse into Soviet Space", The Times, 8 April, 1986, 8.

36. "Soviets Complete First Manned Mir Mission", AW & ST, 21 July, 1986, 18.

37. Ibid.

38. "2 Fly to Second Space Station", New York Times, 8 May, 1986, B25.

39. "2 Russians Return from 4-Month Space Mission", New York Times, 17 July, 1986, A11.

designated TM, was tested in an unmanned mode.[40]

Thus, the Soviet Union has proven that it has the capability to manoeuvre several space instrumentalities and vehicles, both piloted and automated, simultaneously in close formation. The advent of the MIR space station will permit modules fitted out to perform differing tasks such as life sciences, materials processing, additional habitation, biological research, astrophysics, etc. These can all be manoeuvred automatically to dock with the station, avoiding the necessity for multiple manned missions. With the benefit of hindsight, this may well prove to be the safest and most efficient way to construct large orbital complexes. The tragic loss of the US Shuttle Challenger on 28 January, 1986, coupled with the fact that the USA does not presently possess an automatic rendez-vous capability[41] may well hamper the development and construction of the US/International Space Station, to be discussed later in this

40. "Soviet Space Station Program May be 10 Years Ahead of U.S.", Space Commerce Bulletin, 6 June, 1986, 4.

41. See Testimony of John D. Hodge, Director of the NASA Space Station Task Force, in Civil Space Station, Hearing before the SubCommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, United States Senate, 98th Congress, 1st Sess. 15 November, 1983, Serial No. 98-48, 34.

chapter.[42]

Whatever the ultimate outcome, the achievements with MIR have created considerable concern, particularly in the USA. The American Institute of Aeronautics and Astronautics believes that the US lack of commitment to its space programme has "demonstrated that the US... no longer enjoys its former preeminence".[43] Also, Jane's Spaceflight Directory, an extension of the respected British publication on military hardware, claims that the Soviet space programme as a whole is ten years ahead of that of the USA.[44] The disparity in the category of manned experience on orbit was emphasized as being a key criterion.[45] Furthermore, a recent NASA report estimates that the present MIR capability is largely similar to that which the USA wishes to launch in the mid-1990s, including the incorporation of a robot.

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42. See infra section B.

43. "US Sliding a Sad Second in Space", The Royal Gazette, Bermuda, 28 August, 1986, 29.

44. "Publication Gives Edge in Space to Soviet", F.X. Clines, New York Times, 17 June, 1986, C5.

45. Soviet cosmonauts have logged over 4000 days (104,374 hours) in space, as compared to 1587 days (42,453 hrs. 25 min.) for US astronauts. Ibid. and op.cit., supra, note 36.

arm.[46]

Manned operations resumed on MIR in February 1987, followed by the April docking of the first specialized expansion module, for astrophysics.[47] As a continuation of previous trends, the guest-cosmonaut programme has been extended to MIR. Thus, a Syrian cosmonaut, Mohammed Faris, visited MIR for an 8 day mission commencing on 22 July, 1987[48] after a period of intensive training in the Soviet Union.[49] Furthermore, a French Spationaut will spend a

46. Op.cit., supra, note 40, where Professor B.J. Bluth estimates that Mir will total 570 cubic metres of pressurized volume and weigh approximately 125,000 kilogrammes, as compared to the volume of 655 cubic metres and approximate weight of 182,000 kg of the US/International Station.

47. "Soviet long-duration crew activates Mir Space Station", C. Covault AW & ST 16 February, 1987, 19, Cosmonauts Yuri Romanenko and Alexander Laveikin are to spend six months aboard the Mir Station. See also "Soviets Launch Astrophysics Module to Mir", AW & ST, 6 April, 1987, 24, where the configuration of the KVANT Astrophysics Module is discussed. The Module contains x-ray experiments manufactured by agencies in West Germany, the Netherlands, the United Kingdom and by ESA. The KVANT module docked at the second attempt on 9 April, 1987, 'Soviets Dock Module to Mir Following Aborted Attempt', AW & ST, 13 April, 1987, 27.

48. Space Commerce Bulletin, 2 January, 1987, 10.

49. Space Commerce Bulletin, 31 January, 1986, 20.

long-duration mission aboard MIR beginning in mid-1988.[50] In addition, an invitation has been extended to the U.K. for British astronauts to visit MIR in the near future.[51]

This is highly significant at the present juncture of the commencement of the Space Station's Era. There can be little doubt that the guest-cosmonaut programme has been and will continue to be used for political purposes. This is not to say that real co-operation will not take place, for it is clear that such ventures are of mutual utility. In addition to issues of access to technology, it is becoming increasingly evident that States are particularly desirous of manned access to space. This is not only due to the national prestige which this accords, but also, and perhaps more importantly, for reasons of pragmatism. The latter chiefly concern materials processing in space (MPS).[52] The search for improved metals, new alloys,

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50. "French, Soviets Completing Joint Mission Plans" AW & ST, 3 March, 1986, 20; "France Will Have Crewmember On Soviet Space Station", AW & ST, 17 March, 1986, 20; Washington Roundup, Mir Mission, AW & ST, 7 July, 1986, 15; Space Business News, 1 December, 1986, 1 - Jean-Loup Chretien and Michel Tognini, his back up, are in training at Star City outside of Moscow. One of them will spend a month aboard Mir.

51. Space Business News, 6 October, 1986, 1.

52. This will be discussed in more detail infra, Chapter IVA.

purer crystals and new pharmaceutical products cannot be undertaken efficiently without prolonged access to the microgravity and near-perfect vacuum of outer space. Although opinions differ as to the need for man in space[53] there is a distinct impression that quantum leaps in MPS and other technologies will not occur unless spear-headed by a manned programme. This certainly appears to be the case within the Soviet civilian space programme which has conducted extensive MPS experimentation since the days of Salyut 5 in 1976.[54] At a time when the US Shuttle Transportation System is grounded, and access to it when it resumes operations, possibly in mid-1988,[55] will be more

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53. See J.A. Van Allen, "Space Science, Space Technology and the Space Station", Scientific American, volume 254, 32, who asserts that "[t]he progressive loss of U.S. leadership in space science can be attributed ... largely to our excessive emphasis on manned space flight ...", at 39.

54. See OTA Technical memorandum, op.cit., supra, note 4, 24 et seq., and US-Soviet Cooperation in Space (Washington D.C.: US Congress, Office of Technology Assessment, OTA-TM-STI-27, July 1985), 57; and Soviet Space Programs, op.cit., supra, note 10, pp. 274 and 280. Two MPS furnaces have been used, the SPLAV, aboard Salyut 6, and the KRYSTALL, developed by France aboard Salyut 7.

55. "Shuttle Relaunching Set for February '88", R. Abramson, The Gazette, Montreal, 4 October, 1986, A2. This was postponed until 2 June, 1988 when the Orbiter Discovery is set to fly.

restricted,[56] recent Soviet co-operative overtures to Western Europe using MIR assume great significance.[57]

In order to more efficiently administer the use of space applications technology, such as MIR facilities and transportation, the Soviet Union has created a space agency called Glavkosmos[58] to act as a counterpart to NASA in the USA.[59] Under the chairmanship of Alexander I. Dunayev, Glavkosmos, or "Main Administration for Development and Use of Space Technology for the National Economy and Scientific Research",[60] will complement the Interkosmos Council of the USSR Academy of Sciences.[61] The latter's chairman, V.A. Kotelnikov, will continue to administer the

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56. "NASA will Cancel Many Spacelab Missions", T.M. Foley, AW & ST, 1 September, 1986, 40.

57. "Soviets Woo Europeans to Mir", Space Business News, 20 October, 1986, 1; "British-Soviet Space Pact", AW & ST, 3 November, 1986, 41; "Soviet Space Offer to Britain", Spaceflight, vol. 28, July/August 1986, 291.

58. AW & ST, 4 November, 1985, 28.

59. Spaceflight, Vol. 28, January 1986, 8.

60. "Soviets Set to Make Big Gains in Outer Space Exploration", C. Covault, AW & ST, 10 March, 1986, 131.

61. "Soviets Assign Glavkosmos Primary Space Program Role", AW & ST, 13 October, 1986, 19.

scientific aspects of the Soviet Space programme.[62] Glavkosmos will oversee: the marketing of the Proton ELV, which inter alia launched MIR, in the West as a Satellite launcher;[63] the commercial leasing of Gorizont communications satellites;[64] the co-ordination of other commercially-oriented activities within the Soviet Union; and co-operative space activities.[65] According to Nicholas Johnson, a respected commentator on Soviet space activities,

> [t]he Soviets pursue a permanent presence in space, not only from a philosophical and political perspective, but also an economic one. The Soviets estimate that by 1990 the economic impact of 'extraterrestrial industry' (space manufacturing) may reach 50 billion rubles.[66]

This figure is also cited by General Vladimir Shatalov, the Chief of Cosmonaut Training at Star City north of Moscow,

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62. Ibid. Roald Sagdeyev of the Space Research Institute is also an influential figure in dealings with other space-faring nations.

63. "Soviets Seek Western Launch Bookings", AW & ST, 20 October, 1986, 104; "Inmarsat Receives Launch Proposal From Soviets", Space Commerce Bulletin, 4 July, 1986, 5.

64. "Soviets Offer Commercial Leases of Gorizont Communications Satellites", J.M. Lenorovitz, AW & ST, 8 December, 1986, 25.

65. Op.cit., supra, note 61.

66. Op.cit., supra, note 24, 47.

and is approximately equivalent to US$35 billion.[67] Allowing for reasonable prudence and mindful of its propaganda potential, it nevertheless remains clear that the Soviet Union is forging ahead with a very solid programme. This is becoming increasingly attractive to other space-faring nations because of the simple fact, pointed out by Roy Gibson the Director General of the British National Space Centre, that "they're there and they're getting things done".[68]

However, these developments are by no means the culmination of Soviet space activities. Several highly significant projects are under development which could have a profound effect in the Space Stations' Era. Thus, a heavy lift ELV reminiscent of the US Saturn V and called the Energia was tested on 15 May, 1987. Furthermore, up to two space shuttles are being tested, with the first launch

67. See "A Generation After Sputnik - Are the Soviets Ahead in Space?", T.Y. Canby, National Geographic, vol. 170 #4, October 1986, 420 at 455.

68. "Soviets Woo Europeans", op.cit., supra, note 57, 3.

expected in early 1988.[69] These will be crucial to the construction and deployment of very large orbital complexes by the end of this century, according to the US Department of Defense.[70] Furthermore, Dr. Roald Sagdeyev, the Director of the Space Research Institute of the Soviet Academy of Sciences has estimated that

> [t]he way things are going, research production complexes are likely to be out into orbit within the next decades, and there will probably be metallurgical engineering and chemical plants functioning in space. Naturally, the process that will go on in outer space, first of all, will be those that are impossible to organise on Earth in general.[71]

In conclusion, there is widespread belief among informed observers that the Soviet Union is working towards a long term goal of permanent occupation of LEO, preparatory

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69. "Soviet Details Ambitious Space Plans", W.J. Broad, New York Times, 22 July, 1986, C1; see also "Future Capabilities of the Soviet Space Programme", Spaceflight, vol. 28, June 1986, 249; see Washington Roundup, AW & ST, 1 December, 1986, 29, and The Gazette, Montreal, 2 December, 1986, A8; for further information on the Soviet Space Shuttles, see A.J. Young, Space Transportation Systems (1984 unpublished LL.M. Thesis, McGill University), pp. 96-99.

70. "Soviet Military Power - 1984", E. Ulsamer, Air Force Magazine, Vol. 67, 1984, 96.

71. As quoted in J. Popescu, Russian Space Exploration - The First 21 Years - (1979, Gothard House Publications) 127.

to manned Lunar and Mars expeditions.[72] In the emotive words of James Oberg,

> [n]o more breakthroughs are needed. All of the pieces have been tested and verified. Men have proved their adaptability and durability during the long expeditions on Salyut-6; the machines have shown that they, too, can function, as long as men are available to refurbish and repair them. Salyut, Soyuz, Progress - they add up to Kosmograd, the code word for Space Colony Number one, made in the Soviet Union.[73]

B. THE US/INTERNATIONAL SPACE STATION - A CO-OPERATIVE-COMPETITIVE CONTINUUM

> The devil of it is that those who are not interested in space programs (national or international), and those suspicious of international cooperation in any high-technology field, will be ready to exploit every difference as it appears, and to show that the enterprise is at best unrealistic and at worst is the equivalent of selling one's technological heritage to

72. Op.cit., supra, note 4, 43; see also, "Speculations on a Manned Mission", Spaceflight, vol. 28, March 1986, 114.

73. Op.cit., supra, note 2.

those on the other side of the Atlantic.[74]

The US/International Space Station project continues to provoke myriad policy questions at national, bilateral/regional and limited multilateral levels. As negotiations unfold regarding the conduct of Phases C/D (Development and Construction) and E (operation and utilization) of the programme, positions change rapidly. The realization of its importance by all concerned is reflected in the range and fluidity of national political imperatives being brought to bear on the project, particularly by the USA. There is a distinct lack of consensus so far which is exemplified by the amorphousness of the project as a whole. Thus, the architectural configuration of the Space Station remains to be decided upon, together with the components which each partner will construct. These basic concepts should have already been finalized pursuant to Phase B, preliminary definition and detailed design.

Therefore, little can be stated with absolute certainty prior to the conclusion of the negotiations. Indeed, there is considerable doubt whether international agreement can be reached at all. The position is further

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74. Roy Gibson, Director General, British National Space Centre, in Europe/United States Space Activities, 23rd Goddard Memorial Symposium/19th European Space Symposium, Volume 61 Science & Technology Series, (1985, American Astronautical Soc. Pub'n.) opening address, 4.

complicated by the tactics inherent in hard bargaining. The higher the stakes, the more keen are the discussions, and space station roles are high stakes by any standard. In the progression towards an acceptable accommodation of all interests, many compromises will have to be made. The USA in particular has a crucial role to play. If the project is to fly at all, it may have to accept the heretofore unpalatable.

As a consequence of this complexity and uncertainty, the ensuing discussion will be necessarily subjective, but then so are most future-oriented policy estimates. This follows since no one can be seised of all the relevant information, a fortiori those who are not privy to confidential intra- and inter-governmental political exchanges. Nevertheless, it is necessary to have some appreciation of the political context of the discussion on the US/International Space Station, in order to properly understand the legal problems involved. Above all it must be realized that what is being debated is nothing less than the conduct of the several national civilian space programmes for the next twenty to thirty years. Thus, the decisions which are reached now will dictate the direction of Western activity in LEO, particularly manned, for the foreseeable future. Furthermore, these executive governmental decisions will have a profound impact on the activity of their legislative branches in this area.

1. THE USA - A CHANGING LEADERSHIP ROLE

> It has always been the US policy to give maximum visibility to the planning of major national programmes, and - in contrast to the Soviet scene - the outside observer is privy to the hesitations, the failures as well as the successes, in such detail as to be aware of the continuing stresses involved in piloting the space programme through the legislative processes.[75]

There is currently considerable uncertainty regarding US space policy. This pre-dated but was undoubtedly exacerbated by the Challenger loss in January 1986. The ensuing series of reviews of NASA have revealed a crisis of direction for this original and most prestigious of all civilian space agencies, which remains largely unresolved. This irresolution has had a considerable impact upon the space station project both as perceived within the USA and as viewed from the perspective of the potential partners. In order to appreciate the present climate, it is necessary to conduct a brief historical review of the evolution of US space policy up to and including the space station commit-

75. Roy Gibson, 'The Next Step - Space Stations', in M. Schwartz and P. Stares eds. The Exploitation of Space - Policy Trends in the Military and Commercial Uses of Outer Space (1985, Butterworths) 123 at 126.

ment.

(a) A Selective Review of US Space Policy with Special Emphasis on Space Station

US space policy has undergone fundamental changes since the inception of the space age and the current research and development (R & D) of the US/International Space Station reflects and is the creation of these changes. The process began two months after the entrance of the USA into the space era[76] with the special message to Congress delivered by President Dwight D. Eisenhower on 2 April, 1958.[77] The goals established therein were enacted into law on 29 July, 1958 in the form of the National Aeronautics and Space Act (NASAct).[78] In addition to institutionalizing a dichotomy, between civilian space activities to be

76. Following the Soviet Union's launch of Sputnik I on 4 October, 1957, the USA launched Explorer I on 31 January, 1958.

77. See 'A Special Message to the Congress Relative to Space Science & Exploration, 2 April, 1958, Public Papers of the Presidents of the United States, Dwight D. Eisenhower, 1958. Office of the Federal Register, National Archives & Records Service, Washington, D.C., 1959.

78. Stat. 426; 42 U.S.C. 2451.

conducted by the National Aeronautics and Space Administration (NASA) and military space activities which remained under the auspices of the Department of Defense (DOD),[79] the Act specified eight principal objectives for the USA in space.[80] These objectives remain unchanged, though they have received variable emphasis by successive administrations, and can be summarized as follows:

- "expansion of human knowledge of phenomena in the atmosphere and space";
- qualitative improvement of aeronautical and space vehicles;
- "development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space";
- study of potential benefits of aeronautical and space activities for peaceful and scientific purposes;
- preservation of the role of the USA as a leader in space science and applications technology;
- transfer by NASA to DOD and related agencies of militarily valuable/significant information arising from the civilian space programme;
- "co-operation by the United States with other nations in work done pursuant to [the] Act and in the peaceful application of the results thereof"; and
- efficient utilization of scientific and engineering resources of the USA to avoid duplication.

Although all of these goals can be related to the US/International Space Station project, those concerning the

79. Ibid., Sec. 102(b).

80. Sec. 102(c) (1)-(8).

paramount preservation of US leadership, technology transfer to the DOD and international co-operation are especially relevant. In particular, the concept of US leadership in space is all-pervasive and a perusal of virtually any congressional space-related document since 1958 will disclose a reference to its maintenance. However, in contrast to the phraseology in the NASAct, it is in the sense of 'the leader' rather than 'a leader', since the USA has regarded itself as pre-eminent in space since Apollo. This cannot be over-estimated as a motive force behind the entire US space programme.

Since President Eisenhower established the precedent, the setting of space goals has remained the prerogative of that office. This was confirmed when, in response to Yuri Gagarin's inauguration of manned space flight,[81] President John F. Kennedy announced before Congress on 25 May, 1961 that it was

> time to take larger strides - time for a great new American enterprise - time for this nation to take a clearly leading role in space achievement, which in many ways may hold the key to our future on earth. ...I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely

81. 12 April, 1961.

to the earth.[82]

This stirring rhetoric established the leitmotiv of US space policy for the ensuing decade and fiscal appropriations to NASA were readily forthcoming from Congress for this project.[83] Before President Kennedy made this decision, he had considered the possibility of a manned space station as the US goal to challenge the Soviet Union. However, he concluded that the USA might lose such a race and opted for the more promising "moon shot".[84]

> In retrospect, it might have been better if Kennedy had picked the space station as a goal. All the major proponents of space flight had envisioned...the buildup of a space station as an essential prerequisite for any sustained program of activity in space. Instead, we bypassed this to go directly to building a manned lunar program. When this program could no longer attract public support late in the 1960s, the whole space program was left largely without a theme to keep it going. The result was NASA's rapid downslide.[85]

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82. 'Special Message to Congress on Urgent National Needs' 25 May, 1961, Public Papers of the Presidents of the United States, John F. Kennedy, 1961, Office of the Federal Register, National Archives & Records Service, Washington, D.C., 1962.

83. See Orders of Magnitude. A History of NACA and NASA 1915-1980, NASA Publication SP-4403 1981, Washington, D.C., pp. 28-29.

84. See T.A. Heppenheimer, Colonies in Space (Warner Books, 1977), pp. 124-125.

85. Ibid., 125.

History may well show that the success with Apollo was a pyrrhic victory over the Soviet Union. Despite significant space station activity by US military agencies during the 1960s[86] and considerable lobbying by NASA personnel for a space station to be the post-Apollo goal, President Richard M. Nixon opted for a "bold...but balanced" programme in 1970.[87] In recognition of the "many critical problems here on this planet [which] make high priority demands on our attention and our resources", President Nixon opted for a six point plan.[88] Fiscal austerity and electoral disillusionment with the space programme notwithstanding, a retrospective assessment of the 1970s discloses that all of President Nixon's goals were achieved:

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86. See J.M. Logsdon 'Space Stations: A Historical Perspective' in M. Gerard & P.W. Edwards Eds. AIAA/NASA Symposium on the Space Station (1983, Arlington, Virgina), 14, at 15-16; and, by the same author 'The Evolution of Civilian in-Space Infrastructure, i.e. "Space Station", Concepts in the United States", in Civilian Space Stations and the U.S. Future in Space (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-ST1-241, November, 1984) Appendix B, 159, 162-164, where the military space station-related activity is recorded. This will be considered in more detail *infra* Chapter VBI.

87. 'Statement About the Future of the United States Space Programme', 7 March, 1970, USA Public Papers of the Presidents; Richard M. Nixon, 1970, Office of the Federal Register, National Archives and Records Service, Washington, D.C. 1971.

88. *Ibid*.

- continued exploration of the moon - the Apollo programme was completed, though reduced by 3 missions;
- exploration of the planets and the universe - Pioneers 10 and 11 and Voyagers 1 and 2 are some celebrated highlights;
- use of reusable space shuttles to "reduce substantially the cost of space operations" - the US Space Transportation System (STS) was built;
- orbiting of an Experimental Space Station (XSS) - Skylab resulted;
- "hasten and expand the practical application of space technology" - e.g. Landsat was developed; and
- "encourage greater international co-operation in space" - e.g. the European Space Agency and Canada collaborated on the STS project.

Nevertheless, this has often been characterized as a failure of commitment, since a 1969 Space Task Group chaired by Vice-President Spiro Agnew had advocated an STS, a space station, a 100 man space-base, lunar orbiting and surface stations and a manned mission to Mars.[89] As we shall see in a later part of this section, these aspirations are still widely held and are merely waiting in abeyance for their time to come. However, it may be that the Apollo programme had used up the greater part of NASA's currency, both liter-

89. See Marcia Smith, Space Stations and Space Commercialization, Congressional Research Service (CRS) Issue Brief No. 1B83147, 2 July, 1985, Library of Congress, pp. 2-3.

ally and figuratively[90] with the electorate and that NASA's achievements under the Nixon and Ford administrations were considerable in such circumstances. In the present space station context, Skylab, although not regarded as a space station stricto sensu since it was not replenishable, performed significant work during its eighteen months of operation, hosting three separate crews before its February 1974 deactivation.[91]

Consolidation was the watchword of the Carter administration. The latter's Directive of May 1978 established a Policy Review Committee which perceived that the major problem facing US civil space policy was "how best to capitalize on prior investments".[92] The desire to maximize the return on investment of $100 billion in space activities up to this point led to a somewhat reactionary policy which was paradoxical considering the milieu involved. Not only did President Carter in-build "short-

90. The Apollo programme cost US $25 billion 1961 Dollars which translates into approximately US $60 billion today - see Civilian Space Stations Report op.cit. supra note 86, 162.

91. See NASA Facts - 'Skylab - 1973-1974' JSC 08826 (undated).

92. White House Press Release (Description of a Presidential Directive on National Space Policy); The White House, 20 June, 1978.

term flexibility to impose fiscal constraints when conditions warrant"[93] but he also stated categorically that it was "neither feasible nor necessary at this time to commit the United States to a high-challenge space engineering initiative comparable to Apollo".[94] In particular, it was considered premature to make a commitment to a "space manufacturing facility due to the uncertainty of the technology and economic cost-benefits...."[95] President Carter's oft-quoted remark that the STS "will make our use of space in the future routine and perhaps not very exciting"[96] is indicative of the de-emphasis of the prestige rationale so apparent in the early days of US activity in space. National pride as a major justification was seen as no longer realistic in this cynical age. Instead Presidential policy in the Shuttle's formative years exhibited a clear utilitarian ethos. Whilst the first

93. White House Fact Sheet - Office of the White House Press Secretary, 11 October, 1978.

94. Ibid.

95. Ibid., see further, Marcia Smith, Space Policy and Funding: NASA and Civilian Space Programs CRS Issue Brief No. IB82118, 1 July, 1985, Library of Congress, pp. 4-5.

96. 'Special Report - Space Policy', Diane Granat, Congressional Quarterly, 24 July, 1982, Vol. 40 No. 30, 1963.

launch of the space shuttle 'Colombia' on 12 April, 1981, exactly twenty years after man's first orbital flight, was greeted with praise and commendation, its increasing use steadily reduced its impact on the American people. The STS was not a "hearts and minds" programme for national prestige. Although this element is undoubtedly present, it was already or was destined to become merely vestigial with each passing mission.

President Reagan's space policy statement delivered on 4 July, 1982 was a reiteration of what had gone before and constituted a "general endorsement of the space program".[97] Goals established for the programme were "to maintain United States space leadership, ...expand United States private-sector investment and involvement in civil space and space related activities" and "to make the [STS] system fully operational and cost-effective in providing routine access to space."[98] There was thus no new direction or commitment at this stage. However, there was some encouragement for advocates of a space station goal, in the directive to "continue to explore the requirements, operational concepts, and technology associated with perman-

97. Ibid.

98. White House Fact Sheet, National Space Policy, 4 July, 1982.

ent space facilities".[99] In order to develop a coherent space policy, President Reagan formed the Senior Interagency Group (SIG) (Space).[100] The SIG formed a Space Station Working Group which was charged with evaluating the implications of a commitment to a permanently based manned space station.[101]

In the meantime, NASA had revived its study of such a station,[102] the latest in a series of studies which had been conducted periodically over the years.[103] However, a new element was added in 1983, in that the possibility of

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99. Ibid.

100. SIG (Space) is composed of representatives from the Departments of State, Defense & Commerce, the NASA Administrator, the Director of Central Intelligence, the Chairman of the Joint Chiefs of Staff, the Director of the Arms Control & Disarmament Agency, and is chaired by the Assistant to the President for National Security Affairs. In addition, representatives from the Office of Management and Budget and the Office of Science and Technology Policy are present as observers.

101. See NASA's Space Station Activities, Hearing before the Sub-Committee on Space Science and Application of the Committee on Science and Technology, U.S. House of Representatives, 98th Congress, 1st Sess., 2 August, 1983, No. 37, 68.

102. See 'NASA Studies Manned Space Station', C. Covault, AW&ST, 4 August, 1980, 19.

103. See Logsdon, op.cit. supra note 86, pp. 15-21 and 162-175 respectively.

foreign collaboration in a space station project was addressed. Thus, NASA polled Canada, ESA, France, Italy, West Germany and Japan concerning this issue and had a generally positive response.[104] Furthermore, during Congressional Hearings on space station activities, Kenneth S. Pedersen, then head of the NASA International Affairs Division, stated the following in answers to written questions:

> Were the United States to preclude foreign participation in its space station, the incentive for Europe to proceed at an accelerated pace would certainly be heightened. In addition, the dialogue between Europe and Japan on potential space cooperation is expanding, so it is possible that Japan, which has shown great interest in the space station idea, would join Europe on such a venture.[105]

This statement came at a time when there was a growing perception of international competition in space applications. As a manifestation of this competition-awareness, President Reagan announced on 16 May, 1983, that expendable launch

104. See 'Space Station Definition Activities', Kenneth S. Pedersen, International Affairs Division NASA, 2 August, 1983, reproduced in NASA's Space Station Activities, op.cit. supra note 101, pp. 99-106.

105 Ibid., 106.

vehicles would be commercialized.[106] This was in response to the aforementioned SIG (Space) conclusion that

> a partnership between the private sector and the Government would strengthen the US space launch capability, develop a new industry, contribute favourably to the US economy and help maintain leadership in space transportation.[107]

Far from being simply a restructuring of one space application, namely transportation, this was a fundamental change of methodology for the conduct of the US space programme. In this context, the National Academy of Public Administration (NAPA), in a report prepared for NASA in 1983, identified the economic consequences of the US methodology as compared to that in Europe and Japan.[108] It was observed that the tradition in both Western Europe and Japan was that of a full partnership between government and

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106. President Reagan's Policy NSDD-94, see the Statement of Lt.Gen. James A. Abrahamson, then with the NASA Associate Administrator's Office of Space Flight, on 22 February, 1984, in 1985 NASA Authorization Hearings, Sub-Committee on Space Science and Applications, Committee on Science and Technology, House of Representatives, 98th Congress, 2nd Sess. No. 84 Vol. II, 1984, 584 at 563.

107. See Smith, op.cit. supra note 89, 8.

108. "Encouraging Business Ventures in Space Technologies", May 1983 reproduced in Appendix A of Space Commercialization Hearings before the Sub-Committee on Space Science and Applications, Committee on Science and Technology, House of Representatives, 98th Congress, 1st Sess., May 1983, No. 23, 249 et seq.

the private sector, exemplified by consortia in Europe and the Ministry of International Trade and Industry (MITI) in Japan.[109] Thus, the integration and unification of effort in Europe, coupled with MITI as a wing of government in Japan, were perceived as making severe inroads into US dominance. Put another way, European inter-governmental collectivism and Japanese functional integration of government and its private sector export industries, were overhauling the USA with its competitive decentralization, using NASA as a contract distributor. The NAPA concluded that:

> The US commitment to the competitive enterprise system is inconsistent with a centralized planning system or industrial policy through which the government sets production priorities, targets industrial sectors for special emphasis and subsidizes the private participants in selected enterprises.[110]

Thus, the desire for continued US leadership in space found its expression in a new competitive rationale. However, the co-existing concept of international co-operation in space has been equally revered. As the debate concerning the possible conflict between these policy tenets began to surface, President Reagan made his celebrated State of the Union address on 25 January, 1984. Both of the aforementioned themes were aired, though an accommodation

109. Ibid., pp. 165-266.

110. Ibid., 267.

between the two was attempted. Thus, the following excerpt is redolent of the leadership theme:

> America has always been greatest when we dared to be great. We can reach for greatness again. We can follow our dreams to distant stars, living and working in space for peaceful, and scientific gain. Tonight, I am directing NASA to develop a permanently manned space station, and to do it within a decade.[111]

In contrast, the goal of international co-operation is advocated in the contemporaneous statement that

> [w]e want our friends to help us meet these challenges and share in the benefits. NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand freedom for all who share our goals.[112]

In the following part of this section, an assessment of this attempted accommodation will be made through events which have unfolded since this speech.

(b) The US/International Space Station and the Search for a Coherent Policy

The long-awaited space station commitment was undoubtedly intended to be a revitalization of the space programme and a re-dedication of NASA to the type of mission

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111. Text reproduced in the New York Times, 26 January, 1984, B8.

112. Ibid.

at which it excels. However, a number of factors have prevented this process from beginning. The space station is at the centre of a maelstrom of forces which have acted in concert to frustrate its progress as a focus of national attention in the way the Apollo project functioned. These issues will be presented in as logical a manner as possible and, for ease of exposition, they will be separated from each other, though they are all elements of the same mosaic.

(i) The Evolution of Space Station Architecture - The Initial Operating Capability (IOC) outlined by NASA in June 1983 was, above all, an evolutionary concept.[113] The progression from the IOC to the projected future space station is usefully and economically depicted in figures I-1 and I-2. By a process of modular expansion onto a US core station within a lattice of interconnecting trusses surrounded by a flotilla of free fliers, a mature permanent facility would emerge in the early 21st century. This has undergone considerable revision as the input from a growing community of interests necessitates changes. The first batch of models which NASA proposed in 1984 were the planar,

113. Op.cit. supra note 101, 80.

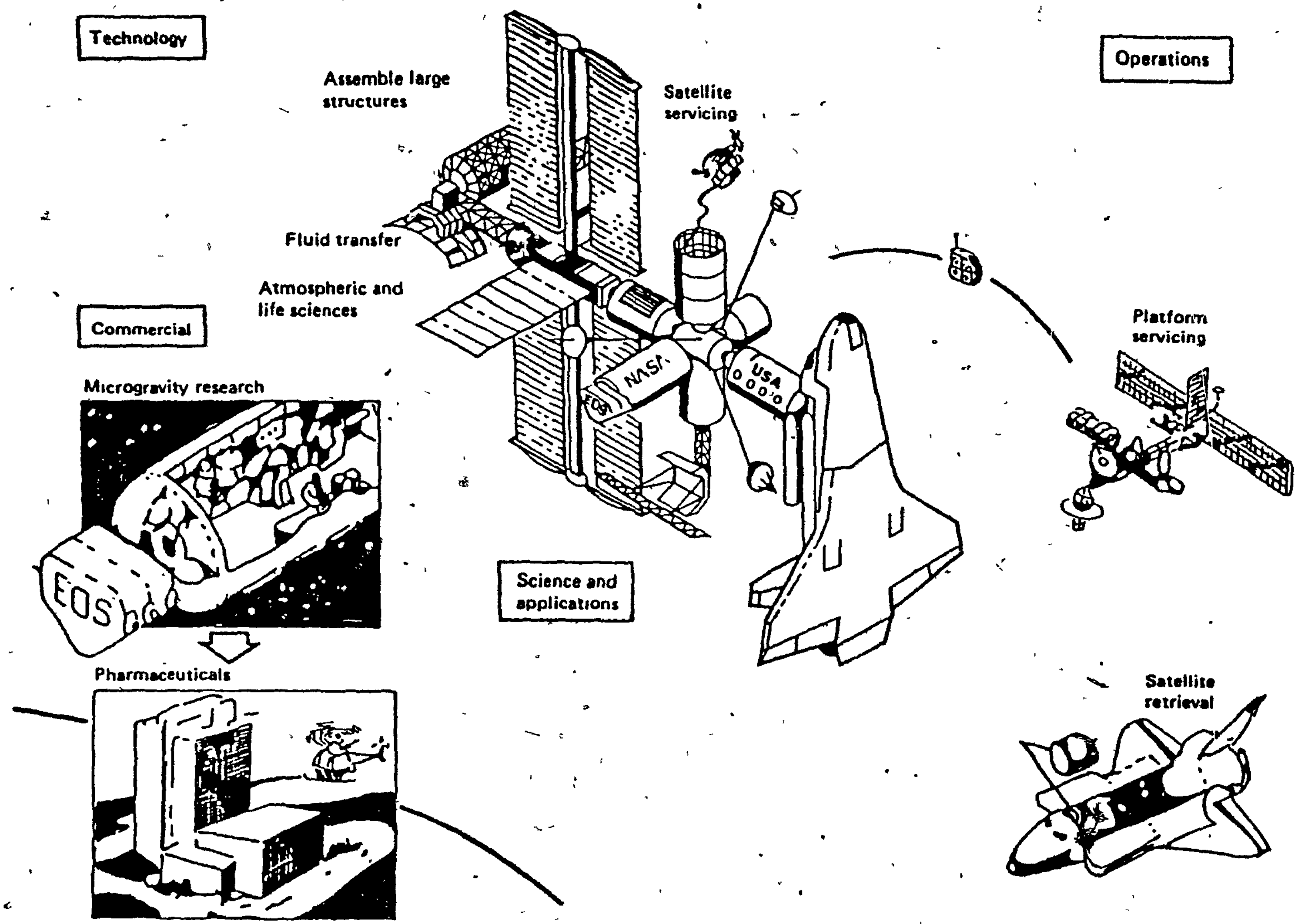


Figure I-1 Space Station Infrastructure - Initial Configuration.

Source: NASA.

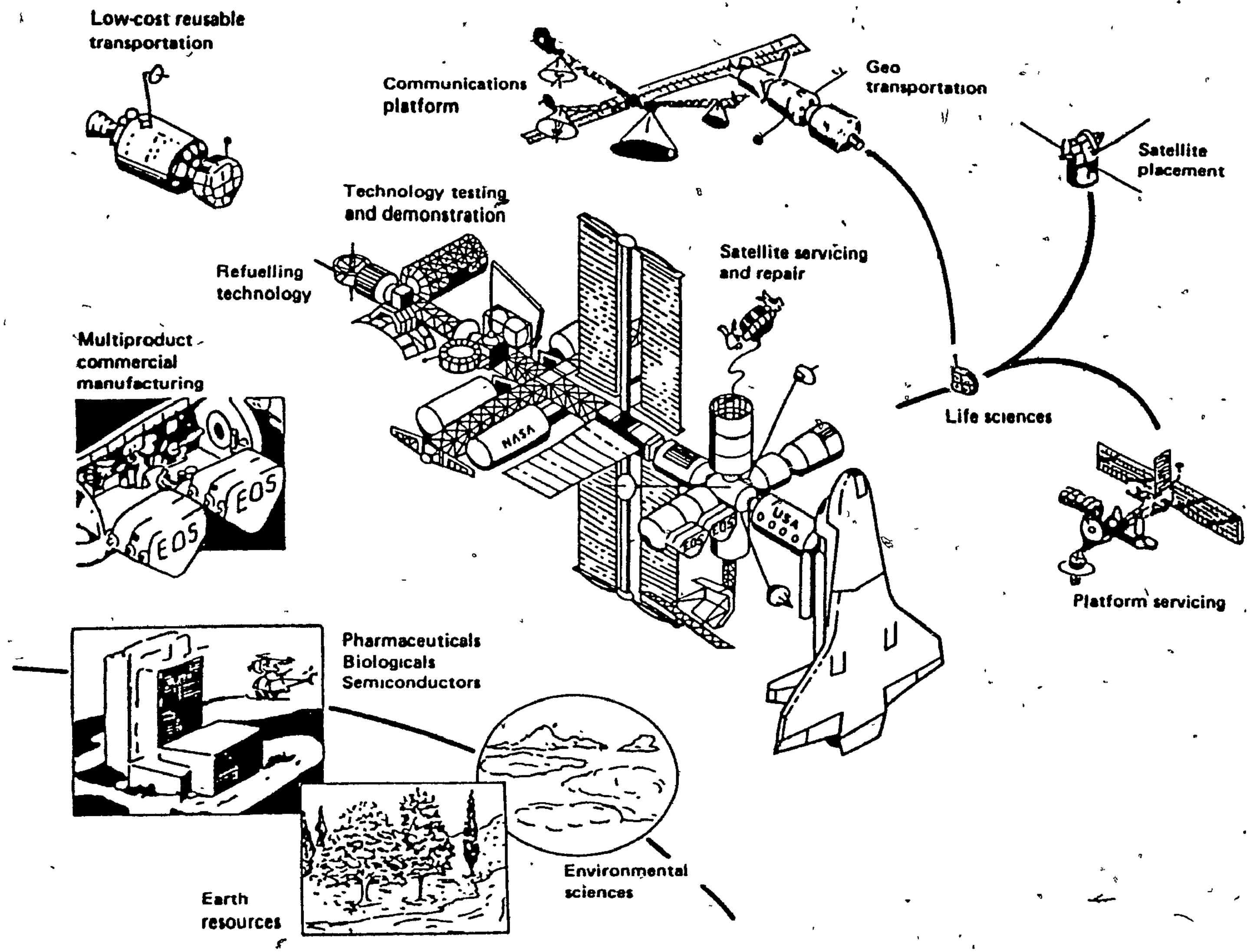


Figure I-2 Space Station Infrastructure - Future Configuration.

Source : NASA.

power tower and delta stations.[114] Though the power tower was favoured for a time, commercial and scientific requirements for optimum microgravity conditions produced the "dual-keel" design in October, 1985. (See figure I-3).[115] In this configuration, the pressurized modules were arranged in a figure eight.

With the successful conclusion of Memoranda of Understanding with Canada,[116] Japan[117] and the European Space Agency,[118] their contributions had to be entered into the equation. These will be discussed in more detail in subsequent sections of this chapter. At this juncture, it is sufficient to note that the USA, ESA and Japan all desired to develop their own materials processing

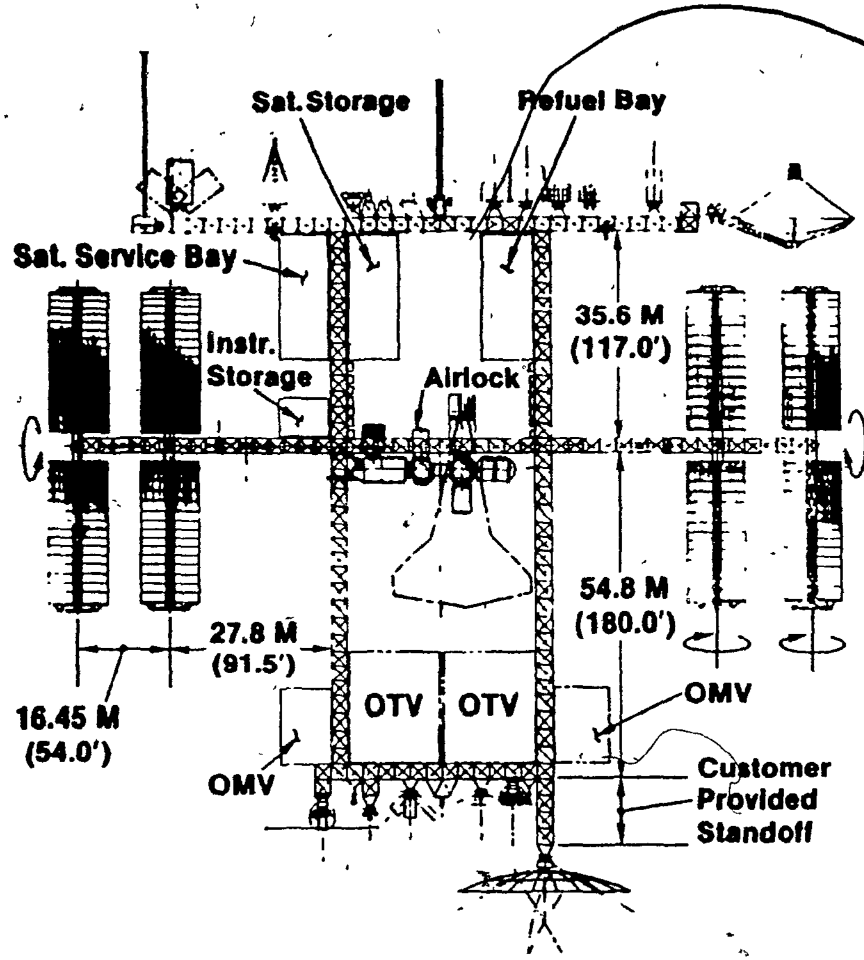
114. 'U.S. Space Agency Narrows Station Concepts'., C. Covault, AW&ST, 9 July, 1984, 14.

115. See 'Space Station Reconfigured', Space Business News, 21 October, 1985, 5; 'Space Station Redesigned for Larger Structural Area', C. Covault, AW&ST, 14 October, 1985, 16.

116. 'Canada Accepts Space Station Invitation' AW&ST, 25 March, 1985, 23.

117. "Space Station Pact", AW&ST, 20 May, 1985, 68.

118. 'ESA/NASA Space Station Agreement Signed at Paris Air Show', Space Commerce Bulletin, 7 June, 1985, pp. 2-3.



New U. S. space station dual keel design (facing page) is significantly different from the power tower reference configuration just abandoned. The dual keel plan shown in this McDonnell Douglas computer drawing uses twin 300-ft vertical masts as the station's keel. The crew and laboratory modules will be hung in the center on a central hub shown here attached to a small square truss. The new configuration was adopted in response to science and commercial needs for more structure on which to mount experiments and placement of the modules where they can have a better zero-gravity environment for materials processing. More structural support will now be available above and below the modules for satellite and upper-stage servicing hangars, illustrated here by the large boxes at top and bottom. Two large circular dish antennas are mounted at right. In the illustration on this page, the new configuration shows a wider, more box-like structure than the long, tall power tower concept. A shuttle orbiter is shown docked to the crew and laboratory modules between the twin masts. The new design has enlarged the mounting space for orbital transfer vehicle (OTV) and orbital maneuvering vehicle (OMV) upper-stage storage along the bottom, where Earth-viewing instruments are also located. Smaller satellite servicing and refueling bays are positioned at the top along with instruments viewing the Sun and deep space. The concept will be refined further and the dimensions given are preliminary.

Figure I-3 US/International Space Station - Dual Keel Design.
Source : Aviation Week and Space Technology 14 October, 1985, 15.

module.

During the course of 1986, three separate events forced yet another alteration in the design. The first was the loss of mission 51-L on 28 January. One of the many reverberations from the Challenger explosion was the advent of launch scheduling difficulties. Although originally targeted for a 1992 launch to commemorate the 500th anniversary of Columbus' discovery of America, the latest operative timeframe is for construction of the IOC between 1993 and 1996. Estimates varied from between 12 to 18 shuttle launches being required to achieve this objective,[119] with the possibility of employing expendable launch vehicles a serious consideration.[120] The latest shuttle manifest schedules five space station launches in 1993, and seven in 1994.[121] This launch rate is only possible with a four shuttle fleet, and President Reagan had directed the development of a replacement for Challenger two months

119. 'Space Station Scheduling', Space Commerce Bulletin, 28 February, 1986, 3.

120. 'Space Station Tinkering Continues', Space Business News, 22 September, 1986, 3.

121. 'NASA releases manifest,, Space Business News, 6 October, 1986, 8.

earlier.[122] The next launch of the Shuttle was planned for 18 February, 1988[123] with a five man crew[124] but is now set for 2 June, 1988. Another side effect was the development of so-called "resource nodes". The interconnecting nodes between the modules have now been enlarged and pressurized to minimize launch frequency and expensive Extra-Vehicular Activity.[125]

The second occurrence in 1986 was a dispute with ESA concerning their contribution to the US/International Space Station. In March, ESA adamantly maintained that their module should be detachable in order to become the foundation for an independent capability.[126] In con-

122. ''Reagan Authorizes Orbiter to Replace Challenger', AW&ST, 18 August, 1986, 18.

123. 'Shuttle Relaunching Set for February '88', R. Abramson, The Gazette, Montreal, 4 October, 1986, A2.

124. 'Space vets Picked for '88 Shuttle', The Gazette, Montreal, 10 January, 1987, D8. The crew is as follows: Frederick Hauck (Commander), Col. Richard Covey (Pilot), and mission specialists John Lounge, George Nelson and Maj. David Hilmers.

125. 'NASA Says It Needs More Information Before Deciding Space Station Design', Space Commerce Bulletin, 26 September, 1986, 4.

126. 'Preliminary Deadline For Space Station Agreement Passes Without Decision', Space Commerce Bulletin, 14 March, 1986, 4.

trast, NASA sought an integrated European module. At one stage, it appeared that negotiations were about to founder and that ESA would be excluded from the project entirely.[127] However, a compromise was reached, whereby ESA would construct both an integrated module for the IOC and a man-tended free flyer.[128]

The third relevant occurrence was the forced adoption of a more modest IOC plan than that of the "Dual Keel" design. The original estimate of the cost of the IOC ~~was~~ US $8 billion and in order to remain within this threshold, it was decided that economies were necessitated. Thus, the number of US pressurized modules was halved to two,[129] though this more streamlined station could be constructed and in operation by 1994, so conforming to

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127. 'Europeans May Be Left Out Of Space Station Partnership', AW&ST, 24 March, 1986, 24.

128. 'Aeritalia Asks That ESA Build Second Space Station Module', M. Feazel, AW&ST, 14 April, 1986, 122; 'ESA Space Station Contribution Includes Man-Tended Free-Flier, Permanent Module, polar Platform', AW&ST, 19 May, 1986, 21; 'NASA, ESA Agree on Station Design Study', AW&ST, 11 August, 1986, 20; 'NASA placates ESA on station', Space Business News, 11 August, 1986, 8.

129. 'Configuration Includes Recent Changes to Meet Budget', Space Commerce Bulletin, 23 May, 1986, pp. 3-4.

President Reagan's original decade target.[130] It is uncertain what the final configuration will be.

(ii) The NASA Crisis -- The Challenger disaster sparked a series of reviews of NASA, the most authoritative being the Presidential Commission under the chairmanship of William P. Rogers. The hearings held over several months disclosed a catalogue of mismanagement, lack of communication within the extensive NASA bureaucracy and a resultant tragic inefficiency in safety procedures.[131] The final report of the Commission, submitted on 9 June, 1986, contained a series of recommendations which have been, or

130. Ibid.

131. See 'NASA Official Says Shuttle Program Had Major Flaws', P.M. Boffey, New York Times, 4 April, 1986, pp. A1 & D19; 'NASA Wasted Billions, Federal Audits Disclose', S. Diamond, New York Times, 23 April, 1986, A1; 'NASA Cut or Delayed Safety Spending', S. Diamond, New York Times, 24 April, 1986, A1; 'NASA Says Audits Produced Savings', P.M. Boffey, New York Times, 26 April, 1986, A1; 'Text of NASA Statement on management Audits', New York Times, 26 April, 1986, A9; 'Senator Says NASA Cut 70% of Staff Checking Quality', R. Pear, New York Times, 8 May, 1986, A1; 'Panel Said to Ask Tighter Controls on NASA Decisions', G.M. Boyd, New York Times, 15 May, 1986, A1.

are in the process of being, fulfilled.[132] However, this painful process has weakened NASA both internally and as perceived by the electorate. As a result, serious doubts exist about the agency's future. Thus, a recent NASA Advisory Council under the Chairmanship of Daniel J. Fink was "left with great concern as to whether NASA can any longer meet the mandate for national pre-eminence established by the National Aeronautics and Space Act."[133] In the space station context, Representative William Nelson (D-Fla), the Chairman of the House SubCommittee on Space Science and Applications, commented as recently as October 1986, that NASA's development of an "operations concept" for the station was in a "primitive state", demanding either an

132. See 'Key Portions of Commission Report on Challenger Accident', New York Times, 10 June, 1986, pp. C10-C12. Some of the recommendations were for: redesign of the faulty Solid-Rocket Boosters - this is ongoing; the Shuttle-management structure should be reviewed - the system is in the process of transitioning to that used during the Apollo programme under Dale Myers; better safety procedures should be instituted with the formation of a NASA office for this function - a NASA Office of Safety, Reliability and Quality Assurance has been established at NASA H.Q. in Washington, D.C.; there should be a consideration of a crew escape system - this is currently under review for feasibility; and there should be discontinued reliance on the shuttle as the nation's sole launch capability - ELVs are in development and programmes and assembly lines were re-started.

133. 'Advisory Group Questions NASA's Leadership Ability', AW&ST, 25 August, 1986, 26.

increase in the pace of planning or the abandonment of international negotiations.[134]

(iii) <u>Deficit Reduction and the Annual Budget Cycle</u> - The $200 billion US budget deficit is a veritable sword of Damocles which will cut discretionary programmes for a number of years to come. The 1985 Gramm-Rudman-Hollings Deficit Reduction Act mandates a phased amortization of the deficit by 1991 in $36 billion increments.[135] However, this coincides with the period of maximum required investment in the space station programme, i.e. during the construction and assembly thereof. It has been observed that "the two agendas are bound to collide."[136] Judging from the budget allocations to NASA for space station over the past three years, see Table I-1, the situation is somewhat precarious. Only through a position of strength can an agency vying for discretionary funds succeed. However, as we have seen, NASA is at a low ebb. It is already anticipated that the space station project will be delayed by

134. 'House Panel Approves Space Station Changes'. AW&ST, 20 October, 1986, 31.

135. National Scene, Aerospace America, February 1986, 8.

136. 'Rumor Mill Churns on Gramm-Rudman', Space Business News, 13 January, 1986, 1.

TABLE I-1

NASA BUDGET ALLOCATIONS FOR SPACE STATION 1986-1988.

THOUSANDS OF DOLLARS

	1986	1987	1988
NASA ESTIMATE	280,000	580,000	1,050,000
REAGAN ADMINISTRATION SUBMISSION	230,000	420,000	767,000
CONGRESSIONAL APPROPRIATION	200,300	420,000	?

*Compiled from various sources.

twelve to eighteen months directly because of the drive for deficit reduction, regardless of other circumstances.[137] Furthermore, it was disclosed in January 1987 that the original NASA estimates for the cost of space station construction (see Table I-2) did not include salaries, ground tracking, construction of facilities or the amount required for shuttle launches.[138] Were these to be included, the price may be nearer $20 billion.[139]

The root of this problem lies in the annual budget cycle itself. In a 1982 Report, the Congressional Office of Technology Assessment concluded a review of the cycle by stating that

> [f]or consistent, long-term policy objectives to be developed and carried out, the budget process must necessarily follow policy guidance, and not the reverse. Without such policy commitments, the annual budget process will result in mission deferrals, stretched schedules, and even cancellation of well-developed

137. See Washington Roundup, AW&ST, 6 January, 1986, 15; Space Business News, 16 December, 1985, 10; 'Space Station Program Begins Budget Battle, Faces Personnel Changes', Space Commerce Bulletin, 17 January, 1986, 2.

138. 'Station Costs Still Up in the Air', Space Business News, 12 January, 1987, 3, 4.

139. Ibid. See also "Space Station is Studied by Military", W.J. Broad, New York Times, 7 April, 1987, CI, where it is stated that President Reagan has approved a $12.5 billion station.

TABLE I-2

NASA ESTIMATED REQUIRED SPACE STATION BUDGET

Year	THOUSANDS OF DOLLARS
1987	580,000
1988	1,050,000
1989	2,070,000
1990	2,270,000
1991	3,310,000
1992	1,530,000
1993	208,000

* Source : Space Business News 13 January, 1986, 9.

> projects, adding up to a waste of scarce resources. All of these have already occurred in recent NASA budgets.[140]

The position is now arguably worse due to NASA's weakened bargaining position.

(iv) <u>The Lack of User Community Consensus on the Space Station</u> - There are, broadly speaking, two methods of approach suggested for the conduct of a space station programme, though there are myriad nuances within them. The first version is the "evolutionary station". This cautious concept would involve more intensive use of the STS together with the emplacement of more free-flying platforms, mostly unmanned with some being man-tended, in low earth orbit. This combination would perform an empirical evaluation of a range of speculative technologies including those grouped under the materials processing rubric. The free fliers would be funded in large measure by the private sector, while public sector funds would be used for research and development and science programmes. Only after this evaluation has been completed, would a decision to undertake a permanently manned station be taken. According to this point of view, this would result in a much more mature,

140. <u>Civilian Space Policy And Applications</u> (U.S. Congress, Office of Technology Assessment, OTA-STI-177, Washington, D.C., June 1982), 273.

defined, useful and efficient concept.[141] Some merits and de-merits of the evolutionary approach are counter-pointed in Table I-3.

It is tempting to characterize the other approach as being revolutionary, though it is probably more accurate to view it as greatly accelerated evolution. This is the full-blown Apollo-style commitment for a multi-modular permanent facility which rapidly expands into a major orbital complex or first generation space colony. This is certainly the idea which NASA espoused originally,[142] and a brief evaluation is made in Table I-4. The trend appears to be towards a more conservative approach somewhere in the middle ground between these two methodologies.

(v) Soviet Leadership and a Cooperative Alternative - As noted above in the section on the Soviet space programme, several influential observers of space activities have concluded that the USA is no longer pre-eminent, but

141. See 'Space Platforms For Science and Applications', W.C. Snoddy, Astronautics & Aeronautics, April, 1981, 28; the comments of former Presidential Science Advisor George A. Keyworth in 'NASA Defines Initial Station Missions', C. Covault, AW&ST, 30 May, 1983, pp. 324-330; 'Reagan Votes For Space Station', New Scientist, 2 February, 1984, 3; and the OTA Report Civilian Space Stations and the U.S. Future in Space, op.cit. supra note 86, pp. 85-98, 122, 124 & 134.

142. See figures I-1 and I-2 supra.

TABLE I-3

SOME MERITS AND DEMERITS OF THE EVOLUTIONARY SPACE STATION.

MERITS	DEMERITS
1. It would probably ensure an early start to significant US activity in LEO.	1. It would not respond to Soviet accomplishments in manned space activity.
2. The cautious approach would undoubtedly result in more clearly defined long term goals set from more informed judgments.	2. There appears to be no shortage of goals, what is needed is a strong commitment to make the project fly at all.
3. It would ensure a balanced programme which would not starve the scientific community of its funding.	3. With Halley's Comet project scientific missions in space have become international ventures. If there is not a significant enough commitment to a manned facility the prospective station partners will look to themselves, or elsewhere.

TABLE I-4

THE ACCELERATED EVOLUTIONARY APPROACH EVALUATED

PRO	CON
1. It would result in a solid infrastructure to begin the process of occupation of the inner solar system as the Soviet Union appears to be aiming towards.	1. It would be very costly and difficult to justify to an electorate in which space enthusiasm is at a low ebb.
2. It would ensure that the USA is on course to regain its arguably lost pre-eminence in space.	2. The USA can compete with the Soviet Union in other areas which are both less costly and result in earlier returns on investment.
3. Unless a commitment is made to a major capability, the growing cadre of competitive space-faring nations will pursue it themselves.	3. From a US domestic point of view, the time is not ripe for such a major commitment, the post-Gramm-Rudman fiscal climate would be more appropriate.

must concede this to the Soviet Union at least insofar as manned activity is concerned.[143] This is further corroborated by recent comments from NASA Administrator James C. Fletcher. In response to criticism of the US position, he stated that "(w)e have to decide where we want to lead and where we are willing to relinquish that leadership to someone else".[144] Furthermore, in his view the Soviet MIR station is "not too different from what we [the USA] are going to have in 1994" and "it is quite clear that by the time we get through with our space station, they may be on their way to the next step."[145] In addition, a NASA memorandum of July 1986 on the Soviet programme predicted that by 1995 there would be twenty cosmonauts on orbit simultaneously inhabiting an orbital complex comprising up to 22 attached modules.[146] This has precipitated several

143. The observers include the AIAA an Jane's Spaceflight Directory see supra section A 2 footnotes 43-45.

144. 'Fletcher Cites 'Turf Battles' In Space Program Decision Delays', C.Covault, AW&ST, 15 September, 1986, 77, 79.

145. Ibid., 80.

146. 'Fletcher Delays Station Decisions to Assess Development Issues', C. Covault, AW&ST, 4 August, 1986, 28.

classified reviews of the Soviet space programme[147] and the compilation of a database on Soviet space station experience to assist in the design of the US/International station.[148]

Such an apparently respected Soviet space station capability may lead to nations which have not co-operated extensively in space with the USSR before, to consider this as a viable alternative to co-operation with the USA, at least until the mid-1990s.[149]

(vi) Long-Range Planning - In the 1985 National Aeronautics and Space Act[150] the US Congress established a 'National Commission on Space' which was charged with "the identification of long-range goals and policy options for the United States civilian space program through a high-level, representational public forum". The report which

147. 'NASA Assessing Soviet Space Program', AW&ST, 8 December, 1986, 24.

148. 'Industry Observer', AW&ST, 22 December, 1986, 13.

149. See 'Multinational Efforts Bolster East-West Space Co-operation', J.M. Lenokovitz, AW&ST, 17 November, 1986, 45; and 'Soviet Space Offer to Britain', Spaceflight Vol. 28, July/August 1986, 291.

150. Public Law 98-361, Title II.

resulted in May 1986[151] can be summarized in Figure I-4 which is drawn from the report itself. The two, by now familiar, themes were again prominent. Thus, it was stated that their scenario

> starts with simple components, but evolves over time into a system of spaceports, bases, and connecting transportation systems that will open the space frontier for large-scale exploration, science, and the initiation of economic development. Resources will be utilized where they are found, to minimize the need for resources transported from Earth. This inner Solar System network will ensure continuing American leadership in space in the next century.[152]

In addition, it was advocated that

> [v]igorous steps be taken to attract other nations to work in partnership with us. We must mobilize this planet's most creative minds to help us achieve our challenging goals. All of humankind will benefit from co-operation on the space frontier.[153]

The "Highway to Space/Bridge Between Worlds" concept as outlined in the Report is a repackaged version of the 1969 Space Task Group conclusions adverted to above. Just as they were unpalatable then, they are coming under criticism by some who would question the $700 billion cost

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151. Pioneering The Space Frontier (Bantam Books, 1986) (211 ff.)

152. Ibid., 15.

153. Ibid., 17.

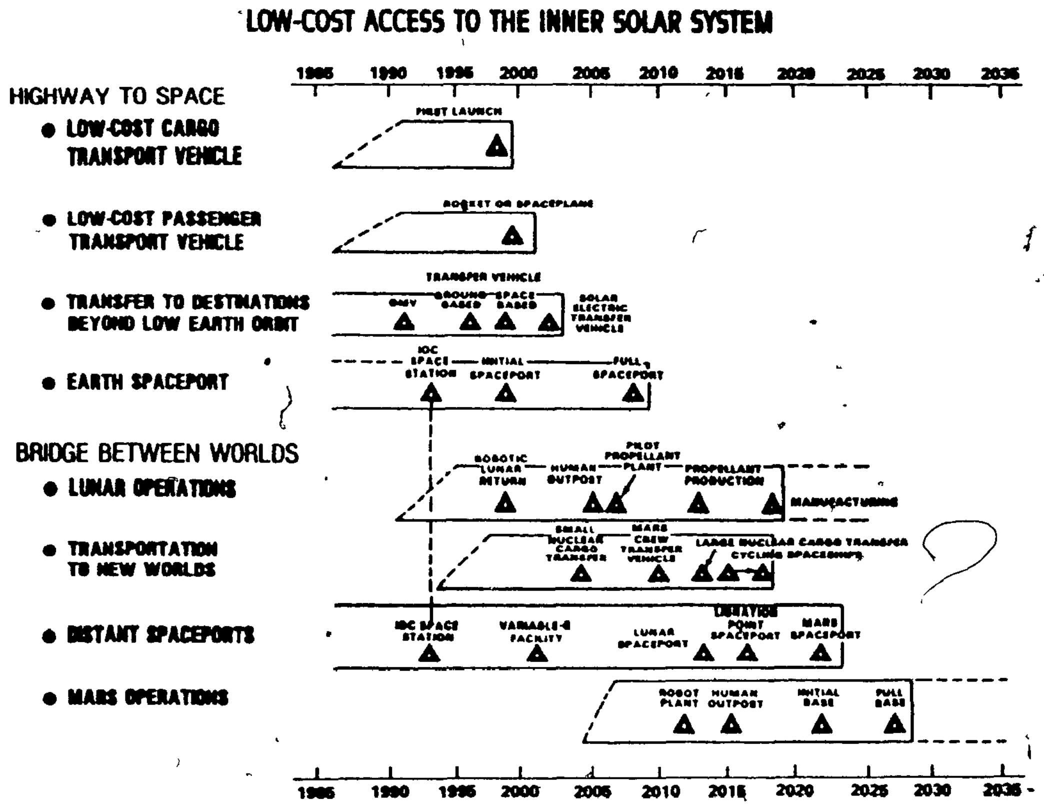

Figure I-4 National Commission on Space - Highway to Space/Bridge Between Worlds Concept
Source : National Commission on Space Report Pioneering The Space Frontier (1986,Bantham)15.

in the 1995-2020 timeframe.[154] Others have criticized it for ignoring the more pressing near-term crisis in the US space-programme, since the report assumes a fully operational space station on orbit by 1994, which is by no means a certainty.[155] Nevertheless, NASA is in the process of devising a ten-year plan by soliciting a variety of reports from a number of influential bodies, to be collated and emerge under the title "Space 1995".[156]

Thus, there is clearly no lack of industry in striving to identify goals for the USA in space. It remains to be seen whether a political decision on which goal to aim for is both possible and capable of commanding the required congressional and electoral support.

(vii) A Military Rationale? - In the 4 February, 1986 State of the Union speech by President Reagan there was a distinct change of emphasis from its 1984 precedent. There is a striking contrast between "we are going forward

154. 'Looking Toward The Year 2035', Donald E. Fink editorial, AW&ST, 24 March, 1986, 13.

155. 'What Do We Do Next in Space?', A.E. Puckett, New York Times, 16 June, 1986, A19.

156. 'NASA Emphasis on Shuttle, Station To Continue Under New Goals', J.M. Foley, AW&ST, 8 December, 1986, 23. This report is due in May 1987.

to build our space station" and "America met one historic challenge and went to the moon. Now, America must meet another - to make our strategic defense real for all the citizens of Planet Earth."[157] A year later, in his 27 January, 1987 State of the Union address, President Reagan did not mention the civilian space programme whatsoever, confining his comments to generalities concerning "proposals to enhance our (America's) competitiveness, including new science and technology centres, and strong new funding for basic research."[158] However, the Strategic Defence Initiative received yet another fillip, being characterized as "the most positive and promising defence programme we have undertaken, its the path for both sides to a safer future, a system that defends human life instead of threatening it. SDI will go forward".[159] This was followed up by a White House Fact Sheet which outlined "The President's Competitiveness Initiative". This did contain a reference to a commitment to the design and construction of a US Space Station and placed emphasis on the "development of advanced civil space technology which will explore a

157. 'State of the Union: Reagan Reports to the Nation', New York Times, 5 February, 1986, A20.

158. Personal video transcript.

159. Ibid.

variety of generic space technologies important to US leadership in space."[160] Despite this, the SDI programme was the one identified with the Apollo and Space Shuttle Spin-off experiences, and procedures are to be established to accelerate the process of private sector applications of SDI technology.[161]

This is but the latest manifestation of an inevitable trend fueled by the fact that the DOD receives significantly more funding for space-related activities than NASA receives. Some recent occurrences may indicate that NASA's current vulnerability is causing a marked imbalance in the always precarious dichotomy between civilian and military programmes. Thus, an attempt by Congress to create a "new mechanism for making space policy,"[162] namely the National Aeronautics and Space Council, was vetoed by President Reagan.[163] One aspect of this refusal undoubtedly stems from the desire to retain jurisdiction for space

160. Inside the Pentagon, Vol. 3 No. 5, 30 January, 1987, 9.

161. Ibid.

162. 'House Recommends White House-Level Advisory Council to Make Space Policy', Space Commerce Bulletin, 25 April, 1986, 5.

163. 'Reagan Vetoes NASA Bill for '87, Las Vegas Review Journal, 15 November, 1986, 3A.

affairs firmly within the Presidential prerogative. However, the Council had been proposed to replace the SIG (Space) mentioned above, which is predominantly composed of military personnel.[164]

Of more impact in the space station context, was the announcement in January 1987 that the DOD wished to use the space station for SDI experimentation, within an overall evaluation of "the role of the military man in space".[165] This has served to delay negotiations with the prospective partners in the space station project while the DOD and NASA come to some accommodation.[166] This is a volte-face from the position maintained by the DOD since the space station

164. Op.cit. supra note 162.

165. 'Space Station to be used for Military Testing', The Ottawa Citizen, 26 January, 1987, A7.

166. 'DOD Worries Halt Station Talks', Space Business News, 12 January, 1987, 6.

project was first announced.[167] It is interesting to recall the 1970 decision to opt for a reusable space shuttle rather than a space station. A government archives memorandum for the record of 13 March, 1969 states that the DOD

> does not have or anticipate projects which require a space station as defined by NASA. DOD has great interest in the development of a lower cost transportation system suitable for their uses as well as for NASA's.[168]

This was not the only reason for the choice of the STS, but it may have been the decisive one given the national security priority in the NASAct. The DOD now sees a military mission for a space station. History, as it is wont to do, may be repeating itself.

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167. 'Station Decision Overrode Strong Opposition', AW&ST, 30 January, 1984, 16. See also the OTA Report op.cit. supra note 86, 105 and footnote 4 where it is stated that "since the cancellation of the Manned Orbiting Laboratory Program in 1968, the U.S. military has been consistent in its public position that there is no military requirement for a "manned space station". This position is still publicly maintained and remains in force, even in the context of the President's call, in March 1983, for development of advanced ballistic missile defense systems (SDI) that could see large amounts of very sophisticated and costly military technology deployed in space".

168. See Logsdon, 'Space Stations: A Historical Perspective', op.cit. supra note 86, 17.

(c) The Meaning of Leadership

To the original concepts of US leadership and the desire for international co-operation has been added a new policy tenet - competitiveness. This competitiveness was for a time confined to civilian space applications, particularly launch capability. However, a new dimension has been added to this, by its association with the military space programme, particularly SDI. Though the latter association with the space station may ultimately guarantee its construction, it complicates an already delicate NASA position. According to Kenneth S. Pedersen,

> the future range of co-operative prospects available to NASA may be compressed because the same systems that must underpin international cooperative projects are increasingly viewed by all parties as being potentially vital tools in the competitive struggle for commercial space leadership.[169]

Far from being just a tool, the space station is a veritable box full. Professor Pedersen advocated a leadership adjustment for NASA whereby it must "learn to share direct management and operational control in projects where it is the largest hardware and financial contributor, especially when

169. 'The Changing Face of International Space Cooperation', Space Policy, May 1986, 120, 136.

manned flight systems are involved."[170] The advent of "leadership" becoming synonymous with "competitiveness" may serve to prevent NASA from making this required adjustment. As we shall see in the following sections, without this the US/International Space Station cannot proceed. Nevertheless, DOD part funding of the space station, if this were to materialize, might go a long way towards tipping the scales against foreign participation.

2. ESA - STRIVING FOR INDEPENDENCE

> The conquest of space is an adventure that will dominate the early 21st century and nothing is going to stop the most able and gifted nations from plunging into a race that has a potential for considerable disruption. Tomorrow's big powers will be those that have successfully met the new challenges; Europeans have to provide themselves with the means for responding to them.[171]

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170. Ibid., 131.

171. 'The Old Man and Space', Marie-France Garaud (President, International Institute of Geopolitics), Géopolitique No. 9, 1985, 2,4.

(a) Collectivism, Competitiveness, and the Independence Motif

The trend towards regionalism in the world also extends to space-related activities; indeed their magnitude, complexity and expense demands a collective approach from non-super-power nations. In Europe, the collective methodology began almost contemporaneously within the space age itself, with the signing of the Treaty of Rome on 25 March, 1957 by "the six".[172] Since then, the European Economic Community (EEC) has expanded to embrace twelve countries.[173] It was clearly perceived by the progenitors of the EEC that Europe must unite to succeed. If they were to remain divided, the several nations would be no economic match for the USA.[174] This common approach has found a natural extension in the high-technology industrial

172. 'The Six' were France, West Germany, Italy, Belgium, The Netherlands, and Luxembourg. For a text of the Treaty, see Sweet and Maxwell's European Community Treaties, 4th Ed. (1980, Sweet & Maxwell) 63 et. seq.

173. The six additional members of the EEC are: the United Kingdom, Ireland, Denmark, Greece, Spain and Portugal.

174. See Uniting Europe - The European Community Since 1950, European Commission publication, Brussels, 1980.

arena. It is long-term EEC industrial policy to promote such growth industries, as is clear from the following statement of the European Commission:

> In the aerospace industry, in data processing and in other areas, opening up markets and pooling industrial capacity will be necessary to reach the scale required by international competition.[175]

The counterpart of the EEC in the space milieu, is the European Space Agency (ESA). Although the memberships of the two organizations are not exactly the same, there is considerable overlap, with ESA having a wider-based representation.[176] ESA succeeded two precursor organizations[177] on 31 May, 1975 when the 'Convention for the

175. From 'The Community's Industrial Policy', European File Series 3/79, European Commission publication, February 1979, 6, (emphasis added).

176. ESA Member States are as follows: France, West Germany, United Kingdom, Italy, Switzerland, Spain, Sweden, Denmark, Belgium, Ireland, The Netherlands, Norway and Austria. Finland is an associate member and Canada has a special relationship agreement with ESA.

177. The European Space Research Organization (ESRO) and the European Launcher Development Organization (ELDO). For a history of these organizations and their transition into ESA see Twenty Years of European Cooperation in Space - An ESA Report '64-'84, ESA publication, 1984, pp. 13-31.

Establishment of a European Space Agency'[178] was signed.[179] In article II of this Convention, it is stated that

> [t]he purpose of the Agency shall be to provide for and to promote, for exclusively peaceful purposes, cooperation among European States in space research and technology and their space applications.[180] ...

Despite the fact that there are strong national space programmes being conducted in parallel with collective activities under the auspices of ESA, their detailed consideration is beyond the scope of this thesis.[181] Instead, there is a concentration on ESA activities herein, since it is that body which is negotiating with the USA concerning European participation in the space station project. ESA space activities are carried out according to

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178. In Basic Texts of the European Space Agency, Vol. I Conventions and Rules, (1980, ESA publication), A6/1 et seq.

179. It was not until five years later, however, that ESA became a de jure international organization, when France deposited its instrument of ratification on 30 October, 1980, see 'Entry into Force of the ESA Convention', M. Bourély, ESA Bulletin No. 25, February 1981, 7.

180. Emphasis added.

181. See for example the account of the French space programme in 'France - World Leader in High Technology', Spaceflight Vol. 28, June 1986, 252.

two fundamental principles. The first is the principle of "fair return", or "juste retour", whereby member States' financial contributions to the ESA budget result, through a fair geographical distribution of industrial contracts by ESA, in a guarantee of at least 90% direct return on its investment to each member State.[182] The other principle is that of "programmes à la carte"[183] by which member states may choose which programmes they wish to contribute towards. This is contained in article V and Annex III of the aforementioned ESA Convention, which together establish two programme levels, one mandatory and the other optional.[184] It is sufficient at this juncture to be aware that space station-related activities would be optional.

The ESA contract distribution system did not replace pre-existing and continuing European consortia arrangements. Consortia have been of particular significance in the area of satellite manufacture, and tenders for ESA contracts have generally observed the "fair return"

182. See 'Europe aims for Space Independence', P. Langereux, Aerospace America, April 1986, 52, 53.

183. Ibid.

184. This is discussed in more detail infra Chapter IIB4.

principle.[185] According to a representative from the french corporation Aérospatiale,

> [f]or the first time the frontiers between groups of industrial companies had followed different lines from national frontiers without producing multi-national companies as a result.[186]

A recent example of this is the formation of EURIMAGE, a consortium of European companies formed to market Landsat data.[187] However, the creation of Intospace, a "commercial microgravity marketing group"[188] has especial relevance as a trend setter for European space station activities. Intospace was created by MBB/ERNO of West Germany and Alitalia of Italy to co-ordinate European materials processing and other commercially-oriented microgravity experimentation.[189] Shareholdings in

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185. 'Competition and Cooperation in Space - 20 Years Apprenticeship', P. Usunier, in Europe - Two Decades in Space 1964-1984, ESA publication SP-1060, 1984, 120, 122.

186. Ibid.

187. Space Business News, 12 January, 1987, 1. Members of the consortium are: SPOT Image (France), the Swedish Space Corporation; the West German DFVLR (Deutsche Forshungs-und Versuchsanstalt für Luft-und Raumfahrt), Telespazia (Italy); and the British company Hunting Technical Services Incorporated.

188. 'Europeans Establishing Microgravity Marketing Firm', AW&ST, 28 October, 1986, 61.

189. Ibid., 65.

Intospace, which is registered in West Germany with its head office in Hanover, comprise two categories, namely 38 per cent divided among European aerospace corporations (the hardware manufacturers) and 62 per cent divided among a wide variety of non-aerospace corporations throughout Europe, ranging from banks and insurance companies to car manufacturers.[190] One of the most significant activities being conducted by Intospace over the next few years is the marketing of the payload capacity aboard the second West German-sponsored Spacelab mission, D2,[191] scheduled for a shuttle launch in the third quarter of 1991.[192] This represents an important testing ground for the European Columbus space station project, to be discussed presently, and it is intended to produce important input towards the definition of the latter project. Intospace follows upon the formation of quasi-private marketing corporations in the other three space application areas: Eutelsat for telecom-

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190. Ibid.

191. 'Spacelab Payloads', AW&ST, 24 March, 1986, 24.

192. 'Shuttle Flight Assignments Utilising European Elements', Columbus Logbook No. 6, December, 1986, pp. 4-5.

munications;[193] SPOT Image for remote sensing data;[194] and ARIANESPACE S.A. for space transportation.[195]

The EUREKA Initiative, launched by French President François Mitterrand on 17 July, 1985 was given formal status by the adoption of a Declaration of Principles at a meeting in Hanover on 5 and 6 November, 1985.[196] This meeting brought together Ministers from eighteen European Governments and representatives from the EEC. They collectively agreed that

> [t]he objective of EUREKA is to raise, through closer cooperation among enterprises and research institutes in the field of advanced technologies, the productivity and competitiveness of Europe's industries and national economies on the world market, and hence strengthen the basis for lasting prosperity and employment. EUREKA will enable Europe to master and exploit the technologies that are important for its future, and to build up its capability in crucial areas.[197]

It has been suggested that EUREKA was promulgated in

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193. ESA Report op.cit. supra note 177, 66.

194. 'Group Created to Market Spot Satellite Data', AW&ST, 12 July, 1982, 26.

195. 'Arianespace: première société commerciale de transport spatial', J. Chappez, 110 J. Droit Int. 695 (1983).

196. Reproduced in Space Policy, February 1986, 80.

197. Ibid., Article I.

response to the US Strategic Defence Initiative.[198] The aforementioned Declaration of Principles states that "EUREKA projects will serve civilian purposes, and be directed both at private and public sector markets."[199] This language clearly does not exclude military applications and a perusal of the target technologies discloses their dual-purpose nature.[200] However, it more closely resembles President Reagan's 'Competitiveness Initiative' which it predates by some fourteen months.[201] Although not confined to the aerospace field, the latter is one of its crucial areas of interest. Already, a group of five European corporations have banded together to study both aerospace products and non-aerospace "spin-off" products to be developed under the

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198. 'Europeans Agree on Eureka Proposals', AW&ST, 28 October, 1985, 47.

199. Op.cit. supra note 197.

200. Technologies Chosen for EUREKA stimulus include products, processes and services in the following high-technology areas: information and telecommunications; robotics; materials-composites; alloys, plastics manufacturing; computers - supercomputer and Gallium Arsenide integrated circuits; biotechnology; marine technology; powerful industrial lasers; environmental protection; and transportation technologies, see Declaration of Principles op.cit. supra note 196, and "Eureka: 1er succès de la coopération technologique européenne", P. Langereux, Air et Cosmos No. 1070, 16 novembre 1985, 56.

201. See supra this Chapter Section B1(b)(v).

EUREKA umbrella.[202] These will receive government funding and co-ordination through the EUREKA Council of Ministers, served by a small secretariat in Brussels.[203]

Thus, there is a clear and concerted drive for European competitiveness in high technology areas, particularly its exemplar the aerospace field. Despite this competitive emphasis, there remains a distinct belief in and desire for co-operation in space activities, as exemplified by the extensive co-operative ventures which ESA has undertaken in the past, especially with the USA. Spacelab is often cited as the most significant Europe-USA co-operative space programme to date. On the positive side, from a European perspective, this was a unique opportunity to gain expertise in manned space activities. Some highlights are the flight of European mission specialist, Dr. Ulf Merbold, on the first Spacelab mission STS 9, in November/December 1983, and the Spacelab D.1 mission in October/November 1985. The latter marked the first time control of STS payload operations took place outside the USA, as they were con-

202. "Eureka: Europe's Battle Cry", K. Owen, Aerospace America, January, 1986, 28, the companies are Aeritalia, Aérospatiale, British Aerospace, CASA (Spain); and MBB.

203. Paragraphs 2.1 and 2.3 of the Declaration of Principles, op.cit. supra note 196, article IV 2.1 and 2.3.

ducted from the Payload Operations Control Centre (German Space Operations Centre) in Oberpfaffenhofen.[204] However, there have also been negative implications from such co-operative ventures. Regarding Spacelab, there is a strong impression in Europe that the fact that ESA spent up to $1 billion to develop a Spacelab module mandated more than the one free mission it received, i.e. the Merbold flight mentioned above. Under the terms of the intergovernmental agreement between ESRO (later ESA) and the USA,[205] as interpreted by the latter, when ESA delivered the Spacelab unit it became US property and, apart from the one free flight, all subsequent ESA utilization of Spacelab was to be cost-reimbursable just like any other user.[206] In addition, there have been some notable US withdrawals from co-operative programmes with ESA. Thus, the Aerosat and International Solar Polar Mission programmes were both

204. See 'D.1 Flight - A First for Europe' - Columbus Logbook No. 2, December 1985, 1.

205. 'Agreement Between the Government of the United States of America and Certain Governments, Members of the European Space Research Organisation, for a Cooperative Programme Concerning the Development, Procurement and Use of a Space Laboratory in Conjunction With the Space Shuttle System, done at Neuilly-sur-Seine, 14 August, 1973, entered into force for the USA the same day, 24 UST 2045, TIAS 7722.

206. Ibid., Article 7 paras A-F.

terminated prematurely by unilateral US cancellation.[207] Furthermore, the October 1986 NASA manifest for the STS incorporates significant delays in ESA programmes, such as EURECA by three years[208] and Ulysses indefinitely.[209] The general European impression that it received poor treatment in the launch manifest is said to be "serving as a new spur to the drive for European autonomy."[210] This drive for independence in space activities is also fueled by the desire for competitiveness adverted to above and is finding its natural expression in European space station planning.

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207. See infra Chapter II B 1(c).

208. See op.cit. supra note 192. EURECA was originally targeted for a 1988 launch and retrieval, the new mission timetable is for launch on 4 April, 1991, with retrieval some time in the fourth quarter of that year.

209. See Washington Roundup, AW&ST, 12 January, 1987, 17.

210. 'European Autonomy Takes Shape', Space Business News, 20 October, 1986, 5.

(b) The Columbus Programme - Cooperation for European Autonomy

European space station planning began in earnest in 1982, with the inauguration of the Space Transportation Systems Long-Term Preparatory Programme (LTPP).[211] The LTPP was augmented by the commencement, pursuant to ESA Council Resolution, of the Columbus Preparatory Programme (CPP) in June 1984.[212] This was followed up by an ESA Declaration by interested member States in November 1984, whereby the CPP was defined as covering "the definition studies of the specific elements for preparing a European in-orbit infrastructure, having regard to the US invitation to participate in its Space Station Programme."[213] However, the most significant decision on future European space activity was reached by a Ministerial level meeting in Rome on 31 January, 1985. By Resolution,[214] the ESA Council reaffirmed "its commitment to maintain and develop European

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211. 'Europe Weighs Joint Space Ventures', AWST, 30 May, 1983, 149.

212. See 'ESA Space Station Planning', J. Collet AAS 85-113 in Europe/United States. Space Activities op.cit. supra note 74, 97.

213. Ibid. 98.

214. ESA/C-M/LXVII/Res.1.

independent capabilities in space," and its approved set of objectives were stated to be

> based on the need for Europe to maintain and build on the achievements of the first two decades of European space co-operation, and to expand Europe's autonomous capability and Europe's competitiveness in all sectors of space activity.[215]

This was allied with a desire "to enhance international co-operation and in particular aim at a partnership with the United States through a significant participation in an international space station".[216] Thus, the Columbus programme for a European in-orbit infrastructure (IOI) was linked with the approval of Ariane 5 development, as the first two elements of the ESA ten year plan 1985-1995. This was coupled with an increase in the ESA general budget by 70 per cent at the end of the five year budget cycle in 1989, to approximately US $1.3 billion.[217] Both Ariane 5 and Columbus are estimated to cost some US$2.1 billion each.[218]

The phase B detailed design studies for Columbus were divided into two stages. The operative concept for

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215. Ibid, emphasis added.

216. Ibid., emphasis added.

217. 'Europeans Accept U.S. Offer to Participate in Space Station', International Herald Tribune, 1 February, 1985, 1.

218. Ibid.

phase B1 comprised four elements intended to lead to an eventual autonomous capability, namely:

- a pressurized module, either integrated within the US IOC or as a man-tended free flier (MTFF);
- two unmanned free-flying platforms, one co-orbital with the IOC and the other in polar orbit;
- a servicing vehicle, either manned or unmanned;
- and a resource module to supply power to the pressurized module in its free flying mode.[219]

Five aerospace contractors were involved, spearheaded by MBB/ERNO as systems co-ordinator.[220] Phase B2 began on 17 April, 1986, the number of member States involved in this optional programme having by then expanded to twelve.[221] As a result of negotiations with the USA on participation in

219. See 'Germany, Italy Propose Space Station', J.M. Lenorovitz, AW&ST, 20 February, 1984, 55; 'European Plan Columbus Manned Module for U.S. Space Station' (pictorial), AW&ST, 21 January 1985, 85; Columbus Logbook No. 7, September 1985 (unpaginated).

220. Aeritalia - pressurized module; British Aerospace-platforms; Aérospatiale - Service vehicle; and Dornier Systems - Resource Module, in ESA's Report to the Space Station Multilateral Programme Review, Washington, D.C., 23 July, 1985, obtained from ESA Washington office (unpaginated).

221. West Germany 38%; Italy 25%; France 15%; U.K. 15%; Spain 8%; The Netherlands 5%; Belgium 5%; Switzerland 2%; Denmark 1%; Sweden 1%; Norway 0.5%; and Austria 0.5%, total 116% of $80 million for the Columbus preparatory programme, see 'ESA Including More Nations in Columbus Project', AW&ST, 1 July, 1985, 51.

the US/International Space Station[222] and the findings of phase B1, the four elements chosen for intensive study were:

- a permanently attached (to the IOC) pressurized module to be launched by the STS and used for materials science, fluid physics and life sciences experimentation;
- a man-tended free flier (MTFF) launched by Ariane 5, consisting of a pressurized module and a resource module with a similar range of experimental capability to the attached module;
- a polar platform, again Ariane 5 launched; and
- an enhanced EURECA facility, deployed as a co-orbiting platform.[223] (See Figure I-5).

In addition to this maximization of Ariane 5 utilization,[224] European space transportation capability will be enhanced by the development of the Hermes reusable manned shuttle. Adopted by the Centre National d'Etudes Spatiales (CNES) in 1985, Hermes was advocated as a Boeing 707 - sized shuttle launched atop a man-rated Ariane 5, capable of carrying six astronauts (including two pilots)

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222. See supra, this Chapter Section B 1(b)(i).

223. 'Columbus Candidate Elements for Phase B2 Studies Chosen', Columbus Logbook no. 4, June 1986, 1.

224. Ariane 5 will be a heavy-lift launcher, powered by the HM60 cryogenic engine. The 5P, with two large solid strap-on boosters is anticipated to be capable of placing 8000 kg plus into geosynchronous transfer orbit (GTO) and some 16,000 kg to LEO, 'ESA Approves Two Studies for Future Space Presence', J.M. Lenorovitz, AW&ST, 9 July, 1984, 17, 18.

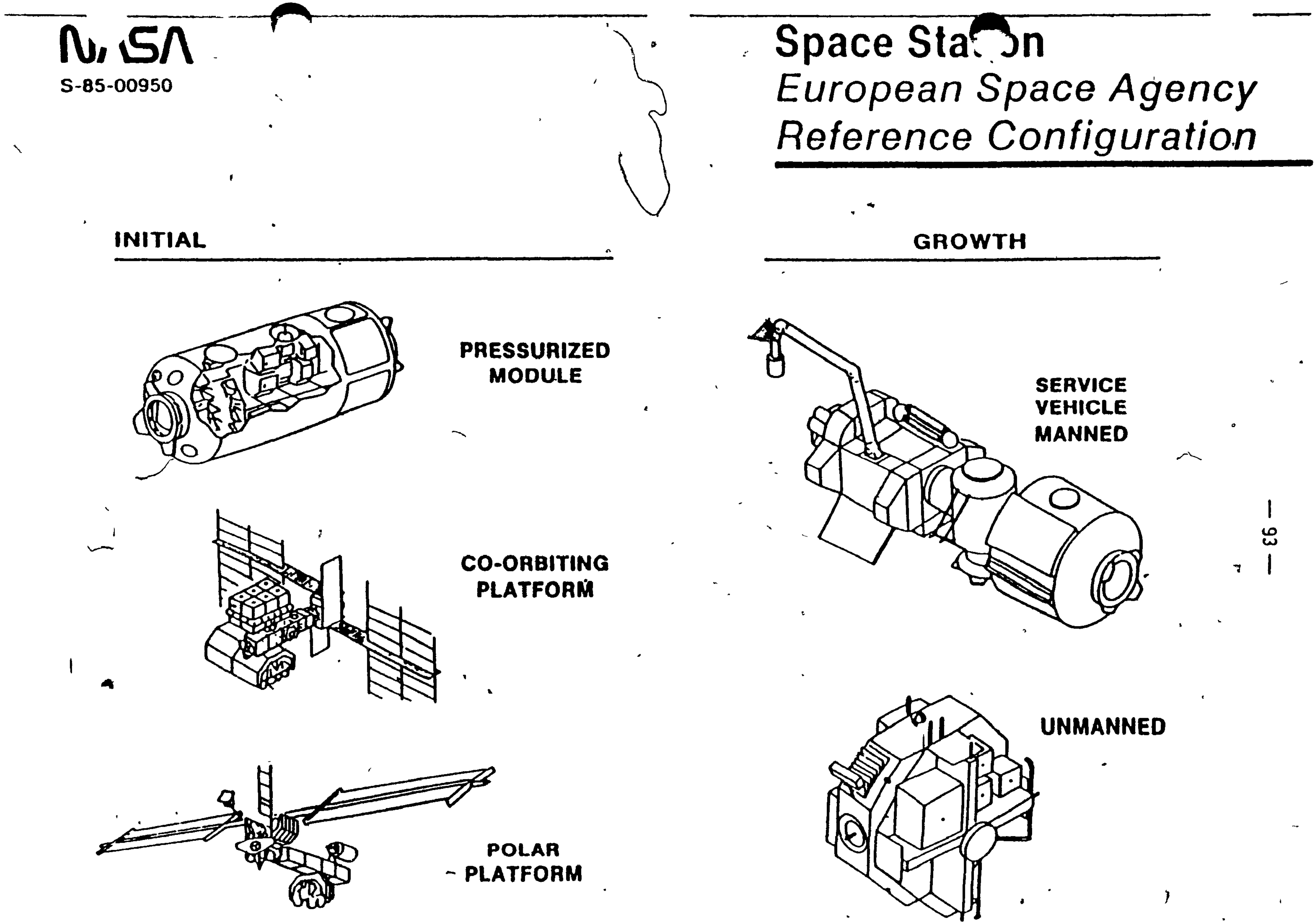

Figure I-5 Space Station - European Reference Configuration.
Source : T.F. Bonner Jr. "Space Station Update. The Dual Keel Configuration and More", 8 November, 1985 presentation to Space Station:Gateway to Space Manufacturing Conference, Orlando, Florida, 7-8 November, 1985,24.

and lifting a payload mass of some 4500kg to LEO.[225] Its three mission profiles were suggested as: autonomous missions for scientific and technological experimentation; in-orbit intervention for satellite repair and servicing; and space station-associated operations including crew relief, cargo transport and rescue capability.[226] ESA adopted Hermes as an optional programme on 27 June 1986[227] and eleven member states have joined so far together with Canada.[228] This US $2 billion project intends to produce two shuttles to be operational by 1995.[229] The shuttles are being designed to be compatible with both the US/ International and the Soviet space

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225 See 'Extracts from Hermes Programme, CNES 1985', Space Policy, February 1986, 82.

226. Ibid.

227. ESA Newsletter No. 2, September 1986 (unpaginated).

228. 'Ten ESA Member Nations Join Hermes Spaceplane Program', AW&ST, 8 December, 1986, 27. The ten are: Austria, Belgium, Denmark, France, Ireland, Italy, Spain, Sweden, Switzerland and West Germany. The United Kingdom also decided to participate on 19 March, 1987, 'Britain joins Hermes Space Plan Program', Satellite News, 30 March, 1987, 3. The U.K. is still pursuing its Horizontal Take-off and Landing (HOTOL) concept. Contractors for Hermes are Aérospatiale and Dassault-Breguet.

229. 'Europeans Plan 2 Shuttles', New York Times, 28 June, 1986, A14.

stations.[230]

The final component of the so-called 'Astonomous Operations Capability (AOS)'[231] is the ongoing development of a European Data Relay Satellite (EDRS). Three geostationary satellites comparable to the US Tracking and Data Relay Satellite network are under development, with the launch of the first two scheduled for 1994 or 1995.[232]

This four element AOC drive, comprising Columbus, Ariane 5, Hermes and the EDRS, is being tabled in the US/International Space Station negotiations with the aim of incorporating as much as possible into the European contribution. One of the motivations for this is that shares of annual total station user capability are to be calculated on the basis of operational contributions by each of the participants.[233] This is one of a veritable catalogue of difficulties which have arisen in negotiations between ESA and NASA for phase C/D of the space station. Issues which

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230. See 'Age of Space: A Soviet Step', op.cit. supra note 30.

231. 'Europeans Test the Waters for Columbus', Space Business News, 21 October, 1985, 1.

232. Op.cit. supra note 182, pp. 59-60.

233. 'New Set of International Negotiations on Space Station Begins', Space Commerce Bulletin, 18 July, 1986, 5.

have reached the public domain include:

- the status of the intergovernmental agreement, ESA would prefer a US Treaty format in the interests of legal certainty and programme continuity;[234]

- technology transfer, especially in view of DOD participation in the project which adversely affects this already difficult process;[235]

- security for intellectual property rights in inventions made aboard the space station for commercial exploitation;[236]

- a US Congressional attempt to confine European activities to life sciences experimentation, i.e. exclude them from access to materials processing manufacturing technology;[237] and

- ensuring an overall equitable basis in management responsibility etc... among a partnership of comparably strong

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234. See for example 'Germany Approves Participation in Space Station, New Ariane', M. Feazel, AW&ST, 21 January, 1985, 17, 19; and 'U.S., Europe Deadlock Over Station Participation', C. Covault, AW&ST, 24 November, 1986, 16, 17, this is dealt with in detail infra Chapter II passim.

235. Op.cit. supra note 119, and 'Europeans Concerned by Delay in Planned Space Station Talks', AW&ST, 22 December, 1986, 25, this is addressed infra Chapter VE.

236. "Allies Detail Space Station Options', Space Business News, 8 April, 1985, 3, see infra Chapter VD for a treatment of this issue.

237. 'Lack of Clear U.S. Space Policy Raising International Concerns', AW&ST, 23 June, 1986, 22.

players.[238]

In concluding this section on European space station activity, it is interesting to recall a lesson from the past. During design studies for the STS in the early 1970s, the USA encouraged European participation in this post-Apollo programme. Two concepts were studied by a number of companies under ESRO auspices, a sortie laboratory and a space tug.[239] After considerable European investment in the favoured space tug concept, the advent of DOD involvement in the STS dictated a reduced foreign participation, particularly in the space tug, which was viewed as strategically important.[240] This later emerged as the US Air Force's Inertial Upper Stage. As a result Europe was only permitted to work on the less expensive Spacelab module. According to the US Congressional Office of Technology Assessment,

> in 2 years, the United States went from its initial encouragement of substantial international cooperation in space transportation system development to a position in which only payloads were being discussed. This change in position left

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238. 'Co-operation on Space Station', W.H. Gregory editorial, AW&ST, 9 July, 1984, 9.

239. See 'International Involvement in a Civilian "Space Station" Program', H. Bortzmeyer, in Appendix C to the OTA Report, Civilian Space Stations and the U.S. Future in Space, op.cit. supra note 86, 177, 199.

240. Ibid.

> segments of the European space community suspicious of U.S. intentions and disturbed by its peremptory behaviour.[241]

As a consequence of this, the progress towards European independence in space began.

> It was the difference in cost between the expensive tug development program and the less expensive (at the time) Spacelab program which freed up the funding needed to initiate joint European support of Ariane.[242]

3. JAPAN - TECHNOLOGICAL AUTONOMY

> Japan has...adopted the following as the basic principles of its space development policy: responding to social needs, maintaining harmony with available national resources and international activities, and preserving autonomy in space development.[243]

241. International Cooperation and Competition in Civilian Space Activities (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-ISC-239, July 1985) 137.

242. Op.cit. supra note 239.

243. UN Doc. A/CONF.101/NP/39, 9 September, 1981, National Paper: Japan, to the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, 1. (Emphasis added).

(a) Japanese Space Programme Infrastructure

Japan's organizational infrastructure for space activities exhibits a basic dichotomy between science and applications technology. The Institute of Space and Aeronautical Science (ISAS), founded in 1964 under the auspices of the Ministry of Education,[244] is responsible for scientific research in space and has developed a series of launch vehicles.[245] Of more significance in the present context, is the National Space Development Agency (NASDA). Created in 1969, NASDA was based at Tsukuba Science City and began development of the Tsukuba Space Centre for spacecraft test and check-out operations the year after.[246] Since then the Space Centre has expanded to include mission control and manned space flight operations.[247] NASDA's launch facility, Tanegashima Space Centre, inaugurated launch activity in 1975 and has

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244. Ibid., 2.

245. These have culminated in the Mu 3S-2 ELV, capable of launching 770 kg to LEO, see 'Japan Prepares for Next Space Phase', AW&ST, 12 March, 1984, 129, 130.

246. 'Building Japan's Technology Base', Editorial by D.F. Fink, AW&ST, 21 July, 1986, 13.

247. 'Tsukuba Expanding Mission Control, Vehicle Checkout Facilities', C. Covault, AW&ST, 18 July, 1986, 40.

proven itself a mature capability since then. NASDA's management reports to the Science and Technology Agency (STA) and the Ministries of Transport and Posts and Telecommunications. Overall co-ordination of Japanese space activity is performed by the Space Activities Commission (SAC) which advises the Prime Minister.[248] The SAC formulated a 'Space Development Policy' in March 1978[249] which established four main goals for the Japanese space programme, which should:

- "be confined to peaceful purposes";
- respond to general social needs with an accessible format;
- promote autonomy in space development, in view of the fact that

> Japan has so far been to a large extent dependent for space technology on advanced nations or has been greatly influenced by them. However, Japan has to develop its own technological resources...so that it may be able to proceed with its space development activities properly and freely.[250]

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248. See National Paper, op.cit. supra note 243, 6.

249. See Outline of Japan's Space Development Policy, Space Activities Commission, 17 March, 1978, reproduced in International Space Activities, Hearings before the Sub-Committee on Space Science and Applications of the Committee on Science and Technology, U.S. House of Representatives, 95th Congress, 2d. sess., May 1978, No. 74, pp. 81-115.

250. Ibid., 86.

- and foster international cooperation.

> Japan's space development will be pushed forward while maintaining cooperation as much as possible with other such activities around the world. For this purpose, Japan will develop various satellites and launch vehicles necessary for her and when the necessity arises for activities which are beyond Japan's technological capability ... it will utilize space shuttle and other means, in order to advance its own space development to an internationally high standard.[251]

With this background, a review of relevant technology follows, to build up a composite picture of Japanese space station activity.

(b) Space Station - Related Developments in Japan

(i) Unmanned Activities - The progression towards Japanese launch capability began with the provision in a 1969 Intergovernmental Agreement with the USA for the transfer of Thor-Delta technology to Japan.[252] Paragraph two of this Agreement contained the Japanese undertaking

> (a) to ensure that any technology or equipment transferred to Japan...will be used solely for peaceful purposes; [and]

251. Ibid., pp. 88-89. (emphasis added).

252. 'Agreement Concerning Co-operation in Space Activities for Peaceful Purposes', Tokyo, 31 July, 1969, entered into force the same day, 20 UST 2720, TIAS 6735, 720 UNTS 79.

> (b) to take all available steps in accordance with Japanese laws...to prevent transfer to third countries of such technology and equipment, and any launch vehicles and...satellites ... manufactured [thereby] except by mutual agreement between the two Governments.

This was augmented by a 1980 Intergovernmental Agreement[253] between the same parties, also relating to the transfer of launcher technology, which states in article 4 that transferred equipment and technology "will not be [further] transferred to any third countries and will not be used to launch projects for any third countries, except by prior agreement between the Governments...." This has been interpreted as prohibiting the launch by Japan of foreign satellites without US permission.[254] Despite these limitations, and a restrictive agreement with the Japanese fishing unions which effectively limits launch frequency to four per year,[255] NASDA developed the N-I and N-II ELVs based on licensing arrangements permitting Japanese con-

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253. 'US-Japan Agreement on Space Cooperation: Launch Assistance', effected by exchange of notes and in force 3 December, 1980, TIAS 9940.

254. See Smith, op.cit. supra note 6, 134.

255. Launches are limited to January, February, August and September each year, see 'Japan's Space Effort Moves into Operational Phase', AW&ST, 8 March, 1982, 107.

struction using US technology.[256] However, a significant step towards an indigenous launch capability was taken with the successful launch on 13 August, 1986 of the H-1 ELV.[257] The first stage and strap-on boosters were the same as those for the N-II vehicle, but the cryogenic LE-5 powered second stage was developed by the National Aerospace Laboratory and NASDA and built by Mitsubishi Heavy Industries Ltd.[258]

A new plateau in Japanese capability will be reached with the production of the follow-on H-2 vehicle. Able to place a two-tonne payload into geostationary

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256. The N-I, a three stage ELV, made under licence in Japan from US-derived technology, succeeded in placing a satellite in geostationary orbit in 1977, the third nation to do so after the USA and USSR. The N-II, also US-derived and licensed, became operational on 11 February, 1981, and was, until recently, the main Japanese applications satellite launcher. Industrial transfers occurred between: McDonnell Douglas Astronautics Corporation and Morton Thiokol from the USA and Nissan Motor for solid propellants; Rockwell International and Mitsubishi Heavy Industries Ltd., (MHI) for liquid-fueled technology; and Aerojet and Ishikawajima-Harima Heavy Industries (IHI) for cyogenics.

257. 'Japan H-1 Rocket Initiates Advanced Launch Operations', AW&ST, 18 August, 1986, 25.

258. Ibid.

orbit,[259] the H-2 will augment the Japanese components of the H-1 to produce an entirely indigenous ELV.[260] Thus, Japan will be enabled to launch foreign payloads unfettered by US control and so compete with Arianespace S.A. and the US ELVs (and any residual shuttle commercial capacity) following the first launch of the H-2 set for January 1992.[261] Of particular interest in the present context, are plans to use the H-2 as an automatic logistics resupply vehicle for the US/International Space Station.[262] In order to accomplish this, Japan will have to develop automatic rendez-vous technology comparable to the Soviet Progress vehicles.[263] As currently envisaged, Japan will develop a "boxlike" external facility, reminiscent of the US

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259. 'Japan Schedules First Flight of H-2 Launch Vehicle for 1992', J.M. Lenorovitz, AW&ST, 21 October, 1985, 127. The H-2 will be capable of lifting 3.8 tonnes to Geosynchronous Transfer Orbit.

260. The LE-7 cyogenic engine will power the first stage and is ten times more powerful than the LE-5 driving the second stage. MHI, IHI and Nissan Motor are all involved once more.

261. 'Japan Preparing New Spaceport Facilities for H-1, H-2 Rockets', AW&ST, 14 July, 1986, 51; and Space Business News, 20 October, 1986, 5.

262. 'Mitsubishi Expands Facilities for H-2 Booster Development', AW&ST, 14 July, 1986, 56, 60.

263. Ibid. see supra section II A-1.

Long Duration Exposure Facility (LDEF), as part of its contribution to the space station.[264] This STA/NASDA project is to be launched atop an H-2 and orbit as a free flier in 1994, prior to being mounted to the Japanese pressurized space station module, to be discussed presently.[265] In addition, a number of Japanese Companies have banded together to form the Institute for an Unmanned Space Experiments Platform, which will work with MITI and the ISAS towards the launch of a free flier in 1992.[266] Originally intended to be launched from a US shuttle, the restricted STS launch manifest may prevent this until after the space station is assembled. However, a parallel STA, MITI, Ministry of Education and NASDA plan calls for an H-2 launched free-flying laboratory on orbit by 1992.[267]

The final component of projected unmanned station-related activities, is the development of Japanese Data

264. 'Japanese Groups Differ on Plans for Space Program Expansion', AW&ST, 10 March, 1986, 138.

265. Ibid.

266. 'Japan Challenging Western Leadership in Space', AW&ST, 14 July, 1986, 18, 22.

267. Space Business News, 25 August, 1986, 1; and Space Commerce Bulletin, 29 August, 1986, 10.

Relay Satellites, which would most probably be H-2 launched.[268]

(ii) Manned Activities - Japanese MPS experimentation occurred during the US SKYLAB mission in 1973.[269] This has been followed up by the purchase of time on the dedicated MPS Spacelab flight, called both Spacelab J and the 'First Materials Processing Test'. Originally scheduled for 1988, the post-Challenger Shuttle manifest sets a second quarter of 1991 launch slot for this mission. The first Japanese astronaut will fly aboard the Shuttle for this mission, as a payload specialist.[270] In addition, the Space Technology Corporation, a recently formed Japanese company uniting the expertise of six individual corpora-

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268. 'Japan's Space Initiatives', editorial D.E. Fink, AW&ST, 14 July, 1986, 13.

269. OTA Report op.cit. supra note 241, 352.

270. The choice will be between Chiaki Naito, a heart specialist, Takao Doi, a launch vehicle specialist, and Manoru Mori, a professor of nucleonics, 'Japan Selects Three Candidates For Shuttle Flight', AW & ST, 19 August, 1985, 25.

tions,[271] has successfully negotiated with Intospace (the European microgravity marketing group), for space aboard the West German Spacelab D2 mission in the 3rd quarter of 1991.[272] A memorandum of understanding has been signed between the two organizations to govern this and future such operations.[273] Pursuant to Spacelab activities, the Japanese government is negotiating with the USA for mission control to be performed from Tsukuba Space Centre, in the same way as the German D1 mission was conducted from Oberfaffenhofen.[274]

Following a June 1982 invitation by NASA to participate in preliminary space station definition studies, the SAC established an Ad Hoc Committee on Space Station

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271. Toshiba Corp., NEC Corp., Hitachi Ltd., Fujitsu Ltd., Mitsubishi Electric Corp., and Ishikawajima-Harima Heavy Industries Ltd. A 40 company group called the Japanese Space Utilization Promotion Centre has also been formed to promote commercial space efforts, 'U.S. Commercial Space Industry Sees Foreign Countries Moving Ahead', Space Commerce Bulletin, 18 July, 1986, 7.

272. 'Japanese Companies, Intospace Discuss Spacelab D2 Flight', AW&ST, 16 June, 1986, 28; and 'Intospace Agrees to Fly Japanese Experiments', AW&ST, 17 November, 1986, 18.

273. Ibid., 'Intospace Agrees...'

274. 'Japan Seeks Operational Control', Space Business News, 18 November, 1985, 11.

Programme in August of that year.[275] In its final report of 10 April, 1985, the Ad Hoc Committee stated that

> it will become increasingly important to provide autonomous capability for space utilization in the future advancement of science and technology as well as improving the national life style.[276]

The Committee carried out an assessment of Japanese participation in the space station project on the basis of four areas of interest: "acquisition of highly advanced technology"; "promotion of the next generation science and technology coupled with expansion of space activities"; "contribution to international cooperation"; and "encouragement of practical use of the space environment".[277] It concluded by recommending Japanese participation by the construction of a Japanese Experiment Module (JEM), while once again stressing the desire for autonomy.[278] The JEM (see Figure I-6) is to comprise: a permanently attached pressurized module/laboratory for MPS and life sciences experimentation; the aforementioned exposed facility to be

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275. In Preface to 'Basic Plan for Japanese Participation in The Space Station Program', 10 April, 1985, Final Report of the Ad Hoc Committee on Space Station Programme, SAC, Japan, obtained from the NASDA office in Washington, D.C.

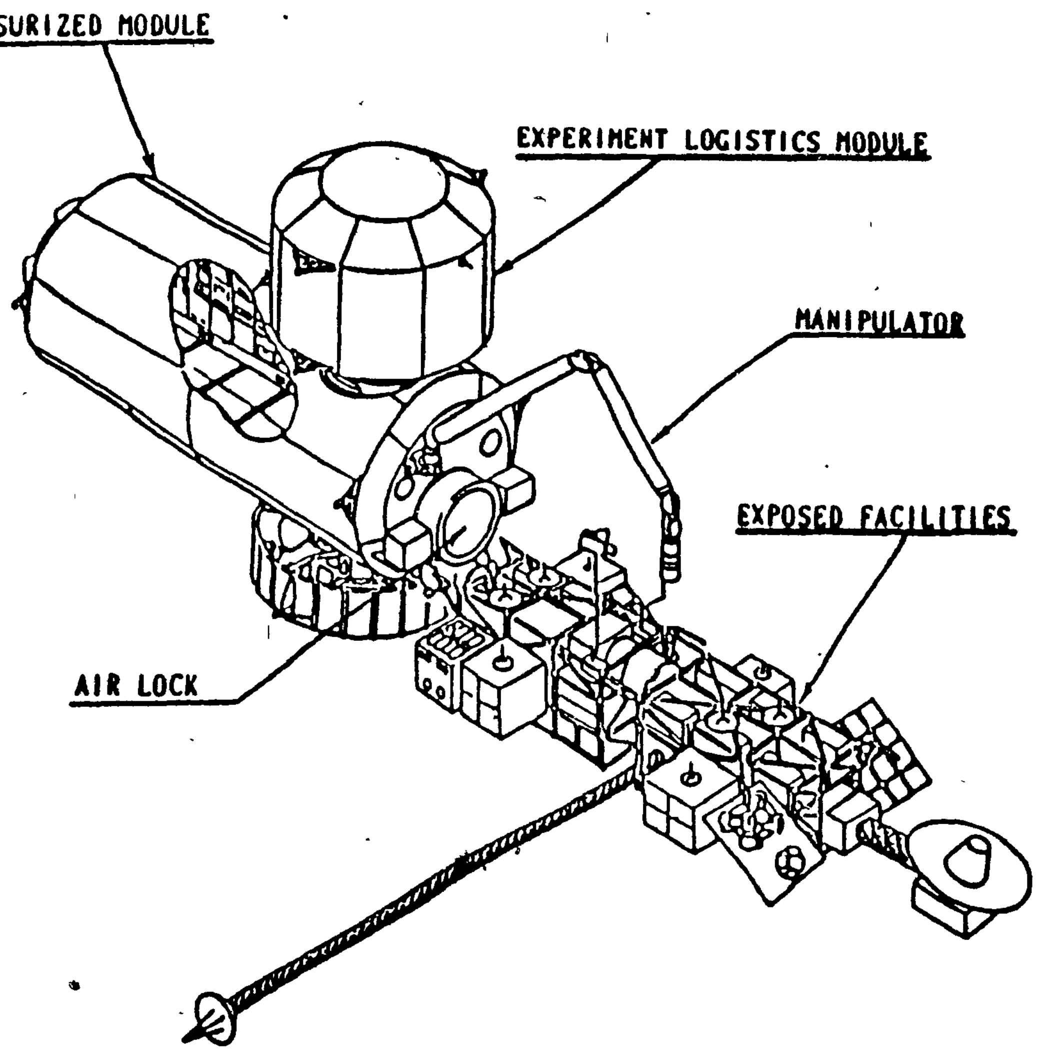
276. Ibid., 13.

277. Ibid., pp. 14-16.

278. Ibid., 21.

SPACE STATION PROGRAM
REFERENCE CONFIGURATION

JAPANESE EXPERIMENT MODULE (JEM)



OSSTT-61D
NASA HQ S86-445 (1)
2-28-86

Figure I-6 Source : NASA.

mounted thereto and to include masts and remote manipulators; and a logistics module to inter alia function as a transport container for returning materials to the Earth.[279] NASDA was designated as the organization to conduct JEM development and it has since formed a Space Station Integrated Project Centre to further this aim.[280] It is anticipated that Japan will spend approximately US$1.5 billion on space station activities.[281] Particular Japanese concerns about the space station project have been reported as being that: the station be used for peaceful purposes only; the USA be committed to it;[282] and proprietary information should be sufficiently protected, either by data encryption or by employing shuttles to transport data on sealed discs.[283]

The final element of this ambitious manned space programme, is the conduct of a three-phase shuttle development plan. Its proponent, the National Aerospace Labora-

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279. Ibid., pp. 22-27.

280. 'Japan Planning Space Agency Unit to Participate in U.S. Station', AW&ST, 30 June, 1986, 24.

281. Space Business News, 11 August, 1986, 1.

282. Space Commerce Bulletin, 31 January, 1986, 10.

283. 'Internationalizing NASA's Space Station', editorial D.E. Fink, AW&ST, 28 October, 1985, 13.

tory, has formulated a timetable that would see a 1995 test of a subscale model, followed by a manned launch of a "small winged manned vehicle" before 2000 atop an H-1 or H-2 ELV.[284] The final phase would be the launch of a larger four-man shuttle comparable to the European Hermes vehicle, on an H-2 equipped with additional solid rocket boosters in the early 21st century.[285]

(c) Cooperative overtures for the Space Stations' Era

Despite the predominantly nationalistic nature of the Japanese space station-related programme just outlined, there is an analogous interest in cooperation beyond that in the US/International Station. This has manifested itself in two proposals. The first, is for the construction of a "Pacific Spaceport" possibly centred on Kiribati "to encour-

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284. 'Japan Pursues Space Shuttle Advanced Technology Work', C. Covault, AW&ST, 21 July, 1986, 84.

285. Ibid., and 'Japan Predicts Shuttle Accidents Will Delay its Programs', AW&ST, 10 February, 1986, 62, 63.

age space commercialization in the Pacific Basin".[286] This is being advocated by Tetsuo Kondo a Diet Member and US Senator Spark Matsunaga (D. Hawaii).[287] In addition to launch activity, the Spaceport would be a focus for international space activities.[288] This assumes significance in view of the widespread belief in the forthcoming "Pacific Century". The second proposal, emanating from the Japanese government, is for a US $5 billion research programme;[289] funded by Japan, the programme called "Human Frontiers" would unite the United Kingdom, France, West Germany, Italy, Canada and the USA in a joint human-biology research drive.[290] It is no coincidence that the Group of Seven (G7) Western industrialized nations is also involved in space station activities.[291]

286. 'Japan Investigates Pacific Spaceport', Space Business News, 30 December, 1985, 1, and Space Business News, 8 September, 1986, 1.

287. Ibid., Space Business News, 30 December, 1985, 7.

288. Ibid.

289. 'Science Proposal Pressed by Japan', P. Lewis, New York Times, 9 April, 1986, A7.

290. Ibid.

291. See infra this Chapter B5.

4. CANADA - BUILDING FOR THE FUTURE

> The Canadian Space Program is an undertaking with a vision: to launch Canadian space technology into the 21st century and, at the same time, to enrich the Canadian economy by creating new industries and jobs.[292]

(a) Canadian Space Policy

On 19 March, 1984, the Liberal Minister of State for Science and Technology Donald Johnston, in recognition of Canada's unique position as "the only nation in which the national space industry sells more than the government spends on space",[293] approved a two year funding plan (1984/85 and 1986/87). Ranking sixth in amount[294] was an allocation of Cdn$2.4 million for commissioning "a one year study to define possible Canadian participation in the space

292. The Canadian Space Program: New Initiatives, Ministry of State, Science and Technology Canada, May 1986, 1.

293. Minister of State, Economic and Regional Development, Science & Technology, News Release, 19 March, 1984.

294. Ibid. Behind ERS-1 $29.7 million; RADARSAT $21.1 million; Ground Systems to receive data from ERS and RADARSAT - $21.5 million; Space Science - $18.9 million; and M-SAT - $3.9 million.

station program of the U.S."[295] This was part of a total planned expenditure of Cdn$445.7 million to 1987. In 1985, following a change of government, the Conservative Minister of State for Science and Technology, Dr. Tom Siddon, announced an 'Interim Space Plan 1985-1986'.[296] In addition to continued support for MSAT - a commercial mobile communications satellite - and RADARSAT - a remote sensing satellite for resource monitoring and navigation - tnere was an acceptance of the US invitation to participate in the space station programme.[297] The following excerpt from the Interim Space Plan is clearly evocative of the characteristic pragmatism with which Canada approached this issue:

> Space Station will be the predominant civilian space initiative of the remainder of this century and will alter dramatically many of the established ways of operating in space. Canadian participation would permit us to maintain and improve our competitiveness in a number of leading edge space technologies. All of our international partners have decided to participate which will afford us further opportunities to develop new business relationships and co-operative programs with the world's major space nations.[298]

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295. Ibid.

296. Ministry of State, Science & Technology Canada, Interim Space Plan 1985-1986, 20 March, 1985.

297. Ibid., pp. 1-2.

298. Ibid., 4.

In addition to conceptualizing an Integrated Servicing and Test Facility (ISTF) incorporating a robotic servicer system based on CANADARM technology (see figure I.7), the RADARSAT programme was targeted for integration with the space station project through including an in-orbit servicing capability.[299] Furthermore, there was a commitment to the development of a "long-term Strategic Space Plan".[300]

Canada became the first of the partners to sign a Phase B Memorandum of Understanding with NASA for the conduct of the space station programme, on 16 April, 1986.[301] A year later, the two parties produced a Programme Level Agreement, called for by article 3.2 of the Phase B MOU.[302] The Programme Level Agreement defined the Mobile Servicing Centre (MSC) as the Canadian contribution to the space station. The MSC will be discussed in

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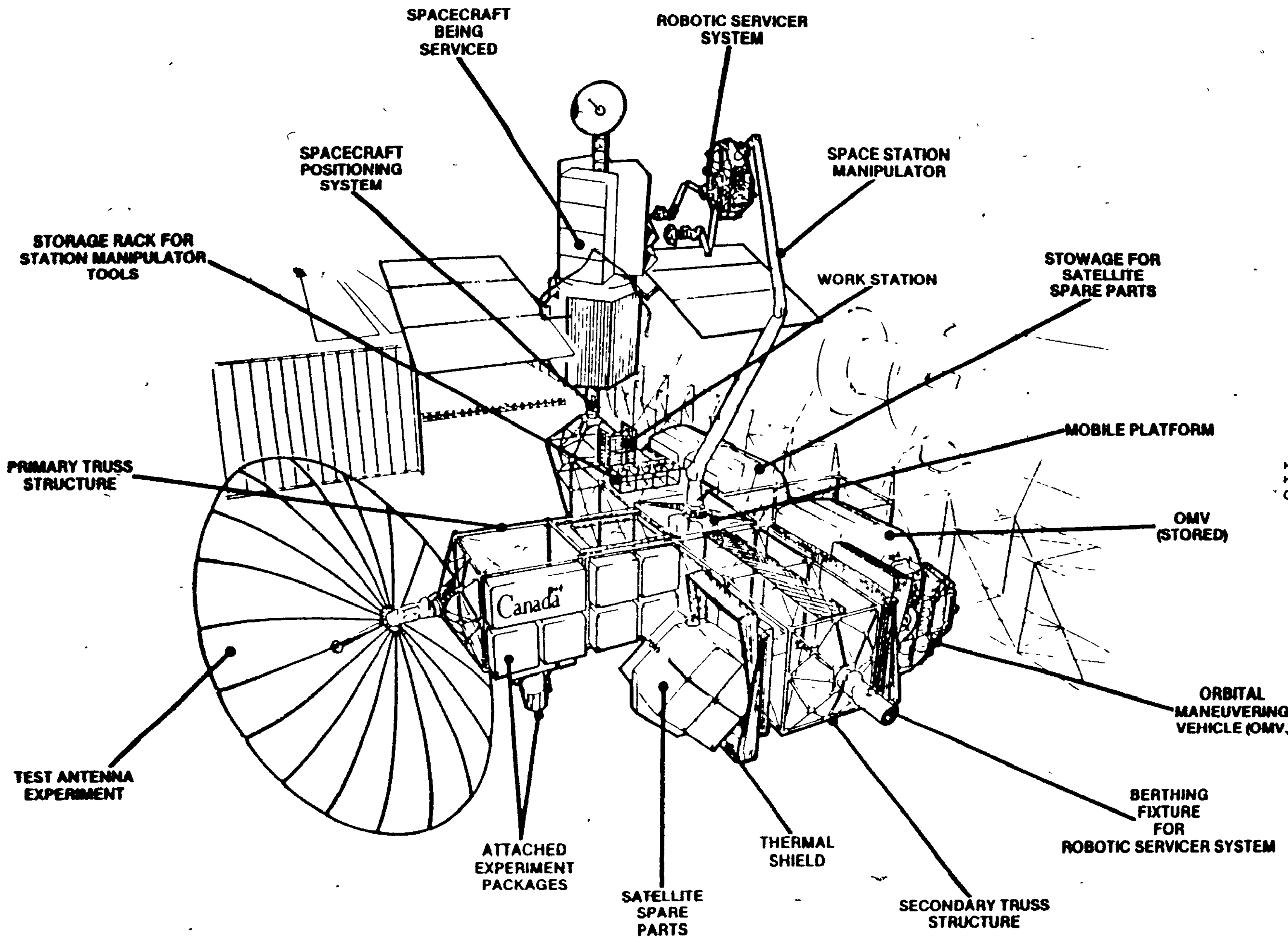
299. Government of Canada News Release, 20 March, 1985, 'Interim Space Plan Announced', 3.

300. Op.cit., supra note 296, 1.

301. 'Memorandum of Understanding Between the Ministry of State for Science and Technology and the National Aeronautics and Space Administration for a Cooperative Program Concerning Detailed Definition and Preliminary Design (Phase B) of a Permanently Manned Space Station'.

302. Ministry of State, Science & Technology Canada, MOSST/NASA Agreement, Canadian Hardware Elements Proposed For Development For Space Station, March 1986.



INTEGRATED SERVICING & TEST FACILITY (ISTF)

Figure I-7 Source : National Research Council Canada <u>Canadian Participation in Space Station</u> (undated) more detail in the next section.

The long-term Canadian Space Plan was released in May 1986 under the auspices of the new Minister of State for Science and Technology Frank Oberle and the Ministers of Communications and Mines.[303] The seven point plan, dominated by the funding levels for space station activities, appears in Table I-5, which is drawn from the official statement of the Programme. Considerable commercial benefits were therein predicted, in two categories: terrestrial industrial spin-off from the Mobile Servicing Centre - Cdn$5 billion plus by the year 2000; and user revenues from materials processing - up to Cdn$400 million by the year 2000.[304] In addition, the plan included enhanced co-operation with ESA through participation in its Hermes programme, with a view to contributing expertise based on CANADARM technology.[305] Furthermore, there was a renewed commitment to the Canadian Astronaut Programme, being conducted by the National Research Council.[306]

303. Op.cit. supra note 292, Marcel Masse (Communications) and Robert Layton (Mines).

304. Ibid.

305. Ibid. 4.

306. Ibid.

TABLE I-5

HIGHLIGHTS OF THE NEW INITIATIVES

The following table summarizes the new initiatives:

New Initiatives	Estimated Costs ($M) 1986/87-1990/91	1986/87-2000/01
1. Support for the implementation by Telesat Canada of a new commercial communications satellite system for mobile users (MSAT) through guaranteed lease of services, market development, and technology development. (DOC)	15	151
2. Participation in the Space Station Program through the provision and operation of a Mobile Servicing Centre for assembly, maintenance and servicing of the Station. (NRC)	169	697
3. Space Station User Development Program for the development of Canadian industrial capabilities to use the Space Station for space-based manufacturing. (NRC)	50	100
4. Remote Sensing Program for the development of advanced technologies and applications for the reception, processing and analysis of radar and other remote sensing data and continued planning for RADARSAT with the objective of obtaining financial commitments from the private sector, provincial and foreign governments. (EMR)	27	77
5. Expanded cooperation with Europe through a long term continuing relationship with the European Space Agency (including participation in remote sensing and communications development programs) and through participation in the spaceplane program (Hermes) of France. (MOSST, EMR, DOC)	39	123
6. Establishment of the Canadian Astronaut Program on a continuing basis. (NRC)	15	55
7. Additional funding for Space Science. (NRC)	20	70

Source : Ministry of State Science and Technology Canada The Canadian Space Programme: New Initiatives May 1986,2.

The final relevant element of recent Canadian policy on space is the creation of a Canadian Space Agency. This had been advocated in October 1985 by the Science Council of Canada[307] and in November of that year by the Canadian Institute for Advanced Research[308] in reports submitted to the Government. The thrust of these submissions was that the existing fragmented space programme conducted by several Government Departments,[309] albeit with co-ordination by an Interdepartmental Committee on Space, was unsatisfactory to focus Canadian space activity and ensure its future competitiveness. In October 1986, the Canadian Government committed itself to the establishment of a Space Agency by the Spring or Summer of 1987.[310] The Agency will have a Cabinet appointee as a Director, and be

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307. Science Council of Canada News Release, Ottawa, 23 October, 1985.

308. Canada and the Space Station - A Report to the Government of Canada, 22.

309. Departments of Energy, Mines and Resources for remote sensing, Department of Communications for telecommunications, the National Research Council for Science and astronaut activities, and the Ministry of State for Science & Technology for Space Station.

310. 'Cuts of $26 million at research council likely to cost jobs', S. Strauss, The Globe and Mail, 9 October, 1986, A4.

answerable to the Minister of State for Science and Technology.[311]

(b) The Mobile Servicing Centre

As defined in the Programme Level Agreement mentioned above, the MSC (see figure I-8) incorporates a remote manipulator system and will perform the following functions: attached payload servicing (not free fliers); space station assembly; station maintenance (external); transportation on the station, on the NASA-developed truss structures; deployment and retrieval operations; and Extra Vehicular Activity (EVA) support.[312] The MSC will not be used to service free flying platforms or future-developed Orbital Manoeuvring Vehicles (for instrumentality movements in LEO) and Orbital Transfer Vehicles (for LEO to GEO and vice versa instrumentality transportation). These elements will be serviced by a NASA-developed Flight Telerobotic System, work on which is currently being coordinated by Goddard Space Flight Centre in Greenbelt, Maryland.[313]

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311. Ibid.

312. MOSST/NASA Agreement op.cit. supra note 302, 2.

313. Ibid. 1 and 'Goddard Will Lead Space Station Information and Robotics Work', T.M. Foley, AW&ST, 1 September, 1986, 215.

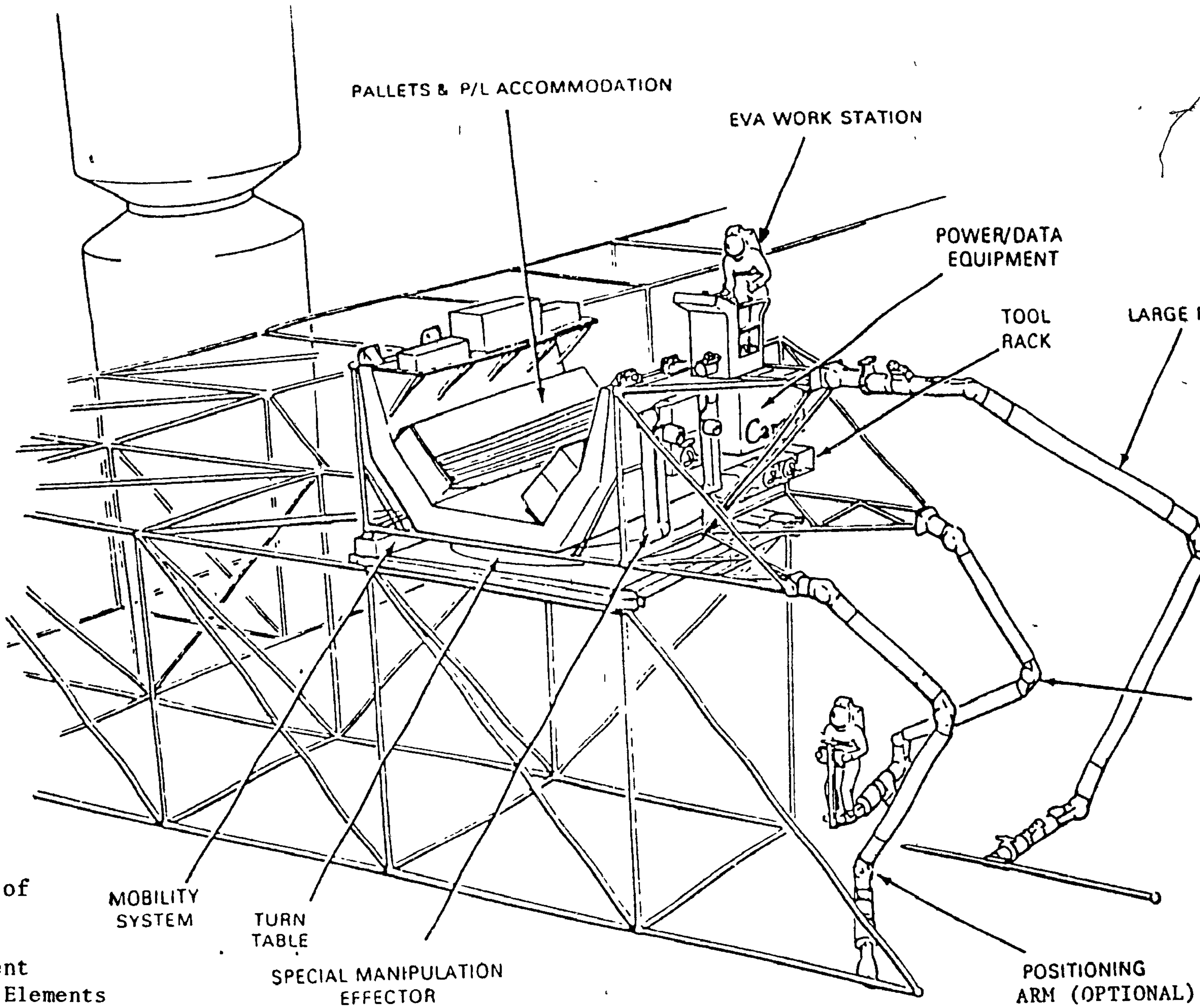

Figure I-8
Source : Ministry of State Science and Technology Canada.
MOSST-NASA Agreement
Canadian Hardware Elements Proposed for Development for Space Station.

MOBILE SERVICING CENTRE (MSC)

The area of Automation and Robotics (A&R) is anticipated to be very lucrative in its terrestrial applications, and several members of the US Congress have expressed concern lest Canada reap too many benefits through its space station participation.[314] The MSC is a natural extension of CANADARM technology and is intended to consolidate Canada's position as a world leader in A&R.[315] This is certainly a continuation of the Canadian ethos, as stated in the 1986 Space Plan, of success stemming from "our ability to apply limited resources to areas where the payoffs are the highest."[316]

In addition to the MSC, Canada will provide a 'fixed servicing site' resembling an aircraft hangar, in which to *inter alia* locate satellites for servicing operations.[317] Total Canadian expenditure on its space station contribution is estimated to be Cdn$800 million, with some Cdn$200 million required for annual maintenance

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314. *Ibid.* 217, and 'New Set of International Negotiations on Space Station Begins'', *op.cit. supra* note 233.

315. See *Canada and The Space Station* Report, *op.cit. supra* note 308, pp. 10-14.

316. *Op.cit. supra* note 292, 1.

317. *Op.cit. supra* note 312.

when the Space Station is operational.[318]

Canada would appear to have been the least problematic partner during phase C/D & E space station negotiations. This is principally due to the nature of its participation which (probably) involves the least amount of duplication among all the partners contributions. However, the recent SDI association with the space station has caused External Affairs Minister Joe Clark to threaten Canadian withdrawal from the Space Station programme unless satisfactory assurances are given regarding its use for "peaceful purposes".[319]

5. THE COOPERATIVE/COMPETITIVE CONTINUUM

> Space is a high profile, international arena where the industrially developed nations display their technological prowess for the rest of the world to see.[320]
>
> Space is not a panacea, space technology helps to solve many problems of economic development, but has to be integrated into

318. '$1 billion tab for our Space-Station Garage', The Gazette, Montreal, 19 March, 1986, B1.

319. 'Ottawa manifeste son impatience', J. Coulon, Le Devoir, 16 February, 1987, 6.

320. Canadian Interim Space Plan op.cit. supra note 296, 8.

an overall approach to these problems. Carrying out space programmes is not an end in itself, merely one means that governments can employ in order to achieve certain economic and social goals.[321]

There are clearly strong nationalistic (or regionalistic in the case of ESA) reasons for embarking on the US/International Space Station. It is no coincidence that the chief participants in this venture are also members of the Group of Seven (G7) Western Industrialized Nations.[322] There is a clear perception of participation in the project being used as a technology-driver, to fuel terrestrial industries in the leading-edge high technologies inherent in activities in space. The so-called spin-off effect is not confined to specific products as Apollo was, but is anticipated to revolutionize entire disciplines such as materials processing, A&R, artificial intelligence and expert systems. These will be the industries of the 21st century and all the G7 nations want to be in the competition for the new markets which they will create. The consequence of exclusion is second class status as a nation and a concomitant weak economy. Thus, the commitment of large

321. UN Doc. A/CONF.101/NP/37, 17 August 1981, Joint National Paper, submitted by the ESA Member States to the Second U.N. Conference on the Exploration and Peaceful Uses of Outer Space, 9.

322. G7 comprises the USA, Japan, Canada, United Kingdom, France, West Germany and Italy.

sums of money to participate in the US/International Space Station is an investment, not an altruistic act of largesse in pursuit of international cooperation for its own sake. However, during negotiations the commercial rationale has repeatedly come into conflict with the dynamics of international cooperation on this scale. Furthermore, problems due to inequalities of bargaining power and fears concerning transfer of technology have contributed to the creation of considerable barriers to cooperation.

Despite these seemingly insurmountable difficulties, there are clear advantages to collaboration. The obvious one is cost-sharing, since large-scale duplication of technology is an unjustifiable waste of resources. From the US perspective, this may be the only way NASA can obtain the necessary funding, short of the DOD making up the deficit. The other partners cannot develop their own space station capabilities - transportation, communication, pressurized modules and free fliers - by the timeframe set for the US/International Space Station. However, there comes a point where Europe and Japan may be prepared to wait the four to five years it would take to have their own capabilities. There can be no doubt after the discussion above that they are aiming towards significant, if not total, independence in Space. Nevertheless, collaboration would ensure commonality of systems for safety and rescue missions, although Hermes is being designed to be compatible with the Soviet MIR station. In addition, successful cooperation would provide a continuation and strengthening of existing political and economic alliances. Furthermore, with responsible technology transfer arrangements there is considerable synergistic potential which would not be tapped if each space power is pursuing similar technology.

Clearly, a compromise must be reached between these two opposing forces. There must be a recognition that only part of what the space station project means will include areas which are inherently capable of benefitting from international cooperation on an institutionalized or formalized basis. Thus, life sciences, astrophysics, the study of the earth's biosphere including weather information, planetary exploration, navigation and some telecommunication could all be among those areas where space station cooperation would be useful. However, at the same time there exists another suite of pursuits which are incapable of cooperation once mature. These include above all materials processing, remote sensing via station-associated polar orbiting platforms, and launch capability. This can be viewed as a new variation on the dual purpose theme, where, instead of civilian/military or peaceful/non-peaceful, the contrast is between co-operable and non-cooperable. If it is perceived in this way, the US/International Space Station does not have to be a zero-sum game where one partners cooperative overture is grist to another partners competitive mill. Naturally, some technologies will be used for both types of activity, cooperative and competitive, depending upon the mission. Thus, space transportation will both carry the products of industrial materials processing experimentation and launch jointly-developed scientific satellites. Furthermore, the seemingly innocuous cooperative activity of today may turn out to be the new market of tomorrow. Nevertheless, if conducted responsibly, reasonable profits will accrue to the participants and more altruistic aims, for the betterment of mankind through increased scientific knowledge, will also be satisfied. As the space station evolves, individual and collective assessments of burgeoning areas can be made to estimate their place on the cooperative-competitive continuum. Such evaluations will no doubt be based on an equation such as the following: where the economic potential of an activity outweighs the perceived political benefits of its conduct as a cooperative undertaking, then it will be undertaken nationally (or regionally).

Thus, the US/International Space Station does not have to be a struggle between nationalism and utopianism, but can be an example of utilitarianism. In conclusion, it must not be forgotten that this is the greatest international cooperative venture ever attempted in space. Whilst the impediments are commensurate with this grand scale, so too are the potential cooperative gains.

PART TWO

THE MECHANISM

"[T]he metabolism of legal development, the process by which law takes in, assimilates and uses matter from without and by so doing gathers the energy for its own growth, is a matter of primary importance for the development of an effective universal system."

C. Wilfred Jenks(1)

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(1) The Common Law of Mankind, (1958, Stevens & Sons Ltd.), 167.

II. A CONSTITUTIONAL PERSPECTIVE OF THE STATUS OF INTERNATIONAL COOPERATIVE SPACE AGREEMENTS

> *[T]he transaction of business with foreign nations is executive altogether.*
>
> Thomas Jefferson[1]

A. PRELIMINARY EXCURSUS INTO THE LAW OF TREATIES

1. INTRODUCTION

In order to gain a full understanding of the implications for the several actors of the various modalities employed in making international space-related agreements, it is necessary to review certain aspects of their constitutional laws. Specifically, the nature and extent of the authority of each potential US/International space station partner to undertake international agreements will be discussed. It will be seen that not only are there important differences in the expression and exercise of such authority, but there are also significant disparities in the municipal legal effects of the international agreements

1. Jefferson 5 Writings (ed. P.L. Ford, 1895), 161 as quoted by L. Wildhaber, Treaty-Making Power and Constitution (1971, Helbing & Lichtenhahn) 60.

which are made thereunder.

2. RELEVANT CONCEPTS IN THE LAW OF TREATIES

Before proceeding to an individual discussion of the respective constitutional frameworks involved, several universal concepts must be clearly distinguished.

(a) The Instrument

"Treaty" is defined in article 2(1)(a) of the 1969 Vienna Convention on the Law of Treaties[2] as meaning

> ...an international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation. (emphasis added).

The first element underlined will be dealt with in the next section. Regarding the second, there is a plethora of terminology applied to the treaty concept.[3] In the present context of space-related agreements, it is important to note for future reference that the terms "Agreement",

2. Opened for Signature (OFS) 23 May 1969, Entered into Force (EIF) 27 January 1980, text reproduced in 63 Am. J. Int. L. 875 (1969) and 8 Int. Leg. Materials 679 (1969).

3. See McNair, The Law of Treaties (1961, The Clarendon Press) pp. 22-25.

"Exchange of Notes" and "Memorandum of Understanding (MOU)" can all denote a treaty.[4] The term treaty can, therefore, be used in both the restrictive sense of a title to a specific agreement, and the generic sense of denoting all international agreements within the above definition.

Memoranda of Understanding are especially prevalent in this field, assuming such significance that additional emphasis on this form of agreement is justified at this juncture. Thus, as a general concept, Lord McNair, in his definitive work on the law of treaties, has stated of the Memorandum of Understanding that

> [t]o an increasing extent it is being used to denote an informal but nevertheless legal agreement between two or more States, particularly when that agreement forms a step in the process of tidying up a complicated situation.[5]

More specifically, W.M. Thiebaut of the European Space Agency (ESA) Legal Affairs Department, has defined a MOU in the space law context "as an agreement between subjects of international law intended to produce obligations between the parties".[6] The similarities to the <u>Vienna Convention</u> definition of a treaty are clear.

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4. <u>Ibid.</u>, 24.

5. <u>Ibid.</u>, 15.

6. "Legal Status of Memoranda of Understanding in the United States" <u>ESA Bulletin</u> No. 38, 99.

(b) The Parties

The first underlined element of the Vienna Convention article quoted above, embodies the principle that treaties are "concluded between States". However, in addition to States, International Organizations can have a treaty-making power. As a corollary to its implied or expressed international legal personality, such an organization can confer upon itself the power to make treaties in its constituent instrument.[7] As will be shown later,[8] this is the case with ESA. Furthermore, treaties can be undertaken between two States (or a State and an International Organization) usually termed a bilateral, and between more than two States, commonly referred to as a multilateral treaty.[9]

Regarding the expressed parties to a treaty, there are basically four: States; heads of States; Governments; and "Particular Ministers, or Departments, or other agencies

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7. I. Brownlie, Principles of Public International Law, 3rd Ed. (1979, Clarendon Press), pp. 677-682; and McNair, op.cit., supra., note 3, pp. 50-52.

8. See infra II B 4.

9. See, however, McNair who would prefer a more restrictive meaning to be given to these terms, op.cit., supra, note 3, pp. 29-30.

of States".[10] The first two forms were, generally, the modalities used until the beginning of the 20th century. However, in more recent times, they have been superseded by agreements between governments or their representatives.[11] The increasing complexity of international inter-relationships in this century has demanded a more informal approach to treaty-making. Thus, the practice of concluding 'Agreements in Simplified Form' has grown up. According to Dr. Wildhaber,

> [t]he formal procedure is adequate and desirable for those treaties which involve expenditures, change domestic legislation, or are politically important. It is increasingly inappropriate for agreements of a technical character or of limited scope, or those which, irrespective of their subject matter, require expeditious conclusion and execution. Governments and administrations have, therefore, sought to evade the formal treaty-making procedure, and particularly the requirement of legislative approval.[12]

It can be cogently advocated that agreements to undertake such a formidable project as the US/International Space Station will involve: considerable expenditures,

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10. Ibid., 15, and Brownlie, op.cit., supra, note 7, 603.

11. Ibid., pp. 15-22, and Wildhaber, op.cit., supra, note 1, pp. 14-26.

12. Ibid., Wildhaber, pp. 106-107.

perhaps US $12 billion[13] as an initial investment, with an unknown amount required for continuous operation over the 20 or so years of the station's lifetime; changes in domestic legislation, which are believed, by most informed sources, to be inevitable; and engender political implications of a kind which have seldom, if ever, emerged in peace-time civilian international affairs. However, at the same time, these agreements will be both highly technical and require expeditious conclusion if the project is ever to be realised by the mid-1990s. On balance, a formal treaty procedure is indicated, particularly in view of the longevity of the project. It would be well to recall Lord McNair's caveat concerning the modern practice of concluding more informal agreements:

> What is important, is that this practice must not be allowed to obscure the fact that the real contracting parties are States. It is necessary to insist upon this point, because any notion that an Agreement expressed to be made between Governments or Government Departments binds only those Governments might have a tendency to impair the binding character of such agreements by encouraging subsequent Governments, perhaps of a political complexion completely different from the Government which made the agreement, to

13. "Configuration Includes Recent Changes to Meet Budget", Space Commerce Bulletin, 23 May, 1986, 4; and "Space Station Partners Press NASA for Cost Clarification", Aviation Week and Space Technology (AW & ST) 11 November, 1985, 18.

repudiate them.[14]

This will possess greater poignancy presently.

(c) The Completion

Several concepts must be distinguished here, self-execution from transformation, and the latter from ratification. Stated simply, a self- executing treaty is one which has the force of municipal law on its proper international completion and requires no additional legislative act to give it such force.[15] Since most treaties are negotiated by the executive branch of government, in democratic systems self-execution is ostensibly a rarity, since municipal law-making is the province of the legislature.[16] Perhaps the clearest example of this process occurs with respect to the 1957 Rome Treaty Establishing the European Economic Community.[17] The 1972 accession of the U.K. to the E.E.C. was accompanied by the enactment of the European Communities Act, 1972.[18] Section 2(1) of the latter states that

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14. Op.cit., supra, note 3, 20.

15. Brownlie, op.cit., supra, note 7, 53.

16. Wildhaber, op.cit., supra, note 1, pp. 14-15.

17. Reproduced in Sweet & Maxwell's European Community Treaties, 4th Ed. (1980, Sweet & Maxwell) pp. 63-133.

18. C.68, 17 October, 1972.

> [a]ll such rights, powers, liabilities, obligations and restrictions from time to time created or arising by or under the Treaties, and all such remedies and procedures from time to time provided for by or under the Treaties, as in accordance with the Treaties are without further enactment to be given legal effect or used in the United Kingdom shall be recognised and available in law, and be enforced, allowed and followed accordingly... (emphasis added).

Not all of the provisions of the Treaty were capable of having 'direct effects' though certain treaty provisions have been held to be so by the European Court of Justice.[19]

The obverse of the concept of self-execution is the doctrine of transformation. The latter holds that in order

19. See A. Parry and S. Hardy, EEC Law (1973, Sweet & Maxwell), 142 et seq. Thus, a number of treaty provisions have been held to be directly applicable such as Article 12, relating to the elimination of customs duties between member States, Case 26/62 Van Gend en Loos v. Nederlandse Administratie der Belastingen, Rec. IX I, (1963), C.M.L.R. 105, (1963) E.C.R., 1. In addition to this, article 189 of the EEC Treaty establishes another category of directly

to give municipal legal effect to the provisions of a treaty, an act of the legislature is necessary, transforming the international instrument into municipal law. This is

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(continued from previous page)
applicable instruments when it states in part that "[i]n order to carry out their task the Council and the Commission shall, in accordance with the provisions of this Treaty, make regulations, issue directives, take decisions, make recommendations or deliver opinions. A regulation shall have general application. It shall be binding in its entirety and directly applicable in all Member States." See also J.A. Usher, European Court Practice (1983, Oceana Publications) 7. However, Parry & Hardy would resist the analogy of direct applicability in Community Law with self-executing provisions of Treaties (ibid., 142) and would confine the former to the Specific circumstances of the European Community. Despite the attractiveness of this disassociation, from the theoretical standpoint, it is, nevertheless, a fact, as the authors themselves admit (loc.cit.) that "Community Treaties are the only international Treaties, certain provisions of which may create direct internal effects in English law." This is a measure of their rarity in international law and why this example was chosen.

certainly the case in the U.K., for example,[20] though there are significant differences in other States, particularly the USA, which will be dealt with in the next section.

In contrast to the above terms which relate to municipal law, ratification in this context is an international legal concept. It can have several different meanings, depending upon the context, but it is essentially the means by which a State expresses its consent to be bound by a treaty in international law.[21] This can be done: by simple signature of a duly authorized State representative;[22] by an exchange of instruments,[23] usually at a later date from that of the conclusion of negotiations; or by the filing of an official instrument of ratification[24] with the other party or the depositary State in the case of a multilateral treaty.[25]

Thus, there is a crucial dichotomy here, since

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20. See Brownlie, op.cit., supra., note 7, 49, and McNair, op.cit., supra., note 3, pp. 81-100.

21. Article 11 Vienna Convention on the Law of Treaties.

22. Ibid., Art. 12.

23. Id., Art. 13.

24. Id., Art. 14.

25. Id., Art. 16.

> a treaty may be valid in the sense that the international obligation connecting the parties is complete, while at the same time a party may lack the necessary executive or legislative power to give effect to the treaty. Invalidity and inability to perform are juridically two different things.[26]

This is an extremely complex area of law, replete with contradictory theories and fraught with uncertainty, such that little can be stated categorically. It is not presumed to herein attempt to provide answers, which have eluded some of the finest jurists of our time, to the grand questions of the international law of treaties. In particular, the status of an agreement in simplified form proved so intractable before the International Law Commission, which inter alia promulgated the Vienna Convention on the Law of Treaties, that it could not be defined in the text of the latter.[27] All that can be hoped for here, is to formulate the questions (which the negotiators of such agreements should be cognisant of) in such a way as to assist fellow observers of the end results of this process. Although the aforementioned negotiators, as representatives of their respective States, are arguably prevented from assessing the

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26. McNair, op.cit., supra., note 3, 59. See also the comment of this author at p. 68, where the importance of distinguishing perfection in international law from that in municipal law is stressed "because the former may occur without the latter."

27. Wildhaber, op.cit., supra, note 1, 108.

constitutionality of their counterparts' actions,[28] no such constraints exist upon an observer. Therefore, what will be attempted in the rest of this chapter, is an evaluation of the municipal law of treaties of each of the potential partners to the US/International Space Station. As adverted to in the introduction to this chapter, this involves an assessment of both constitutional authority to enter into international agreements, however termed, and State practice in the space field.

B. SELECTED ASPECTS OF MUNICIPAL CONSTITUTIONAL LAW

1. U.S.A.

(a) Treaties

The basis of US treaty law can be found in Article II 2(2) of the US Constitution, which states that the President

> shall have power, by and with the Advice and Consent of the Senate, to make Treaties, provided two-thirds of the Senators present concur....

This has invited comment from such luminaries of US history

28. See ibid., the explanation of the Doctrine of Irrelevance, pp. 175-181; and see also Brownlie, op.cit., supra., note 7, 610.

as George Washington, Thomas Jefferson and Alexander Hamilton, together with a host of others over the last two centuries. Problems have arisen with its interpretation, as a product of the classical division of powers between the executive and the legislature, with the judiciary as ostensible arbiters. Indeed, one commentator in his review of the Philadelphia Conference which produced the Constitution avers with respect to the aforementioned article, that "there is nothing particularly sacred about this clause of the Constitution, the arrangement proposed is the child of chance rather than logic or experience".[29] To continue the analogy, there followed a difficult adolescence during which President Washington, among others, curtailed the consultative part of its operation considerably.[30] This led to the Senate becoming active in the <u>ex post facto</u> approval process, incorporating amendments to the texts of treaties before permitting them to be ratified. Although "advice" disappeared, "consent" remained.[31]

In its turn, this development was succeeded by the treaty format being rendered virtually redundant as an

29. L. Rogers, <u>The American Senate</u> (1968, Johnson Reprint Corporation (1926 original)), pp. 59-60.

30. <u>Ibid.</u>, pp. 62-63, see however, L. Fisher, <u>Constitutional Conflicts Between Congress and the President</u> (1985, Princeton University Press), pp. 254-255 where an alternative viewpoint is expressed.

31. <u>Ibid.</u>, Rogers, 66 <u>et seq.</u>

instrument of US foreign policy. Thus, although in the early days of the Republic treaties outnumbered executive agreements by approximately two to one, in more recent times the ratio is approximately one to thirteen in favour of executive agreements.[32] This is part of the general trend away from formal treaties, towards agreements in simplified form, as adverted to earlier.

Despite these developments, the actual mechanics of giving effect to an international agreement have not changed. Although the executive has sole authority to make an agreement, the legislature (i.e. both Houses of Congress) has the power to render the agreement a domestic reality or not to do so, particularly if it involves the appropriation of money, under article I(8) of the Constitution.[33] However, this in turn is limited by the necessity of presenting a credible image abroad. Were Congress to regularly undermine the foreign relations decisions of the executive, this would damage the ability of the USA to negotiate international agreements successfully. This applies equally to that other category of international agreement utilised by the US Government - executive agreements.

32. See Wildhaber, op.cit., supra., note 1, 109.

33. Congress has power to "regulate Commerce with Foreign Nations", see further Fisher, op.cit., supra, note 30, 262 et seq.

(b) Executive Agreements

According to Lord McNair,

> [t]he United States enter into many agreements with foreign States which are not submitted to 'the Advice and Consent of the Senate' but are certainly treaties in the international sense of that term; many of these agreements fall into the category of 'Executive Agreements'[34]. (emphasis added).

Although not explicitly referred to in the Constitution, the executive's basis for the constitutional authority of the President to enter into international agreements is four-fold:

> (1) his duty as chief executive to represent the nation in foreign affairs; (2) his authority to receive ambassadors and other public ministers; (3) his authority as commander in chief; and (4) his duty to "take care that the laws be faithfully executed".[35]

On the basis of this authority, the President may make three types of executive agreement. As with treaties (in the US municipal law context), they may be self-executing or non-self executing depending upon "the intention of the United

34. Op.cit., supra, note 3, 64.

35. Fisher, op.cit., supra, note 30, 273. See also Department of State Public Notice 396, "Treaties and Other International Agreements", amending Chapter 700 of Volume 11 of the Foreign Affairs Manual, Federal Register Vol. 38, No. 157, Wednesday 15 August, 1973, 22084 at 22085, s. 721.2(b)(iii).

States"[36] as disclosed inter alia by the text of each individual agreement and/or the actions of the President.[37] The three forms of agreement are as follows:

- An 'Executive Agreement Pursuant to a Treaty', whose scope is defined by the American Law Institute in terms that "[t]he President may make an international agreement to carry out the purposes of a treaty";[38]
- A 'Congressional-Executive Agreement" whereby

> [t]he President may make an international agreement with the authorization or approval of Congress dealing with any matter that falls within the powers of Congress and of the President under the Constitution;[39]

and a 'Sole Executive Agreement' whereby

> [t]he President may, on his own authority, make an international agreement dealing with any matter that falls within his independent powers under the Constitution.[40]

It is this third category that raises concern both

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36. See The American Law Institute Draft Restatement of the Foreign Relations Law of the United States, 1 April, 1980 (195 ff), Section 131, pp. 41-58, at 46, (hereinafter Draft Restatement).

37. Ibid.

38. Ibid., s. 306, 96.

39. Id., s. 307, 96.

40. Id., s. 308, 99.

in general US constitutional law and specifically in the space context. Whilst the first category of executive agreement draws its authority from a treaty, which is itself the supreme law of the land by virtue of article VI(2) of the US Constitution,[41] the second category is the equivalent of an Act of Congress, having been passed by a Joint Resolution of both Houses thereof.[42] Thus, treaties and the first two categories of executive agreement mentioned above are derived from the "Supreme Law of the Land", superseding prior inconsistent federal and state law.[43] However, 'sole executive agreements' have a questionable status, vis-a-vis prior inconsistent federal legislation, which "has not been authoritatively determined".[44] Nevertheless, the preponderance of opinion seems to be in favour of a 'sole executive agreement': superseding state law; being

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41. Article VI(2) states in part that the "Constitution, and the Laws of the United States which shall be made in pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the Supreme Law of the Land..."

42. Loc.cit., supra, note 39.

43. Draft Restatement, op.cit., supra, note 36, s. 135, 64 et seq.; see also Thiebaut, op.cit., supra, note 6, 102; and Fisher, op.cit., supra, note 30, 272.

44. Ibid., Draft Restatement, 101.

the law of the land, but something less than "supreme"; and, therefore, is incapable of superseding earlier federal legislation or a treaty.[45] This opinion is based less on precedent than on logic, for "it would be inconceivable that the act of a single person, the President, could repeal an act of Congress".[46]

Finally in this context, all of the above are subordinate to subsequent inconsistent federal law.[47] This is itself subject to US observance of the pacta sunt servanda principle, embodied in article 26 of the Vienna

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45. Ibid., s. 135, Comment 6, 70, and Thiebaut, loc.cit., supra, note 43.

46. Id., Draft Restatement, the Reporter's Note goes on to point out that "even if a sole executive agreement were held to supersede a statute, Congress could proceed to re-enact the Statute and thereby supersede the intervening executive agreement as domestic law."

47. S. 135 of the Draft Restatement provides in paragraph 2 that "[a]n act of Congress that is enacted after a rule of international law or an international agreement is in force for the United States supersedes an inconsistent provision of international law or agreement as law of the United States, if the purpose of Congress to supersede the earlier provision is clearly expressed or if the act and the earlier provision cannot be reconciled." Ibid., pp. 64-65.

Convention on the Law of Treaties,[48] which is a general principle of international law.[49] Reference to the accompanying diagram (Figure II-1) may be useful as a summary of the above discussion.

(c) US Practice in Space Co-operative Agreements

By Section 205 of the 1958 National Aeronautics and Space Act (NASAct).[50]

> [t]he Administration (NASA), under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate. (emphasis added).

Although apparently confined to the constitutional treaty format, President Eisenhower on signing the bill into force observed that this section did not prevent the use of "less formal arrangements for co-operation" lest "substantial

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48. Ibid., para. 3 which provides that "[t]he superseding of a rule of international law or a provision of an international agreement as domestic law of the United States by a subsequent act of Congress does not relieve the United States of its international obligation or of the consequences of violation."

49. Brownlie, op.cit., supra, note 7, 613.

50. P.L. 85-568, 29 July, 1958, 72 Stat. 426, 42 U.S.C. 2451.

ELEMENTS OF US CONSTITUTIONAL LAW ON TREATIES

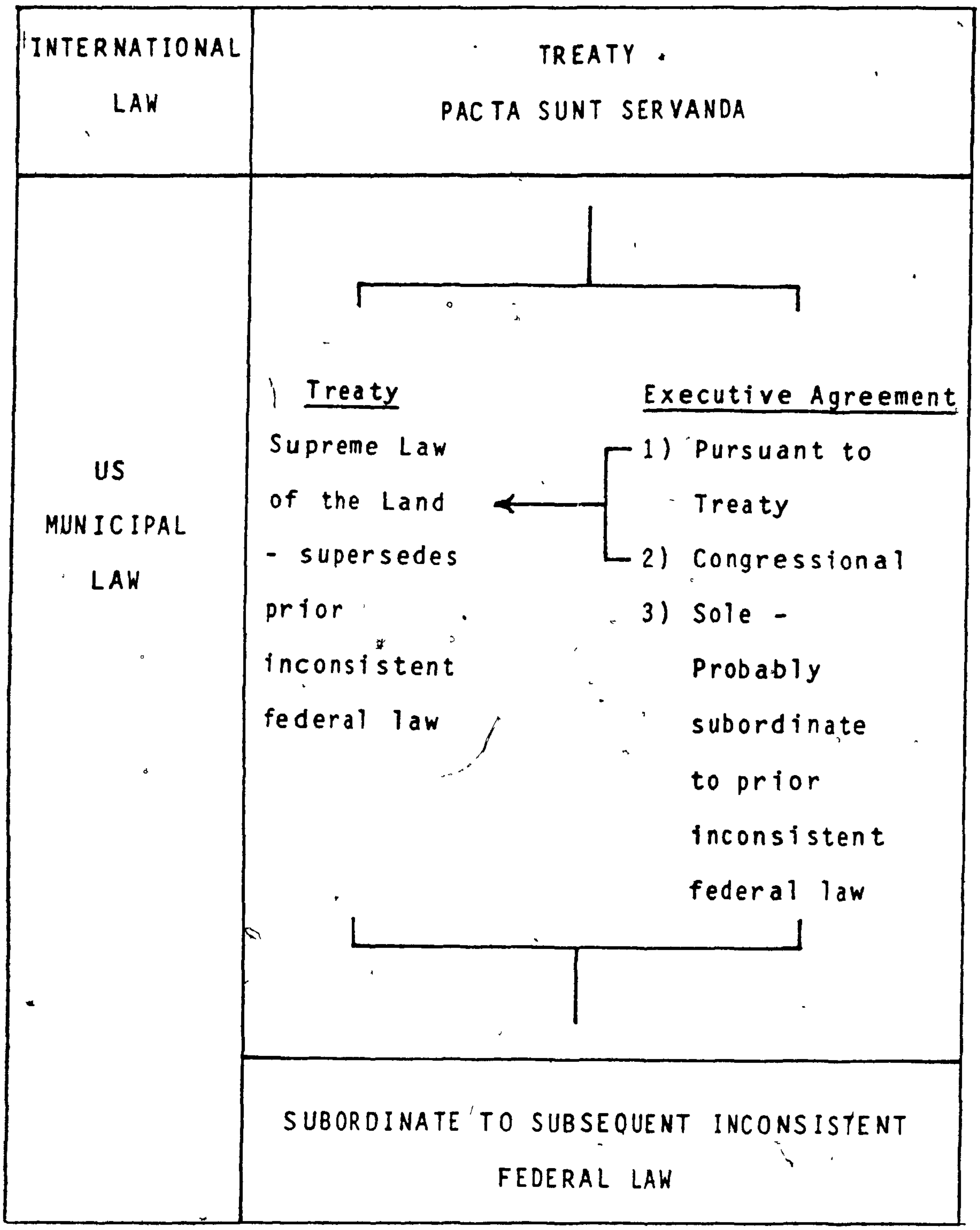

Figure II-1

Source : Personal Compilation.

constitutional questions" emerge.[51] Given the discussion in the previous section, it is not hard to imagine that to have held otherwise would have placed a major fetter upon the power of the executive to conclude agreements in this field.

In practice, US international agreements in this area have been of three types: Inter-agency memoranda of understanding; inter-agency agreements by exchange of letters; or "more formal inter-governmental agreements".[52] Whilst examples of the first two types are relatively common, the inter-governmental agreement, other than by exchange of letters, is a rarity. Arguably the most formalised manifestation of the latter was the 1973 Spacelab

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51. International Co-operation and Competition in Civilian Space Activities (Washington D.C., U.S. Congress, Office of Technology Assessment, OTA-ISC-239, July 1985, 472 ff.), 36. President Eisenhower stated as follows: "I regard this section merely as recognizing that international treaties may be made in this field, and as not precluding, in appropriate cases, less formal arrangements for cooperation. To construe the section otherwise would raise substantial constitutional questions".

52. Ibid.

Agreement.[53] Concluded between the US Government and the European Space Research Organization (ESRO, now ESA), it had a contemporaneous accompanying inter-agency MOU, between NASA and ESRO. The latter was "confirmed" in article 3 of the Agreement. This explicit confirmation can either be seen as extending the "authority" of the Agreement to the MOU, or, alternatively, as incorporating the MOU by reference into the Agreement.

Regarding the status of the Agreement in international law, it was clearly viewed as a treaty by the Europeans. It bears all the indicia of a treaty, including: provisions relating to entry into force i.e. ratification; the designation of France as the depositary government; and it was separately ratified by nine European nations.[54] However, it came into force for the USA on the day it was made and was never submitted to the Senate for its advice

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53. "Agreement between the Government of the United States of America and Certain Governments Members of the European Space Research Organization, For a Co-operative Programme Concerning the Development, Procurement and Use of a Space Laboratory in Conjunction with the Space Shuttle System", concluded 14 August, 1973, EIF 14 August 1973, 24 U.S.T. 2049, TIAS 7722.

54. Belgium, Denmark, France, F.R. Germany, Italy, Netherlands, Spain, Switzerland, and U.K., see S. Gorove Ed., United States Space Law National and International Regulation (1982, Oceana Publications) II.A.15, 157.

and consent.[55] Being neither a treaty in US municipal law, nor an executive agreement made pursuant to a treaty or by Congessional action, it must be deduced that it was a sole-executive agreement. Were this otherwise, it could not have been challenged as it was in relation to the US Air Force (USAF) Sortie Support System.[56]

Article 5(3) of the Spacelab (SL) Agreement obliged the USA:

> to procure only from the European Partners such additional SLs, components and spares as substantially duplicate the design and capabilities of the first SL, as are needed by the Government of the United States of America, including needs arising from its international programmes, and as are available in accordance with agreed schedules and at reasonable prices.

In 1979, the 'European Partners' became aware of a USAF plan to construct a Sortie Support System which would 'substantially duplicate' the first Spacelab. A request by ESA for application of this article met a USAF demurrer in the form of the 'Department of Defense Appropriation Act

55. See Civilian Space Stations and the U.S. Future in Space (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-STI-241, November 1984) Appendix C, 199; Dr. M.G. Bourély, "Agreements Between States and With International Organisations", Paper presented before an International Colloquium on Space Stations, Hamburg, F.R. Germany, 3-4 October, 1984, 15; see also Thiebaut, op.cit., supra, note 6, 99.

56. Ibid., Civilian Space Stations and Thiebaut.

1973'.[57] Section 744 of the latter states that

> [n]one of the funds appropriated by this or any other Act shall be available for entering into any contract or agreement with any foreign corporation, organization, person, or other entity for the performance of research and development in connection with any weapon system or other military equipment for the Department of Defense when there is a United States corporation, organization, person, or other entity equally competent to carry out such research and development and willing to do so at a lower cost.

This being a prior inconsistent federal statute, the later Spacelab Agreement, not being the 'Supreme Law of the Land', was subordinate. Thus, according to Dr. Michel Bourély, the former Legal Advisor to ESA, this Agreement had no greater status than a MOU.[58]

Whilst there has been some doubt regarding the status of a sole-executive agreement, US practice with respect to memoranda of understanding in the space field has exhibited clear indications of their subordinate status. Although there have been a great many such memoranda for co-operative space projects, the majority of which have come to successful fruition, the importance of the few cases where it has gone awry must not be underestimated. There have been two recorded cases where memoranda of understanding have been rendered inoperative by unilateral US cancel-

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57. PL 92-570, 26 October, 1972, 86 Stat 1184.

58. Bourély, loc.cit., supra, note 55.

lation of its participation.

The first occurred with respect to the AEROSAT project to build and launch several aeronautical communications satellites. The parties to the MOU were expressed to be the US Department of Transportation (DOT), ESRO, and the Government of Canada.[59] However, in 1977, three years into the project, (ESA now having taken over ESRO's responsibilities), the Federal Aviation Administration (FAA) which was conducting the project within DOT, was awarded only one million dollars, in their annual appropriation, for AEROSAT. As a result, the FAA "cancelled their participation in the program and with this step the participation of the other

59. "Memorandum of Understanding on a Joint Programme of Experimentation and Evaluation Using an Aeronautical Satellite Capability Between the United States Department of Transportation (Federal Aviation Administration), The European Space Research Organisation, and the Government of Canada, signed and EIF 2 August, 1974 reproduced in Basic Texts of the European Space Agency, Vol. II bis, The Programmes, Part G16; and Gorove Ed., United States Space Law, op.cit., supra, note 54, Vol. II Part A.19, 213 et seq.

interested parties collapsed".[60] It is interesting to note that Article 8(2) of the AEROSAT MOU states that

> [t]he costs and financial obligations undertaken by the Signatories pursuant to this Memorandum of Understanding are subject to the availability of funds therefor. (emphasis added).

An even clearer example of the latter occurred with respect to the International Solar/Polar Mission (ISPM). The 1979 MOU between NASA and ESA[61] provided for the development of two spacecraft, one by each party, inter alia to conduct co-ordinated observations of various scientific phenomena in the solar system.[62] Due to Congressional budget reductions in the 1980/81 fiscal year, NASA could not support all its co-operative programmes and ISPM was cancel-

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60. The U.S. Posture in Space - A Retrospective Assessment, Report prepared by Science & Technology Consultants for the Office of Technology Assessment, US Congress, March, 1981, 33. According to Professor Gorove, the "spirit of the MOU" continued despite this cancellation with the preservation of the AEROSAT Council as a forum for discussion of improvements "in civil aviation operations in oceanic and sparsely populated land mass areas". Ibid., United States Space Law, 215.

61. "Memorandum of Understanding Between NASA and ESA on the International Solar/Polar Mission", 29 March, 1979, ESA Basic Texts, op.cit., supra, note 59, Part G12.

62. Ibid., article 1.

led.[63] This was done unilaterally and without consultation with ESA,[64] despite both Article 18 (on settlement of disputes jointly between the NASA Administrator and the Director General of ESA) and Article 20 of the MOU(whereby the parties agreed that project termination would be "mutually agreed by NASA and ESA"). Nevertheless, the legitimacy of this action was supplied by Article 13 of the MOU, by which it was

> understood that the ability of NASA and ESA to carry out their obligations under this Memorandum of Understanding is subject to their respective funding procedures.[65]

(d) Summary and Interpretation

US practice in co-operative space ventures has exhibited a tendency to treat them more as administrative exercises or procurement contracts rather than international

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63. Unispace '82: A Context for International Co-operation and Competition - A Technical Memorandum (Washington DC: US Congress, Office of Technology Assessment, OTA-TM-ISC-26, March 1983) Appendix B, 69.

64. Op.cit., supra, note 60, pp. 62-63.

65. See Thiebaut, op.cit., supra, note 6, 99. Although ESA elected to continue the programme, with their single spacecraft to be launched by NASA, many of the objectives of the mission were dependent upon simultaneous observation of phenomena by two spacecraft.

agreements. This is a function of both NASA's methodology in negotiating such agreements[66] and the major disparities which have existed in the past, with the USA as the clearly and necessarily dominant partner in any co-operative space venture. This should not obscure the fact that NASA, as an agency of the US Government, is, as we shall see in the following sections, negotiating with other States or International Organisations through their representative agencies.

According to the NASA legal branch, NASA has the

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66. Its rationale is comprised of six basic elements: international projects are undertaken only when they contribute to NASA's goals and US foreign policy objectives are relevant; a bilateral format is preferred; scientists from around the world should be able to participate; no exchanges of funds should be made between participants; there should be limited technology transfer between the parties; and there should be dissemination of the results as widely as possible to the scientific community, subject to the nature of the programme. Op.cit., supra, note 63, pp. 68-69, see also K. Pedersen, "International Co-operation and Competition in Space: A Current Perspective", 11 J Space L 21 (1983), and, by the same author, "The Changing Face of International Space Co-operation", Space Policy, Vol. 2, No. 2, May 1986, 120 et seq.

power to conclude international agreements on its own.[67] However, as with any other agency of the US Government, NASA must conform to Department of State regulations concerning the conclusion of international agreements. These regula-

67. Personal correspondence with Ms. Helen S. Kupperman, Special Assistant to the NASA General Counsel for Space Station. The NASA mandate to conclude such agreements was emphasized by section 108(b)(3) of the NASAct (added by the 1985 NASA Authorization Act) which states that

> (b) The [NASA] Administrator is authorized and encouraged to -- ...
> (3) conduct such research and development in cooperation with other public and private research entities, including private industry, universities, Federal, State, and local government agencies, foreign governments, and international organizations, and to enter into arrangements (including joint ventures) which will foster such cooperation. (Emphasis added).

Furthermore, S.1201.103(a) of the US Code of Federal Regulations, Title 14, Chapter V: National Aeronautics and Space Administration states that

> NASA is headed by an Administrator, who is appointed from civilian life by the President by and with the consent of the Senate. The Administrator is responsible, under the supervision and direction of the President, for exercising all powers and discharging all duties of NASA and has authority and control over all personnel and activities of the agency. (Emphasis added).

tions were made pursuant to the 1972 Case-Zablocki Act[68] and appear in title 22 of the US Code of Federal Regulations.[69] They are designed to ensure

> full and timely disclosure to the congress of all concluded agreements and consultation by agencies with the Secretary of State with respect to proposed agreements.[70]

The criteria used by the Department of State to decide whether an undertaking by a US Government agency constitutes an international agreement are reproduced in Appendix 1 to this thesis. Incorporated within these regulations is the Circular 175 procedure employed by the Department of State

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68. P.L. 92-403, 22 August, 1972, 86 Stat. 619 (1972), 1 U.S.C. 112 b (1982). This act provides inter alia that "[t]he Secretary of State shall transmit to the Congress the text of any international agreement, other than a treaty, to which the United States is a party as soon as practicable after such agreement has entered into force with respect to the United States but in no event later than sixty days thereafter". (Emphasis added). Furthermore, S.112a of the US Code (Added 23 September, 1950, Chapter 1001 S.2 64 Stat. 980) which gave rise to the publication entitled United States Treaties and Other International Agreements (UST) provides that the latter "shall be legal evidence of the treaties, international agreements other than treaties, and proclamations by the President of such treaties and agreements, therein contained, in all the Courts of the United States ...".

69. Title 22 Foreign Relations, Chapter 1, Department of State, SubChapter S - International Agreements, Part 181.

70. Ibid., s. 181.1(b).

relevant excerpts of which are reproduced in Appendix 2 to this thesis.[71] This procedure occurs in Volume 11 Chapter 700 of the Department's Foreign Affairs Manual.[72] Section 722.1 of the latter states that

> [n]egotiations of treaties, or executive agreements, or for their extension or revision are not to be undertaken, nor any exploratory discussions undertaken with representatives of another government, until authorized in writing by the Secretary [of State] or an officer specifically authorized by him for that purpose. Notification of termination of any treaty or executive agreement requires similar authorization.

A specific authorization is also required to sign any such agreement.[73] Thus, the signature by the NASA Administrator to a MOU, or any other international agreement, has been approved in advance by the Department of State and in the case of a "sole executive agreement" bears the authority of the President. This 'sole-executive agreement' is both vulnerable domestically and, by extension, internationally, although the two are juridically distinct. Of course memoranda of understanding are perfectly legal, both constitutionally in the USA and internationally as agreements in simplified form. . Nevertheless, it is submitted that the Space Station Project, when judged by the criteria outlined

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71. Ibid., s. 181.4(b).

72. Federal Register, op.cit., supra, note 35, 22085.

73. Ibid., ss 722.2 and 722.3.

in Appendices 1 and 2 to this thesis, is rather too serious subject matter for a MOU. However, the form of agreement chosen for Phase B of the Space Station Project was parallel bilateral Memoranda of Understanding.[74] This should not be regarded as precedental, since these Memoranda are expressed to be of a preliminary nature only.

2. CANADA

(a) **The Treaty Power** - The roots of Canadian treaty-making power lie in its colonial past. It evolved by various stages, reflecting the disintegration of the British Empire, the emergence of the Commonwealth, and eventual independent status.[75] The historical perspective is just as important here as it was in the US section, for the treaties made today are done so within a framework established long ago. Being one of the inherent prerogative powers of the British Monarch, as advised by his or her ministers,

74. The three Memoranda of Understanding were concluded between NASA and: the Canadian Ministry of State for Science and Technology - 16 April, 1985; the Science and Technology Agency of Japan - 20 May, 1985; the European Space Agency - 3 June, 1985.

75. See A.E. Gotlieb, Canadian Treaty-Making (1968, Butterworths) pp. 4-10.

the treaty-power has always been an executive function.[76] It devolved gradually into the hands of the "Governor-General in Council on the advice of the Canadian ministers", particularly the Secretary of State for External Affairs.[77] This arrangement was formalised with the issue by King George VI of the 'Letters Patent constituting the Governor-General of Canada' in 1947.[78] Thereafter, apart from one minor exception, Canada could exercise complete control over its treaty-making power.[79]

Modern Canadian treaty practice[80] involves the conclusion of two types of international agreement: an inter-governmental treaty; and a treaty by exchange of notes or letters. The procedure for the conclusion of an inter-governmental treaty is threefold. Firstly, an Order-in-Council is passed authorizing the Secretary of State for

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76. McNair, op.cit., supra, note 3, 68.

77. Gotlieb, op.cit., supra., note 75, pp. 4-5.

78. Ibid., 5.

79. The exception occurs with the "Head of State" form of treaty which requires the participation of the British Monarch. However, this form has never been used by Canada since the grant of the Letters Patent, see P.W. Hogg, Constitutional Law of Canada, 2nd Ed. (1985, The Carswell Co. Ltd.) 243.

80. I.e. post-1944, see Gotlieb, op.cit., supra., note 75, 40.

External Affairs to execute an instrument of full power. Secondly, an instrument of full power is made empowering a plenipotentiary to sign a treaty, after which the treaty is signed.[81] Increasingly, this is the extent of the procedure, with subsequent ratification seldom required. In those rare instances when it is mandated, an instrument of ratification is made pursuant to an Order-in-Council enabling the Secretary of State for External Affairs to do so. This instrument of ratification is exchanged with the other party to a bilateral, or deposited with the depositary State in the case of a multilateral.[82] However, according to the present Canadian Ambassador to the USA, Allan Gotlieb,

> [t]here is no evidence to suggest the existence of any rule in Canada which provides that Canadian treaties require ratification to become binding. The overwhelming majority of Canadian treaties... come into force on signature or, in the case of agreements in exchange-of-notes form, on the date of the exchange of notes between representatives or, on the date of the reply (i.e. the second note)[83].

Thus, in practice, the treaty by exchange of notes or letters is an agreement in simplified form which does not require ratification. It is, nevertheless, concluded

81. Ibid., pp. 38-39.

82. Id. 39.

83. Id. 38.

between States, via their representatives, who may be: foreign ministers; ambassadors; high commissioners, or "even by a minister in charge of a department other than external affairs".[84]

Whilst the exercise of the treaty power is constitutionally an entirely executive function, the most important treaties, usually those requiring formal ratification, will involve a measure of Parliamentary approval.[85] However, it is in the implementation of treaties that Parliament as the legislature comes into its own. Following U.K. constitutional law, treaties which would change the municipal law of Canada must be subject to an act of transformation to give them legal effect. While many treaties will not involve subject-matter outside the executive powers of government,

> many treaties cannot be implemented without an alteration in the internal law of Canada. For example, treaties between Canada and other States relating to patents, copyright, taxation of foreigners, extradition, and many other matters, can often be implemented only by the enactment of legislation to alter the internal law of Canada.[86]

Such a transformation can be effected in four ways, by:-

84. Hogg, op.cit., supra., note 79, 243.

85. Ibid., 244, and Gotlieb, op.cit., supra., note 75, pp. 16-17.

86. Ibid., Hogg, 245.

embodying the treaty as an Act of Parliament; an Act of Parliament to which the treaty is an approved schedule; a joint resolution of the House of Commons and Senate; or merely by discussion without action in Parliament.[87]

b) Canadian Practice in Space Co-operative Agreements

Regarding Canadian practice in the space field, there have been numerous examples of both types of treaty format being employed. Canada's two major partners in co-operative space ventures have been the USA and ESA. Canada-USA bilateral agreements have been made, variously: by exchange of notes;[88] by exchange of notes incorporating a

87. Gotlieb, op.cit., supra., note 75, pp. 17-19.

88. Agreement on Remote Sensing from Satellites and Aircraft - signed at Ottawa, 19 and 22 March, 1976, EIF 22 March, 1976, 27 UST 1075; TIAS 8247; Agreement on Remote Sensing: Satellites and Aircraft, signed at Washington, 20 October and 6 November, 1980, EIF 6 November, 1980, TIAS 9934; and Agreement on Liability for Loss or Damage from Certain Rocket Launches - signed at Ottawa and EIF 31 December, 1974. 26 UST 27, TIAS 8005.

MOU (Protocol in French);[89] by exchange of notes accompanied by an annex;[90] by an exchange of notes with both a MOU and an Annex;[91] and finally, by MOU alone.[92]

89. Agreement on Experimental Communications Satellites: Intercontinental Testing, signed at Washington, 13 and 23 August, 1963, EIF 23 August, 1963, 14 UST 1701, TIAS 5474, NASA and the Canadian Department of Transport were the parties to the MOU; Agreement on a Communications Technology Satellite, signed at Washington 21 & 27 April, 1971, EIF 27 April, 1977, 22 UST 713; TIAS 7131 - NASA and the Canadian Department of Communications were the parties to the MOU; and "Agreement for a Co-operative Program concerning the Development and Procurement of a Space Shuttle Attached Remote Manipulator System", signed at Washington, and EIF 23 June, 1976, 27 UST 3801, TIAS 8400 - the parties to the MOU were NASA and the National Research Council of Canada.

90. Agreement Relating to Remote Sensing from Satellites and Aircraft, signed at Washington and EIF 14 May, 1971, 22 UST 684, TIAS 7125.

91. Agreement relating to Remote Sensing for Global Crop Information, signed at Washington, 31 March and 10 April, 1978, EIF 10 April, 1978, 29 UST 3208, TIAS 9007.

92. Memorandum of Understanding between the US Department of Defense and the Canadian Department of National Defence Concerning NAVSTAR Global Positioning System, signed at Washington and Ottawa, 7 August and 5 October, 1978, EIF 5 October, 1978, TIAS 9689; and Memorandum of Understanding between the Ministry of State for Science and Technology and NASA for a Co-operative Program Concerning Detailed Definition and Preliminary Design (Phase B) of a Permanently Manned Space Station, 16 April, 1985, copy obtained from Ministry of State for Science and Technology (MOSST).

Briefly focusing on the two most relevant agreements, both in the sense of related subject matter and as potential precedents, may exemplify the process. Thus, the Agreement for the Remote Manipulator System (RMS), called CANADARM, was by exchange of notes between the US Department of State (Frederick Irving on behalf of Henry Kissinger the then Secretary of State) and the Government of Canada, (represented by its Ambassador to the USA, J.H. Warren). Each of the correspondents "confirmed" the provisions of the MOU on behalf of their respective governments, reproducing the salient points in brief. In contrast, the Space Station phase B MOU was expressed to be between NASA in its own right and the Canadian Ministry of State for Science and Technology (MOSST). However, in the preamble to the MOU, it was stated that "[i]t is understood that in this MOU, MOSST is acting on behalf of several departments and agencies of the Canadian Government". The Signatories were Thomas Siddon, the former Canadian Minister of State for Science and Technology, and James M. Beggs the former NASA Administrator.

Regarding Canada-ESA "bilaterals", which are also numerous, emphasis on three series thereof should illustrate the procedures used.[93] The first series, concerning Canada's co-operative relationship with ESA, comprises two agreements, both expressed to be between the Government of Canada and ESA. The 1978 Agreement[94] upgraded Canada's observer status with ESA, by a Canadian commitment to the ESA budget (1 per cent) together with appropriate voting rights in relation to those optional programmes in which Canada elected to participate. The Signatories were the former ESA Director General, Roy Gibson, and the Minister of Communications, Madame Jeanne Sauvé, now Governor General of Canada. With the imminent lapse of the 1978 Agreement (expressed to be in force for five years) the parties renegotiated and signed a 1983 Agreement.[95] The latter increased the Canadian financial obligation to 3 per cent of the ESA budget, and extended the range of activities with which Canada could become involved. The Signatories were

93. This is a personal classification for ease of exposition only.

94. Agreement Concerning Co-operation Between the Government of Canada and the European Space Agency, signed at Montréal 9 December, 1978, EIF 1 January, 1979, ESA/LEG/5, TR 79-121, Paris 25 January, 1979.

95. Agreement Between Canada and the European Space Agency Concerning Co-operation; signed at Noordwijk, 9 January 1984, EIF 1 January 1984 (the previous Agreement terminated on 31 December, 1983) ESA/LEG/56, TR 84-296, Paris 17 January, 1984.

Erik Quistgaard the Director General of ESA, and Donald Johnston, the former Canadian Minister of State for Science and Technology.

The second series involved Canadian participation in the European Remote-Sensing (ERS) Satellite Programme. Consisting of two "Arrangements"[96] and one Agreement,[97] the parties were again ESA and the Government of Canada, though the latter was not represented by anyone of ministerial rank.[98]

The final series to be mentioned herein, is

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96. An "Arrangement Concerning the Participation of the Government of Canada in the Preparatory European Remote-Sensing Satellite Programme", signed at Paris and Ottawa on 26 and 31 March, 1980, EIF 31 March, 1980, ESA/LEG/23, TR 80-954, Paris, 11 August, 1980; and an "Arrangement between the Government of Canada and the European Space Agency Concerning the Participation of the Government of Canada in the Phase B of the European Remote Sensing Programme of the European Space Agency", signed at Ottawa and EIF 7 February, 1983, ESA/LEG/50, Paris, 3 May, 1983.

97. "Agreement Between the Canadian Government and the European Space Agency Concerning the Participation of Canada in the Development and Exploitation Phases of the ERS-1 Programme". Signed at Ottawa and EIF 8 January, 1985, ESA/LEG/68, TR 85-303, Paris, 30 January, 1985.

98. The first Arrangement was signed by Ralph Baker of the Canadian Remote Sensing Centre on behalf of the Government of Canada, while the second Arrangement and the Agreement were both signed by Kenneth Witham for the Government of Canada.

comprised of two Arrangements concerning the L-Sat Programme.[99] These were made similarly to those for the ERS programme, and were signed by the ESA Director General[100] and by the Head of the Department of Communications, on behalf of the Government of Canada.[101]

Clearly, all of the above are potentially agreements in simplified form and capable of being treaties in both international law and Canadian constitutional law.

3. JAPAN

(a) Treaty-Making and the Constitution

The modern Japanese State was reforged by the 1946

99. "Arrangement Concerning the Participation of the Government of Canada in the L-Sat Programme", signed at Ottawa, 28 July, 1980, EIF 26 July, 1980 (previously signed by ESA Director General), ESA/LEG/25, TR 80-1379, Paris, 18 November, 1980; and the "Arrangement Concerning the Participation of the Government of Canada in the Development Phase of the Large Telecommunications Satellite Programme (L-Sat)", signed in Paris and EIF 25 June, 1982, ESA/LEG/39, TR 82-761, Paris, 5 July, 1982.

100. Roy Gibson in 1980, and Erik Quistgaard in 1982.

101. Alexander Curran.

MacArthur Constitution.[102] After this, the Emperor ceased to be the repository of Japanese sovereignty and became "no more than the symbol of the unity of the nation wherein sovereign power resides".[103] By article 41 of the Constitution, the 'National'Diet[104] is declared to be the "highest organ of State power" and the "sole law-making organ of the State". The executive power is vested in the Cabinet,[105] which is headed by a Prime Minister[106] (currently Yasuhiro Nakasone), and the Cabinet is "collectively responsible to the Diet" in the exercise of its power.[107] This system is strongly reminiscent of that

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102. A.W. Burks, The Government of Japan (1961, Thomas Y. Crowell Co.) 17, officially entitled "the Constitution of Japan" made 3 November, 1946, enforced 3 May, 1947.

103. Y. Yamada, "The New Japanese Constitution", 4 Int. Comp. L. Q. 197 (1955), 199.

104. Formerly the Imperial Diet, see J. Williams, "The Japanese Diet Under the New Constitution", 42 Am. Pol. Sci. Rev. 927 (1948) 928.

105. Japanese Constitution, article 65.

106. Ibid., Art. 66 (1).

107. Id., Art. 66 (3).

which obtains in the U.K.,[108] including a bicameral parliamentary system "with the supremacy of the lower house over the upper", though, unlike the U.K., both houses are elected as in the USA.[109]

The basis of the treaty-power is to be found in article 7(1) of the Constitution, which states that

> [t]he Emperor shall, with the advice and approval of the Cabinet, perform the following acts in matters of state on behalf of the people: (1) Promulgation of amendments of the constitution, laws, cabinet orders and Treaties. (emphasis added).

This is augmented by article 73 of the Constitution, whereby

> [t]he Cabinet shall, in addition to other general administrative functions, perform the following functions:... (3) Conclude treaties. However, it shall obtain prior or, depending on circumstances subsequent approval of the Diet.

In concluding a formal treaty, the following acts are performed: the Cabinet assigns full powers to a

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108. A.C. Oppler, "The Reform of Japan's Legal and Judicial System Under Allied Occupation", 24 Wash. L. Rev. and State Bar J. 290 (1949) 299.

109. Ibid. The House of Representatives is the dominant lower house, and the House of Councillors is the upper, see Arts. 42-64 of the Japanese Constitution. For further information on the structure of Japanese government, see Burks, op.cit., supra, note 102, pp. 97-133, and J.M. Maki, Government and Politics in Japan - The Road to Democracy (1962, Praeger), pp. 92-109.

plenipotentiary; the plenipotentiary negotiates and signs the treaty; the Prime Minister issues an instrument of ratification on behalf of the Cabinet; the advice and approval of the Diet is sought, this may also occur before the issuance of the instrument of ratification; the latter instrument is exchanged or deposited as appropriate by the plenipotentiary; and, finally, the Emperor proclaims the validity of the treaty.[110]

As with other nations, not all Japanese treaties require ratification. However, Japan appears to sign treaties subject to ratification statistically more often than the average.[111] Those treaties which do not require ratification come into force upon signature. In order to satisfy article 73(3) of the Constitution, the Cabinet must seek the approval of the Diet, and this is usually done before signature to avoid subsequent criticism by the latter.[112] Thus, there exists "an integral relationship between the two branches of government in foreign policy-

110. See L.J. Adams, Theory, Law and Policy of Contemporary Japanese Treaties (1974, Oceana Publications Inc.) pp. 15-16 and 30.

111. Ibid., 36, 32% of Japanese treaties do not require ratification, as compared to 52.1% of all treaties recorded in the UNTS between 1946 and 1965.

112. Id., 33.

making".[113] Although not all treaties in practice require the approval of the Diet, the exceptions are limited.[114] The actual signature to a treaty may be given by a number of officials recognised as being competent to conclude treaties on behalf of Japan, pursuant to an assignment of full powers. The choice of the appropriate person to sign a particular treaty varies with the nature thereof, and the Prime Minister, Cabinet Ministers, ambassadors and chargés d'affaires have all done so.[115]

Regarding the status of treaties in the municipal law context of Japan, they are not the supreme law of the land as in the USA, but are superior to ordinary legislation.[116] Furthermore, in the implementation of treaties, those which are self-executing are enforceable in municipal

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113. Id. This relationship may well be what was envisaged by the framers of the US Constitution, whereby a 13 member Senate (one for each of the Colonies on independence) would advise the President on the conclusion of treaties. However, for a number of reasons, this rapidly became unworkable. See Rogers, op.cit., supra, note 29, pp. 84-85.

114. The three exceptions are: (a) where a specific delegation has been made to the Cabinet enabling it to conclude a treaty independently; (b) by usage, some less important treaties have not required Diet approval; and (c) the Cabinet can conclude treaties pursuant to existing treaties; ibid., Adams, 17.

115. Id., 29.

116. Id., 19.

law, based on article 98(2) of the Constitution, which is an institutionalization of the pacta sunt servanda principle and states that "[t]he treaties concluded by Japan and established laws of nations shall be faithfully observed".[117] Non self-executing treaties are not so enforceable until after transformation by municipal legislation.[118]

(b) Japanese Practice in Space Co-operative Agreements

As was the case with Canada in the previous Section, Japan employs the Exchange of Notes format for the conclusion of agreements in the space field. This instrument is recognised by Japanese international law scholars as being a treaty, as are Memoranda.[119] Prior to the space station project, Japan had concluded a number of bilateral space-related agreements with the USA, all of which have been by exchange of notes and expressed to be between the governments of both parties. These exchanges have been variously made between:- the Japanese Minister for Foreign Affairs and the US Ambassador to Japan, both in simple

117. Id., 21.

118. Id.

119. Id., pp. 50-52, where the author cites a number of Japanese authorities' positions on the definition and classification of treaties.

form[120] and with an amplifying "Attachment";[121] and between the Japanese Ambassador and the US State Department, both in simple form[122] and with an accompanying MOU and Annex.[123] The latter was the most detailed of all the bilaterals mentioned so far, and was a three-tiered agreement. The first tier was the inter-governmental part, the second, the MOU, was between the Science and Technology Agency of Japan (STA) and NASA, and the third, the Annex to the MOU, was between the National Space Development Agency of Japan (NASDA) and NASA. However, the authority for the latter came from the STA.

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120. Agreement relating to Experimental Communications Satellites: Intercontinental Testing, signed at Tokyo and EIF, 6 November, 1962, 13 UST, TIAS 5212; Agreement Relating to Shuttle Contingency Landing Sites, done at Tokyo and EIF, 28 January, 1980, TIAS 9915; Agreement Concerning a Tracking Station in Okinawa, signed at Tokyo and EIF, 2 September, 1968, 19 UST 6011, TIAS 6558; and a follow-up Agreement on the Tracking Station in Okinawa, signed at Tokyo and EIF, 25 September, 1969, 20 UST 3017, TIAS 6778.

121. Agreement on Space Co-operation signed at Tokyo and EIF, 31 July, 1969, 20 UST 2720, TIAS 6735.

122. Agreement on Space Co-operation in Launch Assistance, signed at Washington and EIF, 3 December, 1980, TIAS 9940.

123. Agreement Concerning the Furnishing of Launch Assistance by the USA to Japan, signed at Washington and EIF, 23 May, 1975, 26 UST, 1029, TIAS 8090.

Regarding the status of the STA, it is one of a number of agencies established under the auspices of the Prime Minister's Office.[124] The PM's Office has co-equal status with the several other Ministries, such as the Ministry of International Trade and Industry (MITI), which together comprise the Cabinet.[125] NASDA is a statutory creation and is answerable to the STA.[126] The NASA-STA MOU for Phase B of the Space Station[127] was a departure from established practice as outlined above. This is explained in the Preamble to the MOU which provides that

> [t]he co-operation in the detailed definition and preliminary design activities on the Space Station, to be carried out under Article 3 of the "Agreement between the Government of the United States of America and the Government of Japan on Co-operation in Research and Development in

124. See Burks, op.cit., supra, note 102, 103; and UN Doc. A/CONF.101/NP/39, 9 September, 1981, National Paper of Japan to the Second UN Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE '82), 35.

125. Ibid.

126. Id., National Paper, 6.

127. "Memorandum of Understanding Between the National Aeronautics and Space Administration and the Science and Technology Agency of Japan for the Co-operative Program Concerning Detailed Definition and Preliminary Design Activities of a Permanently Manned Space Station", 20 May, 1985, obtained from the NASDA office in Washington DC.

> Science and Technology"[128] ... will support the United States' and Japan's mutual interest in creating a truly productive partnership and further strengthening the bonds of friendship existing between the two nations through science and technology co-operation.

The aforementioned Article 3 of the Science and Technology Agreement, signed by former US President Jimmy Carter and former Japanese Prime Minister Masayoshi Ohira, provides that

> [i]mplementing arrangements setting forth the details and procedures of the specific co-operative activities under this Agreement may be made between the two Governments or their agencies, whichever is appropriate.

Thus, the Space Station MOU was one of the exceptions to the Constitutional rule of treaty approval by the Diet, since it was an executive agreement made pursuant to a treaty[129] and draws its authority therefrom.

4. ESA - AN INTERNATIONAL ORGANIZATION

In evaluating the status of an International Organization, there are two levels of analysis: what international law enables an Organization to do in the generic sense; and what the specific constituent instrument in question

128. Signed at Washington and EIF, 1 May, 1980, 32 UST 1123, TIAS 9760.

129. See op.cit., supra, note 114.

empowers it to do. In the generic sense, the concept of international legal personality has evolved. Its indicia have been summarized by Professor Brownlie as follows:-

> (1) a permanent association of states, with lawful objects, equipped with organs;
> (2) a distinction, in terms of legal powers and purposes, between the organization and its member states;
> (3) the existence of legal powers exercisable on the international plane and not solely within the national systems of one or more states.[130]

One of the powers which may flow from satisfying these criteria is the ability to conclude treaties with other international legal persons i.e. States or International Organizations.[131] This potentiality in international law is realized in a particular case by the terms of a constituent instrument[132] and/or practice by an organization thereunder.[133] Furthermore, the status as treaties of the agreements made by an International Organization is in part derived from the practice of States and other such organizations in accepting them as such.[134]

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130. Op.cit., supra, note 7, 679.

131. J.W. Schneider, Treaty-Making Power of International Organizations (1959, Librairie E. Droz, Geneva, Librairie Minard, Paris) 135.

132. Ibid., 69.

133. Brownlie, op.cit., supra., note 7, 698.

134. Schneider, op.cit., supra., note 131, 17.

There are basically three types of treaty exhibited by the practice of organizations: agreements between organizations and States "concerning particular questions", whereby organizations "act as autonomous parties and they resemble States"; agreements dealing with the "status of organizations in regard to States", such as those regarding privileges and immunities and the establishment of headquarters; and inter-organization agreements.[135] In view of the difficulties of generalizing further in this area, ESA's constituent instrument will now be discussed.

The 1975 <u>Convention for the Establishment of a European Space Agency</u>[136] provides in article XV and Annex I(1) that

> [t]he Agency shall have legal personality. It snall in particular have the capacity to contract, to acquire and dispose of movable and immovable property, and to be a party to legal proceedings.[137]

This was a continuation of the position which had obtained

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135. <u>Ibid.</u>, pp. 140-141.

136. <u>Basic Texts of the European Space Agency</u>, Volume 1 <u>Conventions and Rules, A6/1 et seq.</u>; done at Paris, 30 May, 1975, EIF 30 October, 1980, see M. Bourély, "Entry into Force of the ESA Convention", <u>ESA Bulletin</u> #25, February 1981, 7.

137. Annex I, entitled Privileges and Immunities, is specifically incorporated into the Convention by articles XV(2) and XX(1) thereof.

under the auspices of ESRO[138] which was formally recognized by, inter alia, the USA as a 'Public International Organization'.[139] Regarding the conclusion of co-operative agreements with other States, there is an important difference between the procedure adopted by ESRO and that of its successor organization, ESA. Thus, by article XIII of the ESRO Convention, it was stated that

> [t]he Organisation may, by a unanimous decision of the Council, co-operate with other international organisations and institutions and with Governments, organisations and institutions of non Member States.

This is reiterated in article XIV(1) of the ESA Convention and, at this initial stage, the procedures are the

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138. See "Convention for the Establishment of a European Space Research Organisation", Basic Texts, op.cit., supra, note 134, A1/1, article XIV, done at Paris, 14 June, 1962, EIF 20 March, 1964. See also, "Protocol on Privileges and Immunities of the European Space Research Organisation" A3/1, article 1.

139. Executive Order 11760 "Designating the European Space Research Organization (ESRO) as a Public International Organization Entitled to Enjoy Certain Privileges, Exemptions and Immunities", signed by President Nixon, 17 January, 1974, Federal Register, Vol. 39, No. 14, Monday, 21 January, 1974, 2343.

same.[140] However, the following stages exhibit significant variations. Thus, the ESRO system employed the 'Special Projects' exception in order to co-operate outside already mandated ESRO programmes.[141] This necessitated a Council Declaration to authorize the use of the aforementioned exception, following which,

> the Member States interested then conclude, in their capacity as sovereign States ... a multilateral agreement, called an "Arrangement", which allows the Organisation to grant assistance towards carrying out the project, i.e., in reality, to execute it itself.[142]

In concluding co-operative agreements, therefore, ESRO would commit itself formally by the authorized signature of its

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140. Article XIV (1) provides that "[t]he Agency may, upon decisions of the Council taken by unanimous votes of all Member States, cooperate with other international organisations and institutions and with Governments, organisations and institutions of non-member States, and conclude agreements with them to this effect."

141. Article VIII of the ESRO Convention, regarding Special Projects, provides as follows: "[i]f, outside the agreed programme but within the scope of the Organisation, one or more Member States engage in a project in connection with which the Council decides, by a two-thirds majority of all Member States, to make available the assistance of the Organisation or the use of its facilities, the resulting cost to the Organisation shall be refunded to the Organisation by the State or States concerned." See M. Bourély, "The Legal Status of the European Space Agency", in Proceedings of the Twenty-Third Colloquium on the Law of Outer Space, Int'l Inst. of Space L. of the Int'l Astronautical Fed'n, 21-28 September, 1980, Tokyo, 129, 130.

142. Ibid., Bourély.

Director General, and the Member States would then ratify this agreement individually.[143] This was the case with the Spacelab Agreement discussed supra in the section on the USA.[144]

In contrast to the foregoing, the ESA Convention institutionalized a dichotomy of programmes - mandatory and optional.[145] Optional programmes are carried out in accordance with Annex III to the Convention which prescribes a three step procedure: proposals are submitted to the ESA Council which adopts a Resolution accepting the programme;[146] the participating States draw up a Declaration embodying their commitment to the project;[147] after which there is a three month grace period during which those Member States who do not wish to participate in the programme so declare; Technical and Financial Annexes to the Declaration follow, together with the promulgation of

143. Ibid.

144. III B 1 (c).

145. ESA Convention, article V (1).

146. Ibid., article XI 5 (c) (i).

147. Article I 2 of Annex III.

Implementing Rules.[148] According to Dr. Bourély,

> [t]hese three legal instruments - the Resolution, the Declaration and the Implementing Rules - thus lay down the obligations of the participating Member States and of the Agency. Since however, this procedure is specified in the ESA Convention, it is not considered necessary to ratify the legal instruments concerned.[149]

In order for non-Member States to participate in such a programme, an additional agreement is required, between such State and ESA as an International Organization.[150]

In the context of the Space Station Project, an inter-agency MOU was signed between NASA and ESA for phase B

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148. Ibid., and see M. Bourély, op.cit., supra, note 55, 12. As an example of this procedure, the L-Sat programme gave rise to the following instruments which may all be found in ESA Basic Texts, op.cit., supra, note 59: G14a. Resolution on a Programme Related to the Development of a Multi-purpose Large Platform, 26 July, 1979, ESA/C/XXXIII/Res. 1; G14b. Declaration on the Project Definition Phase of a Programme Related to the Development of a Multi-purpose Large Platform (Phase B1), 26 July, 1979, ESA/C/XXXIII/Dec. 2; G14c. Additional Declaration (Phase B2), 6 December, 1979, ESA/JCB/XXXV/Dec.; G14d. Implementing Rules for the Project Definition Phase of the L-Sat Programme, 10-11 October, 1979, ESA/JCB (79) 36 rev. 2.

149. Ibid., Bourély; however, the latter observes that some Member States of ESA consider that ratification is still required - at note 8.

150. See e.g. supra, note 99, the two ESA-Canada "Arrangements" concerning the L-Sat Programme.

activities.[151] The preamble to the MOU states that it was made pursuant to a Resolution of the ESA Council, on 31 January 1985, at Ministerial level. Thus, the Member States were represented by Government Ministers, usually from their respective Ministries of Science and Technology or their equivalents. In addition to serious doubts having been expressed within ESA regarding the status of MOUs, as we have seen <u>supra</u> in the section on the USA, the aforementioned Dr. Bourély has stated categorically that

> [i]t is to be hoped that the persons responsible for negotiating the conditions and modalities of European participation in the American space station programme will bear in mind the lessons learned from the cooperative Spacelab/Space Shuttle programme and that they will manage to persuade their American partners that, in such a vast enterprise as this, it is in the interest of both parties to organise their cooperation on the strongest and most reliable bases possible.[152]

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151. "Memorandum of Understanding Between the National Aeronautics and Space Administration and the European Space Agency for the Conduct of Parallel Detailed Definition and Preliminary Design Studies (Phase B) Leading Toward Further Co-operation in the Development, Operation and Utilization of a Permanently Manned Space Station", 3 June, 1985, obtained from the Washington Office of ESA.

152. <u>Op.cit.</u>, <u>supra</u>, note 55, 15.

C. CONCLUDING REMARKS

The preceding discussion represents a synthesis of many different laws from several legal systems both international and municipal. In addition, the presentation of each system in turn has involved considerable distillation. Amidst the uncertainties which have surfaced, several impressions will have, nevertheless, become clear. Perhaps the most significant is that of the fragility and ambiguity inherent in our international legal "system" a fortiori agreements made thereunder. Whilst the fragility may be somewhat surprising, the ambiguity is inevitable, given the multiplicity of municipal legal and political systems which contribute to its development. The conclusion of agreements in the space field is a microcosm of this process.

We have seen that each potential space station partner reaches the negotiating table by widely differing constitutional processes, though Canada and Japan generally employ similar instruments upon completion. The search for a precedent for the Space Station Project is complicated by the fact that the latter implies, as we have seen in Chapter I supra, an order of co-operation unlike any other before it in: politico-economic terms; the complexity of the undertaking; the level of integration required to make the project work; the sheer magnitude of the project; and in the longevity envisaged for it - at least twenty years, probably much longer. It is submitted that these facts mandate the conclusion of agreements between the participants standardized at the highest common denominator.

It has been shown that Canadian, Japanese and European practice all envisage the inter-governmental treaty format effective as such both in international and municipal law. However, US practice, due to its unique constitution, employs an instrument, of whatever denomination, which has an equivocal position in the US municipal legal system. Since the USA is the dominant partner in the project, its influence will be considerable in the choice of the form of agreement for the Space Station Project. This choice will be a political one, involving considerations which go far beyond the confines of the present discussion. As an observer of the process and a lawyer searching for legal certainty, the full US treaty form is indicated. If it is thought that the "tyranny of the minority" in the Senate[153] would prove insurmountable, perhaps a Congressional Executive Agreement could be made. It appears inevitable that the Space Station Project will involve

153. One third plus one of Senators present may prevent a treaty being approved, by article II(2) of the US Constitution, see supra, B 1(a).

Congress at some stage, though the timing of this involvement may be delicate given the flux of national political imperatives. There will undoubtedly be a need for municipal legislation associated with this project and, perhaps, a piecemeal approach through annual budget appropriations will be necessitated for the project to proceed domestically at all.

Nevertheless, from an international perspective, the stronger the foundations of the agreement, the more likely it will be that the project will reach fruition and that a uniform substructure of municipal laws and regulations will be built thereunder. To put it another way, the stronger the agreement is in terms of its formation, the more likely it will be implemented through its own self-fulfilling force. It must be realized, that this is the first of what could be many such agreements in the Space Stations' Era. The ever-widening cadre of space powers will steadily effect an equalization of the bargaining positions of those nations already in space. In anticipation of this process, it is to be hoped that the form of agreement chosen for the Space Station Project may be a worthy precedent.

A final point concerns the possibility of a multilateral agreement being concluded among the parties. This is advocated by some[154] to ensure privity of contract between the parties, since a US-dominated system of bilaterals would require the conclusion of additional agreements between Japan and ESA, Canada and ESA, and Japan and Canada. Despite the logic of a single multilateral agreement, this runs counter to NASA's methodology and has not been seriously advocated by more than one partner's authorized representative in the public domain.[155] Nevertheless, parallel bilaterals, providing the terms are identical, would achieve the same result as a single multilateral. Indeed, it may be that the partners would not wish to compromise their ability to negotiate more favourable or additional terms with the other "equal" partners. In the next chapter, there will be an assessment of managerial structures employed in past international cooperative space projects which exhibit various interpretations and permutations on the themes of equality and equity.

154. See G. Lafferanderie 'The Legal Regime for the Transfer of Technology', in Commercial Use of Space Stations - the Legal Framework of Transatlantic Cooperation (1986, DGLR Publication) 156, 166.

155. Ibid., Dr. Lafferanderie is Legal Counsel to ESA.

III. STRUCTURES FOR INTER-GOVERNMENTAL OPERATION AND UTILIZATION OF THE US/INTERNATIONAL SPACE STATION

> *Whether we like it or not, international collaboration is with us and is here to stay. That said, not all collaborative arrangements will succeed. It is crucial not only that each partner should bring a significant contribution to the table and thereby command the respect of the others, but also that each partner feels that he has obtained a square deal. If these criteria are not satisfied, the partnership will soon sour and sooner or later perish.*
>
> Sir Philip Foreman
> Chairman and Managing Director
> Short Brothers[1]

A. ESTABLISHING THE PARAMETERS - CONCEPTS UNDER NEGOTIATION

The spring 1985 trio of Memoranda of Understanding for phase B space station activities between the USA, as represented by NASA, and agencies from the three prospective

1. Excerpt from speech given before the American Society of Mechanical Engineers, reproduced in Aviation Week & Space Technology (AW&ST), 7 April, 1986, 13. Short Brothers is a world-renowned aerospace company based at Belfast in Northern Ireland.

partners Canada,[2] Japan[3] and ESA,[4] all contained language confining the effects of said memoranda to preliminary matters. In the NASA/STA and NASA/MOSST memoranda, this was expressed identically in each preamble in the following terms: "This MOU does not, however, commit either Party to cooperation beyond the detailed definition and preliminary design phase of the Program". This was more forcefully expressed in the NASA/ESA MOU wherein the above limitation of the commitment was included in a substantive article of the MOU and was accompanied by a statement to the effect that the Phase B MOU did not "prejudge the form of

2. 'Memorandum of Understanding (MOU) Between the Minister of State for Science & Technology and the National Aeronautics and Space Administration for a Co-operative Program Concerning Detailed Definition and Preliminary Design (Phase B) of a Permanently Manned Space Station', signed and entered into force (EIF) 16 April, 1985.

3. 'Memorandum of Understanding Between the United States National Aeronautics and Space Administration and the Science and Technology Agency of Japan for the Cooperative Program Concerning Detailed Definition and Preliminary Design Activities of a Permanently Manned Space Station', signed and EIF 20 May, 1985.

4. 'Memorandum of Understanding Between the National Aeronautics and Space Administration and the European Space Agency for the Conduct of Parallel Detailed Definition and Preliminary Design Studies (Phase B) Leading Toward Further Cooperation in the Development, Operation and Utilization of a Permanently Manned Space Station', signed and EIF 3 June, 1985.

the future cooperative agreement".[5] The reasons underlying this caveat have been discussed in the previous chapter.[6] In the present context, it is enough to be aware that the MOU format is not a satisfactory basis for future cooperation on the US/International Space Station, at least as far as ESA is concerned. In addition to this, the prospective partners identified a number of issues requiring clarification in order to successfully conclude agreements for phases C/D (development and construction) and E (utilization). Again the Memoranda involving Canada and Japan expressed these in identical terms whereby

> [b]asic principles for cooperation during the development, operation and utilization phases that will need to be examined during this Phase include, but are not limited to, involvement in the development, operation and utilization of the Space Station; access to and utilization of the Space Station; and development of procedures to provide access to and suitable protection for technology and information.[7]

These four issues, the level of involvement, access to the station, transfer of technology and the protection of

5. Ibid., Article 1.2.

6. See supra Chapter II B1(c).

7. This appears in article 1, 'Objectives', of both the NASA/MOSST MOU and the NASA/STA MOU. (emphasis added) see infra Chapter IV D & E for a discussion of the protection of intellectual property and transfer of technology.

intellectual property, are formulated in a more detailed fashion in the NASA/ESA MOU.[8] Furthermore, the latter expands the identifiable areas of concern to include the following:

> - principles regarding Space Station system pricing;
> - identification of those operational costs to be shared on an equitable basis; ...
> - use of barter to offset costs;
> - European participation in the Space Station crew; and
> - determination of appropriate legal commitment, definition of the nature of agreement, and exploration of other legal issues (e.g., the registration of elements of the Space Station

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8. Article 1.1 of the NASA/ESA MOU formulates these four issues in the following terms:

> [S]ubjects which will have to be agreed and included in agreements governing those phases (C/D&E) include, but are not limited to:
>
> - respective responsibilities in the design, development, operation, and utilization of the Space Station system, including European responsibility for one or several identifiable element(s) of the system;
> - principles regarding access to and use of all elements of the Space Station system, including through European space transportation systems as they become available, on a basis which provides for equitable and non-discriminatory treatment for all partners;...
> - protection of intellectual property rights, including those of commercial users, [see <u>infra</u> Chapter IVD];
> - definition of appropriate technology interchanges and development of procedures to provide access to and suitable protection for technology and information;...(see <u>infra</u> Chapter IVE].

system).[9]

The Memoranda established two levels of coordination during phase B activities, bilateral and multilateral. At the bilateral level, three Programme Coordination Committees were set up to integrate each participant's contribution to the Space Station into the US Initial Operating Capability (IOC) concept.[10] Multilateral coordination was divided into an International Utilization Coordination Working Group (IUCWG) on the one hand and an International Operational Concepts Working Group (IOCWG) on the other. The IUCWG was charged with developing an overall utilization plan for the space station by coordinating each partner's "Space Station Utilization Plan", while the mandate for the IOCWG was to "consider various operational aspects of the Space Station, such as crew planning and operations costs."[11]

Several principles have emerged during the negotiations which will affect further cooperation. The first, termed "functional allocation" is a NASA concept whereby

9. Ibid., article 1.1., the last issue is discussed supra Chapter II, (nature of agreement) and infra Chapter VII (Registration).

10. The terms of reference for each Programme Coordination Committee are contained in article 6 of each of the respective Memoranda.

11. Article 7.2 of each MOU.

each partner develops a different component of the space station to avoid duplication of effort.[12] This is the logic at the root of the debate between NASA and ESA regarding the US Congressional direction to confine ESA participation to the construction of a life sciences module rather than duplicating a US materials' processing module.[13] The second principle is a corollary of the first and is described as "mutual" or "open access". This implies that the entire space station should be a common facility allowing each partner to have access to all the others' contributory elements. According to the former Director of International Affairs for NASA, Kenneth S. Pedersen,

> [s]ome form of open access is essential if one hopes to use the expanded up-front resource base offered through international partnership to gain more diversified and enhanced capabilities for the overall facility. Without assurances of mutual access, each partner would be sorely tempted to concentrate on building and controlling access to only the most commercially or technologically rewarding elements. The result would be a degree of disjointed duplication that, at some level, would become either unworkable or so inefficient that it would tip the cost-benefit balance firmly against coopera-

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12. Comments of Robert V. Lottman, NASA Headquarters, Washington, D.C., at International Business in Space Conference, sponsored by the Center for Space Policy Inc. at J.W. Mariott Hotel, Washington, D.C., 15 January, 1986.
13. See *supra* Chapter I B1(b)(i).

tion.[14]

However, for these two principles to work effectively, a third must enter the equation, that of "priority" or "preferential access" to transportation to and from the station. This has been identified by both the aforementioned Professor Pedersen[15] and former ESA Legal Advisor Dr. Michel Bourély,[16] in terms that partners should be given either discounted prices or a priority or preferential rating above non-participants, in access to the US shuttle Space Transportation System (STS). This has led to both anxiety among the partners lest the USA monopolize the STS, which is the primary launch system for the station, and a concomitant drive for the consideration of non-US launch capability for space station operations.[17]

14. K.S. Pedersen, 'The Changing Face of International Space Cooperation', Space Policy Vol. 2 No. 2, May 1986, 120, 133.

15. See 'International Cooperation and Competition in Space: A Current Perspective', 11 J. Space L., 21, 25 (1983). Professor Pedersen is currently teaching at Georgetown University, Washington, D.C.

16. See 'Agreements Between States and With International Organisations', paper presented at an International Colloquium on Space Stations, Hamburg, West Germany, 3 & 4 October, 1984, 10.

17. See supra Chapter IB2 and IB3, where they deal with the ESA Hermes and the Japanese H-2 programmes.

Underlying these three principles, is the fourth and most important one, which defines the perception of the entire space station project. On one side, are the space powers which have come of age and desire a recognition of their status as equal partners in this venture. On the other side, there is the USA, long dominant as the world's leading space power and firm in negotiation from this position of strength.[18] While recognizing that the climate for international cooperation has changed and the balance is shifting, there is a natural desire for an equitable recognition of the lion's share of the investment in the space station project provided by the USA. All common lawyers know the maxim "equality is equity", however, as is often the case and certainly is so in this situation, all things are not equal.[19]

It is a considerable challenge to the negotiators of this project to balance all these principles and still emerge with a coherent, efficient and accessible space station. Whilst this is a venture of unprecedented scale and which provokes an unprecedented range of implications, it does not occur in a legal vacuum. There have been a

18. See Pedersen, <u>op.cit.</u> <u>supra</u> note 14 <u>passim</u>, for an excellent assessment of the political climate.

19. See <u>supra</u> Chapter I <u>passim</u>.

large number of highly significant international space-related cooperative activities undertaken over the last twenty years or so pursuant to international agreements. The second part of this chapter will review the most important of these with the twofold aim of understanding where the law has come in order to predict where it is going, and to identify precedents of action or omission which may be useful for the phase C/D & E Space Station agreements.

B. PREVIOUS INTERNATIONAL CO-OPERATIVE SPACE VENTURES - THE SEARCH FOR A PRECEDENT

International co-operation has taken place at a number of levels, with considerable variation in each level. The following is a selective evaluation based on a subjective criterion of relevance. The latter comprises the following elements: the parties involved in the US/International Space Station project; the level of complexity of the cooperative activity; and the importance attached by the present negotiating parties to such agreements as indicative of past conduct.

1. BILATERAL AGREEMENTS

(a) Procurement Relationships

(i) Remote Manipulator System (RMS) - As part of the post-Apollo STS programme, NASA and the National Research Council of Canada (NRC) signed a MOU in 1975[20] which was activated a year later by an exchange of notes between the US and Canadian governments.[21] This led to the construction of the RMS or CANADARM so crucial to many of the STS operations which have been performed to date. Indeed, its success and notoriety are such that further elaboration is unnecessary here. For present purposes, there are a number of provisions of the RMS MOU which merit attention. As a preliminary point, management co-ordination was conducted at three levels: Headquarters RMS Coordinators responsible for overall coordination of the

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20. 'Memorandum of Understanding Between the National Aeronautics and Space Administration and the National Research Council of Canada for a Co-operative Program Concerning the Development and Procurement of a Space Shuttle Attached Remote Manipulator System', signed by NASA on 9 July, 1975 and the NRC on 18 July, 1975.

21. Agreement relating to Space Cooperation in the Production of a Remote Manipulator System, effected by exchange of notes, signed at Washington and EIF 23 June, 1976, with MOU attached ibid, 27 UST 3801, TIAS 840, C.T.S. No. 34, 23 June, 1976.

project;[22] RMS Project Managers for day-to-day management;[23] and a Joint RMS Working Group (JRMSWG), co-chaired by the Project Managers, for exchange of information, monitoring interface items, and dealing with problems as they occurred.[24] In addition, the RMS Coordinators and Project Managers would develop and update a Joint RMS Project Plan through a series of review procedures.[25]

Regarding financing of the project, each side was to "bear the full costs of discharging their responsibilities"[26] and there was to be no recoupment of R & D costs by either party from the other through this programme.[27] The crux of the agreement was a commitment by Canada to the effect that,

> [i]n order to assure the integrity of operation and management of the Space Shuttle system, NASA shall have full control over the RMS first flight unit after its delivery, including unrestricted use free of cost.[28]

In return, NASA made three commitments:

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22. MOU article VI 1.

23. *Ibid.*, article VI 2.

24. Art. VI 3.

25. Arts. IV and VI 5.

26. Art. VII 1.

27. Art. VII 4.

28. Art. XIII 2.

- to procure future RMS and simulator hardware (at least two) from Canada;[29]

- to abstain from developing an RMS "substantially duplicating" the Canadian one, subject to Canadian default on the MOU, the retention of rights to "pursue technology developments directed at advancements in the state-of-the-art beyond that directly related to this RMS", and the rights to study but not develop duplicative capabilities and to study and develop non-duplicative RMSs "without restriction";[30]

- and to "provide access for Shuttle and Spacelab use to Canada in preference to countries not participating in the development of the [STS]" on a cooperative or cost-reimbursable basis,[31] together with a similar preference to "Canadian proposals for cooperative flights" on the STS.[32]

In evaluating the RMS programme, the late Dr. John H. Chapman, a chief architect of Canada's present success in space, stated that "[t]here appears to be a consensus among Canadian government agencies that present mechanisms and

29. Art. VIII 1.

30. Arts. X and XI.

31. Art. XIII 3b.

32. Art. XIII 3c.

procedures are not adequate for the exploitation of future operational systems."[33] He cited imbalances in payments (in the favour of the USA), lack of early consultation for preparation for the operational phases of programmes and the need for "long term cooperative planning ... to enable the international user community to define their requirements and to set up cost-sharing mechanisms."[34] With respect to the Space Station project, there seems to have clearly been advanced notice, given phase A participation by the prospective partners long before the January 1984 Reagan State of the Union commitment.[35] However, international user community cooperative planning inter partes has been conspicuously absent to date.

(ii) US-Japan Launch Services Agreement - In May 1975, Japan negotiated and signed an agreement with the USA for the launch of three Japanese satellites aboard US

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33. In a written Statement of 16 May, 1978 to the International Space Activities Hearings before the Sub-Committee on Space Science and Applications of the Committee on Science and Technology, U.S. House of Representatives, 95th Congress, 2d. sess., May 1978, No. 74, 310, 325.

34. Ibid.

35. See supra Chapter I B 1(a).

ELVs.[36] This resulted in successful flights aboard US Delta vehicles in 1977 and 1978.[37] These launches were furnished, together with associated services such as pre-launch check out, and tracking and data support, on the basis that "payment for all costs incurred by the Government of the United States as a consequence of preparation for the conduct of the launchings will be made by NASDA". Furthermore, it was "understood that the mechanism for reimbursing NASA ... is intended by the Government of Japan to assure full reimbursement of costs".[38] This is indicative of a great number of such agreements concluded by NASA with a wide range of nations. However, it is one of the few substantive US-Japan agreements relating to space, in that the accompanying MOU and Annex contain detailed provisions regarding respective responsibilities in connection with the three launches. However, for present purposes, it is

36. Satellites - Furnishing of Launching and Associated Services, agreement effected by exchange of notes, signed and EIF 23 May, 1975, 26 UST 1029, TIAS 8090, accompanied by a MOU and Annex.

37. 14 July, 1977, GMS-1 Himawari-GMS-1, geostationary meteorological satellite, 14 December, 1977, CS-SAKURA - Medium-capacity communications satellite for experimental purposes, and 8 April, 1978, BSE-YURI medium scale broadcasting satellite for experimental purposes.

38. Exchange of Notes op.cit. supra note 36, para.3.

sufficient to note that this is more in the nature of a business transaction, a payment for services rendered. Although a co-operative activity, it is finite as compared to the RMS agreement mentioned above. Nevertheless, neither can be described as a partnership, since there are merely differences of degree in procurement; Japan from the USA of launch services for money, and the USA from Canada for future considerations.

(b) Partnership Arrangements

(i) Canada-ESA Cooperation Agreements - On 1 January, 1979, the first Canada-ESA Cooperative agreement came into force.[39] This was an expansion of Canada's observer status with ESA and was predicated upon the establishment of a "framework for the co-operation of Canada in the Agency's activities as an important step towards closer relations...".[40] The Agreement provided two spheres of cooperation, reflecting ESA's structure. Thus, Canada agreed to contribute one per cent of the general ESA budget

39. 'Agreement Concerning Cooperation Between the Government of Canada and the European Space Agency', signed at Montreal 9 December, 1978, EIF 1 January, 1979, ESA/LEG/5, Paris, 25 January, 1979.

40. Ibid., Article I.

for mandatory activities,[41] and was permitted to participate in any ESA optional programmes at rates to be agreed in separate arrangements for each such project.[42] In addition, Canada was given voting representation on the ESA Council, with the provision for two delegates together with their advisors, and a concomitant right to representation on any subsidiary programme boards set up pursuant to optional programmes to which Canada became a party.[43] The clearest indication of the egalitarian nature of this partnership, occurs in article VI whereby ESA endeavours

> to ensure a fair industrial return to Canada, to the same extent as provided to Member States, with respect to the geographical distribution of work relating to activities in which Canada participates.

It will be recalled from Chapter I that the fair return principle is one of the basic canons of ESA.[44] It is clear from article VI of the Agreement that Canada is accorded a status equal to that of any ESA Member State.

The 1979 agreement was followed up by another in

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41. Arts. II and IV.

42. Art. III.

43. Art. V.

44. See <u>supra</u> chapter IB2(a).

1984[45] which is in substantially the same terms as its predecessor, except that the Canadian contribution to the general budget is raised to 3 per cent.[46] It is important to emphasize that this agreement continues the framework for cooperative activity in both science and applications areas.

(ii) Space Telescope (ST) - Commenced in 1977, the ST project was agreed between NASA and ESA in the form of a MOU.[47] Later named the Hubble Space Telescope, the original launch date of 1983/1984 has now become 17 November, 1988, aboard the Shuttle Atlantis.[48] Revisits in the third quarter of 1991 and the fourth quarter of 1994

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45. 'Agreement Between Canada and the European Space Agency Concerning Cooperation', signed at Noordwijk on 9 January, 1984 with effect from the 1 January, 1984, ESA/LEG/56, Paris, 17 January, 1984.

46. Ibid., Article IV 1.

47. 'Memorandum of Understanding Between the National Aeronautics and Space Administration and the European Space Agency on Cooperation in the Space Telescope Programme', signed and EIF 7 October, 1977, ESA/C (77) 51, rev. 1, in Basic Texts of the European Space Agency Vol. II bis The Programmes (1980, ESA Publication) part G11.

48. 'NASA Releases Manifest', Space Business News, 6 October, 1986, 8.

for repair and/or refurbishment are also scheduled.[49] As its contribution to this NASA project, ESA agreed to build a Faint Object Camera (FOC) to assist in astronomical observations and also the ST solar arrays.[50] In return for providing 15 per cent of the cost of the ST, and subject to the scientific merit of its proposals,

> ESA will obtain, for use by ESA-sponsored astronomers, a portion of the observing time on the total complement of scientific instruments of the ST. It is expected and intended that this portion will be not less than 15% of the observing time on the average over the lifetime of the ST Project.[51]

Expected to last ten to fifteen years,[52] the selection of proposals for observation will be decided by an ST Proposal Review Committee on which ESA will have at least two representatives.[53] Final determinations will be made by the NASA Associate Administrator for Space Science, "after consultation with ESA as necessary".[54] Other than specific ESA procurements of US goods to enable it to carry out its part of the project, there is to be no exchange of

49. Ibid.

50. NASA/ESA ST MOU Article 4.

51. Ibid., Article 9(3).

52. Ibid. Article 3.

53. Ibid. Article 10.

54. Ibid.

funds between the parties.[55]

The ST has been completed and will continue to be in storage awaiting its 1988 launch. It is premature to evaluate the project before it begins its operational phase, but it is interesting to note that Professor Hubert Curien, while president of the French space agency CNES (Centre National d'Études Spatiales), stated that

> as a 15-percent partner, we would be very glad if we could be considered in the decision making of programs, as more than a minor partner. The difficulty in a minority is to have the feeling that your voice is really heard.[56]

(iii) International Solar/Polar Mission (ISPM) - As was the case with the ST, the ISPM project was governed by a MOU signed in 1979.[57] Each of the parties, NASA and ESA, agreed to produce a spacecraft for launch aboard a US Shuttle in early 1983, in order to study solar and inter-

55. Articles 11 and 12.

56. See International Space Activities, op.cit. supra note 33, 9.

57. 'Memorandum of Understanding Between NASA and ESA on the International Solar/Polar Mission', signed and EIF 29 March, 1979, ESA/C(78)145, ESA Basic Texts, op.cit. supra note 47, G12.

planetary physics.[58] As originally conceived, the observations of one spacecraft in the northern hemisphere of the solar system could be coordinated with those of the other in the southern hemisphere.[59] However, due to a unilateral US withdrawal from this project[60] in 1981, it has now been reduced to one ESA spacecraft launched aboard a US Shuttle at a date yet to be determined. In view of its nearer equal partnership, apart from the launch provision and a radioisotopic thermoelectric generator from the USA, the arrangements for the conduct of the project were more liberal, as compared to those for the ST for example.[61] Thus, all activities were to have been decided by mutual agreement[62] and joint decisions were to have been taken on the choice of experiments steered by a Joint Working

58. Ibid., Article 2.

59. Article 1.

60. See supra Chapter II B 1(c).

61. See the comments of Dr. Wolfgang Finke, former Director General of the Aerospace Division of the West German Federal Ministry for Research and Technology, in International Space Activities, op.cit. supra note 33, 147, where he states that "With regard to the solar-polar mission, leaving aside transportation, we are about 50-50 partners in this project. Therefore, if the project is to be postponed or cut down severely, we feel that this would be a blow to all of us".

62. NASA/ESA ISPM MOU, article 3.

Group co-chaired by NASA and ESA Project Managers.[63]

2. MULTILATERAL ARRANGEMENTS

(a) SPACELAB - A Sui Generis Procurement

The RMS Agreement dealt with above, was largely modelled after the precedent set by the Spacelab (SL) Programme. Although apparently more complex, the two programmes are essentially similar. Spacelab had a triadic legal foundation, comprising the following agreements:

- an Arrangement, between member states of ESRO and the Organization, to permit the latter to undertake the programme, dated 15 February, 1973;[64]
- a MOU between NASA and ESRO, dated 14 August, 1973;[65] and
- an Inter-Governmental Agreement among the USA

63. Ibid., article 6.

64. ESA, Basic Texts, op.cit.; G9a.

65. 'Memorandum of Understanding Between the National Aeronautics and Space Administration and the European Space Research Organisation for a Cooperative Programme Concerning Development, Procurement and Use of a Space Laboratory in Conjunction with the Space Shuttle System', done at Neuilly-sur-Seine and EIF 14 August, 1973, 24 UST 2059, TIAS 7722.

and nine member states of ESRO[66] signed later the same day as the MOU and confirming the latter.[67]

The most significant provision of the Arrangement was article 9, whereby ESRO "acting on behalf of the Participants" was declared to be "the owner of the Spacelab elements developed under the programme, as well as of the facilities and equipment acquired for its execution". This was in contrast to article XI 3 (a) of the MOU and article 7D of the Agreement which stated that

> [i]n order to assure the integrity of operation and management by the Government of the United States of America of the Space Shuttle system, this Government shall have full control over the first SL unit, after its delivery to the Government of the United States of America, including the right to make final determination as to its use for peaceful purposes.

This gave rise to considerable debate regarding the status

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66. 'Agreement between the Government of the United States of America and Certain Governments, members of the European Space Research Organisation, for a cooperative programme concerning the development, procurement and use of a Space laboratory in conjunction with the Space Shuttle system', done at Neuilly-sur-Seine, and EIF 14 August, 1973, 24 UST 2049, ibid. TIAS. The nine ESRO member States are Belgium, Denmark, France, West Germany, Italy, The Netherlands, Spain, Switzerland, and the United Kingdom. Austria joined later, in 1974.

67. See M.G. Bourély, 'The Legal Framework of the Spacelab/Space Shuttle Programs in Comparison with the Apollo/Soyuz Test Program', 4 J.Space L. 77, 89 (1976).

of Spacelab, particularly in the context of registration.[68] The issue was finally resolved by a US registration of it pursuant to article IV of the Registration Convention[69] as an integral part of the STS, since it was entirely functionally dependent on the shuttle and was incapable of independent existence as a space object.

Under the terms of the Agreement, in exchange for the joint planning of the first SL flight and the inclusion of a European astronaut aboard it, the ESRO member states ceded all subsequent use thereof to the USA "free of cost".[70] The inbuilt choice for the USA to undertake future SL use on a cooperative (non fee-paying) or a cost-reimbursable basis with ESRO member States,[71] turned out to be an option for the latter, somewhat predictably. Furthermore, there was a commitment in article XI of the MOU

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68. See M.G. Bourély, 'Legal Regimes of International Space Flight: Legal Issues Relating to Flights of the Spacelab', in S.Gorove ed., The Space Shuttle and the Law, (1980, L.Q.C. Lamar Soc. Monograph series No. 3 U. of Miss.L.Center), 73; and G.P. Sloup, 'A Guide to Lawyers to Understanding the NASA Space Shuttle and the ESA Spacelab' III Z.L.W. 196 (1977).

69. 'Convention on Registration of Objects Launched into Outer Space', opened for signature (OFS) 14 January, 1975, EIF 15 September, 1976; 28 UST 695, see infra chapter VII.

70. Agreement, article 7E.

71. Ibid., article 7A, B and E.

by NASA to

> provide access for use of SLs developed under this cooperative programme for experiments or applications proposed for reimbursable flight by ESRO and Governments participating in the SL programme, in preference to those of third countries considering, in recognition of ESROs participation in this cooperative programme, that this will be equitable in the event of payload limitation or scheduling conflicts.

This was no more favourable than that accorded to Canada in the RMS MOU, despite the greater investment, by ten times as it turned out, of the European States as compared to that of Canada. In addition, the NASA undertakings to procure additional SLs from ESRO and to abstain from duplicative SL development[72] were outweighed by the commitment by the USA and the Europeans not to recover R & D costs of their respective programmes from each other.[73] As interpreted by Dr. Michel Bourély, when ESA legal adviser,

> [t]he explanation for this clause, which is somewhat unusual in an agreement of this kind, is the need for ESA to procure directly from the United States certain existing equipment in order to avoid developing it again in Europe. The Europeans have been unable to obtain any compensation for this unfavourable element as they had hoped to do so by receiving preferential treatment in connection with reimbursable launch services supplied by the American launch sites.[74]

72. MOU article VIII 1 & 2.

73. Agreement Article 8B.

74. _Op.cit._ _supra_ note 67, pp. 94-95.

Regarding launch prices, Article 8C of the Agreement stated that the ESRO member States and ESRO itself were to be "charged on the same basis as comparable non-government United States domestic users", i.e., on a non-preferential commercial basis.

The management of the programme was also three tiered, with the MOU calling for each party to appoint an SL Programme Head, Project Managers and a Joint SL Working Group (JSLWG).[75] Although ESRO was permitted to be represented on STS change control boards, it was not allowed to vote.[76] The totality of the SL programme as perceived by the Europeans, was aptly summarized by the aforementioned Dr. Bourély, who stated that

> the Spacelab/Space Shuttle Program has the disadvantage for Europeans of not being executed on a basis of complete equality with their partner and thus places them in an unfavourable position with regard to responsibilities, funding, access to technology and the right of use. We may hope, however, that if this Program, as is desirable, is extended in the long term, the Europeans will, through their experience, become more "equal" partners of the Americans.[77]

75. MOU article VI.

76. *Ibid.*, art. VI4.

77. *Op.cit. supra* note 67, 97.

(b) Space Applications Projects

(i) Symphonie - Although ostensibly a bilateral project between France and West Germany under the auspices of an inter-governmental agreement,[78] a subsequent multilateral agreement regarding the provision of launch services by the USA[79] converted Symphonie into a *de facto* trilateral venture. This was due to the inability of ELDO to successfully produce a European ELV as envisaged by article 1(1) of the Franco-German bilateral on Symphonie. The two experimental telecommunications satellites produced under the aforementioned bilateral were launched, in December 1974 and August 1975 respectively, from Cape Canaveral atop Thor-Delta ELVs by the USA pursuant to the aforementioned multilateral agreement.

78. 'Convention entre le Gouvernement de la République Française et le Gouvernement de la République Fédérale d'Allemagne sur la construction, le lancement et l'utilisation d'un satellite expérimental de télécommunications', signed 6 June, 1967, Journal Officiel No. 215, 12 September, 1968, reproduced in N. Jasentuliyana & R. Lee (Eds), Manual on Space Law (1979, Sijthoff) Vol. I, 149.

79. 'Agreement Concerning Conditions for the Furnishing of Assistance by the National Aeronautics and Space Administration for the Launching of the French-German Symphonie Communications Satellites', Exchange of Notes at Washington, 21 & 24 June, 1974 between the USA, France and West Germany. EIF 24 June, 1974, 25 UST 3431, TIAS 7994.

A number of political compromises had been made prior to the launch of the first Symphonie satellite. As envisaged in the bilateral agreement, the Symphonie programme was for

> le lancement et l'utilisation d'un satellite expérimental de télécommunications destiné à distribuer des programmes de radiodiffusion et de télévision, à assurer des communications téléphoniques et télégraphiques et à transmettre des données.[80]

However, it became apparent that the parties were pursuing a future operational capability, with the possibility of Symphonie taking up a certain portion of transatlantic and European regional telecommunications handled exclusively by INTELSAT.[81] This was also motivated by a desire to establish a European technological capability to manufacture future telecommunications satellites, since the satellites purchased by INTELSAT were almost entirely produced by American aerospace corporations who were the only ones then capable of doing so in the West.[82] However, article

80. Symphonie Bilateral op.cit. supra note 78, article 1(1). (emphasis added).

81. N. and M. Mateesco Matte, Telesat, Symphonie et la coopération spatiale régionale (1978, The Carswell Co. Ltd.), 56 and 67 et seq.

82. Ibid., 69.

XIV(d) of the <u>INTELSAT Agreement</u>[83] requires States Parties which intend

> individually or jointly to establish, acquire or utilize space segment facilities separate from the INTELSAT space segment facilities to meet its international public telecommunications services requirements, ... [to consult] ... prior to the establishment, acquisition or utilization of such facilities ... with the Assembly of Parties, through the Board of Governors, to ensure technical compatibility of such facilities ... [with those of] INTELSAT ... and to avoid significant economic harm to the global system of INTELSAT.

In addition, US launch policy as of October 1972 established three conditions governing the provision of US launch services to foreign nations regarding telecommunications satellites.[84] Thus, the US agreed to launch satellites: which had been approved by INTELSAT following the Article XIV procedure; those which had not been submitted to consultation with INTELSAT but where it had been agreed that this would be done in good faith; and those which, despite an unfavourable recommendation from INTELSAT, the USA considered could be modified to remove the features attract-

83. International Telecommunication Satellite Organization (INTELSAT) Agreement, done at Washington and OFS 20 August, 1971, EIF 12 February, 1973. 23 UST 3813, TIAS 7532.

84. White House Fact Sheet, 9 October, 1972.

ing such disapproval.[85]

The launch contract, incorporated by reference into the multilateral agreement for the Symphonie launches, provided in article XVI that it was

> understood and agreed between the parties that the fundamental purposes of the programs of use for Symphonie satellites to be launched under this contract are and will continue to be experimental in character.[86]

Furthermore, any envisaged use of Symphonie otherwise than purely for experimental purposes mandated consultation with NASA, which could then require the operation of the INTELSAT article XIV procedure.[87] In the event, Symphonie did not become an operational system and was confined to experimental activities.[88]

From an organizational standpoint, the Symphonie bilateral is a model of equality, flowing from the fact that

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85. Ibid., See N.& M. Matte, op.cit. supra note 81, 72.

86. Ibid., Annex IV, 123.

87. Ibid.

88. There was a perception by the Europeans that this was the result of the conditions imposed by the USA in the launch contract and the multilateral agreement. See the comment of Prof. Hubert Curien in International Space Activities, op.cit. supra note 33, 7, where he states that "the operation, jointly with our German colleagues of the Symphonie satellites,... must remain experimental due to constraints imposed by the launching power".

it was for the construction of two satellites, by two States contributing equal shares to the project and deriving equal benefits therefrom.[89] Thus, the "Conseil de direction" comprised six members, three from each partner, with an alternating chairmanship. It decided all matters by consensus regarding the mission of the satellites and it approved the work of the "Comité exécutif".[90] The latter was made up of two permanent secretaries, together with their expert advisors and conducted the day-to-day management of the project.[91] The Committee rendered decisions by consensus and distributed industrial contracts for satellite manufacture on the basis of article 7(2) of the agreement, which states that

> Le maître d'oeuvre doit assurer entre l'ensemble des travaux exécutés en France et l'ensemble des travaux exécutés en République fédérale d'Allemagne une répartition quantitative égale et une répartition qualitative équitable.

Despite its attractive simplicity, this formula is not easily transposable to the US/International Space Station project due to the inequalities therein as it is currently envisaged.

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89. Franco-German Bilateral, article 3.

90. Ibid., article 5.

91. Article 6.

(ii) <u>The European Remote Sensing Satellite (ERS) Programme</u> - This project commenced in December 1978 under the auspices of an ESA Council resolution.[93] The March 1979 Declaration by interested member states set out the terms of participation in a preparatory ERS programme.[94] Canada, desiring involvement in the pursuit of a remote sensing capability, negotiated an Arrangement with ESA in March 1980.[95] By this, Canada was accorded the rights of a participant in the preparatory programme, contributing 9.15 per cent and 16.35 per cent respectively to the internal and external costs of ESA for the programme.[96] In addition, Canada was given the right to be represented by one delegate, together with advisors, on the Remote Sensing

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93. ESA/C/XXVIII/Res. 4 (12 December, 1978) ESA, <u>Basic Texts</u> <u>op.cit</u>. G17a.

94. ESA/PB-RS/II/Dec.1 (13 March, 1979), <u>ibid</u>. G17b.. The participating member States were: Belgium, Denmark, Italy, The Netherlands, Spain, Sweden, Switzerland, United Kingdom, Ireland, France and West Germany.

95. 'Arrangement Concerning the Participation of the Government of Canada in the Preparatory European Remote-Sensing Satellite Programme', signed in Paris 26 March, 1980 and Ottawa 31 March, 1980 and EIF on the latter date, ESA/LEG/23, Paris, 11 August 1980.

96. <u>Ibid</u>., articles 2 & 3.

Programme Board.[97] The latter made decisions by two thirds majority on the budget and other matters involved in the execution of the project.[98] Canada's participation in the ERS programme was extended twice, by Arrangement for phase B in 1983,[99] and by Agreement for phases C/D and E in 1985.[100] The latter increased Canadian representation to two delegates.[101] Set for a 1988 launch[102] the ERS Programme is a prime example of how a number of nations can cooperate successfully, despite differing percentage contributions, to conduct space applications activities.

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97. Id., article 4.

98. Declaration op.cit. supra note 94, article 3.

99. 'Arrangement Between the Government of Canada and the European Space Agency Concerning the Participation of the Government of Canada in the Phase B of the European Remote Sensing Satellite Programme of the European Space Agency', signed and EIF 7 February, 1983, ESA/LEG/50 Paris, 3 May, 1983.

100. 'Agreement Between the Canadian Government and the European Space Agency Concerning the Participation of Canada in the Development and Exploitation Phases of the ERS-1 Programme', signed and EIF 8 January, 1985, ESA/LEG/68, Paris 30 January, 1985.

101. Ibid., article 4.

102. See Twenty Years of European Cooperation in Space - An ESA Report '64-'84 (1984, ESA Publication), 84.

(iii) L-SAT - Another ESA applications project, involving the United Kingdom, Italy, the Netherlands, Switzerland and Denmark, L-SAT, or Olympus, is a multi-purpose large platform. The first Olympus platform, set for a late 1987 launch aboard an Ariane 3 ELV, will incorporate four elements, including a Ka Band (20/30 GHz) communications payload and a direct broadcast payload.[103] Future applications of Olympus include use for two important Canadian space projects, MSAT and RADARSAT.[104] This has resulted from Canada's accession to the L-SAT project by a 1980 Arrangement with ESA to join in this optional programme.[105] In return for its five per cent contribution, Canada was accorded the status of full participant and given the right to be represented by a delegate and advisors on the Joint Board on Communication Satellite Programmes. The latter Board approves the annual budget by two-thirds majority, but a unanimous decision is required to approve

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103. P.J. Conchie, 'The Olympus Satellite' in Europe/United States Space Activities Vol. 61, Science & Technology Series (1985, American Astronautical Society Publication) 17, 18-19.

104. Ibid., 120, see supra Chapter I B4(a).

105. 'Arrangement Concerning the Participation of the Government of Canada in the L-SAT Programme', signed 26 July, 1979 by ESA and 28 July, 1980 by Canada and EIF on the latter date, ESA/LEG/25, Paris 18 November, 1980.

the contribution levels of the participants and the timing of the project.[106] This was followed by a 1982 Arrangement for the development phase of L-SAT, in similar terms to its predecessor.[107] This is a further example of successful international cooperation for space applications for commercial/industrial purposes.[108]

(c) Public Service Criterion Programmes

Programmes selected and grouped in this subsection have as a common theme their public service motivation. By

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106. 'Implementing Rules For the Project Definition Phase of the L-SAT Programe', ESA/JCB(79) 36 Rev.2 in ESA Basic Texts, op.cit., G14d, article 3.

107. 'Arrangement Concerning the Participation of Canada in the Development Phase of the Large Telecommunications Satellite Programme (L-SAT)', signed in Paris and EIF 25 June 1982, ESA/LEG/39, Paris 5 July, 1982.

108. See Declaration on the Project Definition Phase of a Programme Related to the Development of a Multi-Purpose Large Platform (Phase B1), ESA/C/XXXIII/Dec. 2 (Final) 26 July, 1979, ESA Basic Texts, op.cit., G14b, which states in the Annex regarding programme objectives: "(a) the first objective is the development of a multi-purpose large platform designed for a range of future telecommunication applications on a basis that will maximise future competitivity (sic) of European industry for export sales in the world market; (b) the second objective is the development and in-orbit demonstration of a payload which will advance European technology status, stimulate users, and promote new markets". (emphasis added).

this is meant an application of space technology which, because of its transnational public necessity, is conducted on a cooperative non-commercial basis.

(i) AEROSAT - Although this programme never came to fruition, for reasons outlined above,[109] it contains many interesting organizational features which may be useful for the Space Station project. The two principal documents which laid the foundations of AEROSAT were: a MOU among the US Federal Aviation Administration (FAA), ESRO and Canada;[110] and an Arrangement among ESRO, COMSAT General Corporation (a US company) and Canada.[111] The programme was created in response to a call from the International Civil Aviation Organization (ICAO) for States and international organizations to evaluate the utilization of space

109 See supra Chapter II B1(c).

110. 'Memorandum of Understanding on a Joint Programme of Experimentation and Evaluation Using an Aeronautical Satellite Capability Between the United States Department of Transportation (Federal Aviation Administration), The European Space Research Organisation, and the Government of Canada', signed 9 May and 2 August, 1974, EIF on the latter date, reproduced in ESA Basic Texts, op.cit. G16.

111. 'Arrangement to Establish an Aeronautical Space Segment Capability Between the European Space Research Organisation, Comsat General Corporation, and the Government of Canada', signed 2 December, 1974, Ibid.

technology for aeronautical operational needs.[112] Motivated also by the desire to avoid duplication of effort in this field with global implications, the aforementioned parties to the MOU established a Joint AEROSAT Evaluation Programme[113]

> to bridge the gap in time and knowledge between the current experimental efforts, and an operational satellite capability; the initial capability must be an extension of the current experimental efforts and provide verification of system design; subsequently it must demonstrate that it will be possible to attain the quality of service expected in an operational phase for air traffic control and air carrier purposes.[114]

In particular, the Programme aimed to place two satellites in GEO via Delta ELVs to provide voice and data communications between ground stations and aircraft during long haul flights.[115] In addition, two sets of ground facilities were intended, Aeronautical Satellite Communications Centres - for surveillance and data management, and Aeronautical Services Earth Terminals (ASET), one on each side of the Atlantic, for telecommunications transmission.[116] It is interesting to note that the USA and Canada were to have

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112. AEROSAT MOU. Preamble.

113. Ibid., Article 1(1)(d).

114. Id., Article 1(2)(a).

115. Id. Article 2.

116. Id., Article 4.

equal use of the North American ASET despite the disproportionate investment in the programme which will be discussed presently.

Expressly stated not "to prejudge institutional arrangements for an operational capability", an AEROSAT Council was provided for in article 5 of the MOU. The FAA and ESRO were each accorded six representatives, while Canada was given three, and other participants which acceded to the venture subsequently would be permitted one representative each. Decisions were to be unanimous if possible, with at least the approval of the FAA and ESRO delegations (one vote per delegation) being required.[117] The Chairmanship was to alternate at yearly intervals between an ESRO and an FAA representative, the first being provided by the latter.[118] ESRO and Canada were to have access to the AEROSAT capability free of charge, while the FAA was to lease its share from a US company created for the purpose.[119] AEROSAT utilization was to be determined by the Council, according to the Joint Evaluation Programme.[120] Another interesting feature of the MOU was the

117. _Id_. Article 6(2).

118. _Id_. Article 6(3).

119. _Id_. Article 10(1).

120. _Id_. Article 10(2).

provision on dispute settlement, whereby they were to be referred to the Administrators of the FAA and ESRO to decide, with an ultimate recourse to agreed arbitration.[121]

The later Arrangement for AEROSAT set up a parallel organizational structure. Thus, a Space Segment Board was formed, comprising three representatives each from ESRO and COMSAT Corporation, and one representative from Canada.[122] Decisions were to be reached unanimously if possible, with at least the concurrence of the ESRO and COMSAT representatives, which shared an alternating Chairmanship. The Board was to conduct the procurement of the space segment including budgetary authority and the issuance of contracts. The space segment was to be jointly owned in undivided shares in proportion to the contributions of the partners,[123] which were: ESRO 47 per cent; COMSAT 47 per cent; and Canada 6 per cent.[124] Furthermore, the AEROSAT utilization capacity and industrial contracts for its construction were to be allocated in proportion to these

121. Article 16.

122. Arrangement op.cit. supra note 111, article 5.

123. Ibid., article 8.

124. Id., article 9.

contributions.[125] The contract was awarded to a consortium including General Electric, COSMOS (itself a consortium of European companies) and Canadian companies.[126] The first launch was originally anticipated in 1979, with the second following within eight months.[127] Despite its premature termination in 1981 by the unilateral US withdrawal due to funding difficulties, an international committee was subsequently set up under the auspices of the AEROSAT Council, to monitor civil aviation operations in the context of space technology.[128]

(ii) COSPAS/SARSAT - The most significant East-West cooperative space venture since the Apollo-Soyuz Test Project in 1975, COSPAS-SARSAT was created in 1979. The SARSAT (Search and Rescue Satellite-Aided Tracking) system involving the USA, France and Canada is particularly relevant in the present context. However, its association with

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125. Articles 12 and 13(5).

126. 'AEROSAT development links European and transatlantic space industries', ESA Newsletter no. 5, November 1976 (unpaginated).

127. Ibid.

128. See S. Gorove (Ed.) United States Space Law - National and International Regulation (1982, Oceana Publications Inc., periodically updated), Vol. II, 215.

the Soviet COSPAS (from the Russian for "Space System for the Search of Vessels in Distress") system augurs well for future co-operative ventures as the Space Stations' Era unfolds. The SARSAT system was created following preliminary evaluations conducted in parallel by NASA, the Canadian Department of Communications (DOC) and the French CNES. These activities were coordinated in a MOU signed in 1979 and confirmed by subsequent exchanges of letters between these three parties.[129] The MOU stated in article 2.2 that, following positive feasibility studies of a system utilizing satellites to aid search and rescue activities for both aircraft and maritime vessels, "[t]he goals of such a system would be to improve distress monitoring coverage, reduce detection time and provide more accurate initial location of distress incidents". The several objectives of the SARSAT system are then outlined, and include:

- orbiting three US National Oceanic and Atmospheric Administration (NOAA) spacecraft, equipped with Canadian-developed signal repeaters and French-developed

129. 'Memorandum of Understanding between the Department of Communications of Canada and the Centre National d'Etudes Spatiales of France and the National Aeronautics and Space Administration of the United States of America Concerning Co-operation in an Experimental Satellite-Aided Search and Rescue System', signed at Ottawa, Washington and Paris, 16 and 19 July and 27 August, 1979; EIF 27 August, 1979.

signal processors[130] to detect and retransmit distress signals;

- establishing ground local user terminals (LUTs)[131] to receive satellite signals and relay data to the following elements;

- creating Mission Control Centres (MCC) in each of the participating countries, with the master control being in the USA, to receive data from LUTs and coordinate with other MCCs;[132]

- and alert Rescue Coordination Centres to carry out local search and rescue activities.[133]

The distress signals are emitted by emergency locator transmitters (ELTs) carried by aircraft, and emergency position indicating radio beacons (EPIRBs) carried by certain classes of maritime vessels.[134]

The space segment is clearly stated to be owned by the US National Environmental Satellite Service (NESS) of the NOAA, itself a part of the US Department of

130. Ibid., article 3.1.

131. Ibid.

132. Ibid., article 4.3.

133. US-Soviet Cooperation in Space (Washington, D.C.: US Congress, Office of Technology Assessment, OTA-TM-STI-27, July 1985), Appendix C, 109.

134. MOU article 3.1.

Commerce.[135] In addition, NESS retains "total control of the satellite in orbit with unilateral rights of payload management. Interference with the primary payload [chiefly meteorological] will not be permitted."[136] Organization of the project was on two levels, a Steering Group comprising one member from each of the three partners to coordinate activities and give policy guidance to the second body, the Joint Working Group.[137] The latter performs technical coordination pursuant to a joint programme implementation plan. Both bodies operated by decision by mutual agreement, i.e. consensus, with Working Group issues unable to be so decided referred to the Steering Group. The Chairmanship of these two bodies was on an annual basis, with the first being NASA representatives, rotation being implied.[138]

The final point of interest with respect to this MOU was its provision for participation of the agencies of other countries.[139] Such accession was subject to consultation among the parties, and has resulted in the

135. Ibid., article 5.1.2.

136. Ibid.

137. Ibid., article 11.

138. Ibid.

139. Ibid., article 13.

participation of several other nations.[140]

This was followed up by a MOU signed later in 1979 among the SARSAT partners and the Ministry of Merchant Marine, (MORFLOT) of the USSR.[141] The resulting COSPAS-SARSAT network aimed at "interoperability" between the two

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140. See for example, 'Understanding Among the Department of Communications of Canada, The Centre National d'Études Spatiales of France, The National Aeronautics and Space Administration of the United States of America, and the Royal Norwegian Council for Scientific and Industrial Research Concerning Participation by Norway in an Investigation of the Demonstration and Evaluation of an Experimental Satellite-Aided Search and Rescue System', signed at Ottawa, Paris, Washington and Oslo, 25 and 30 September, 19 October and 13 November 1981 and EIF 13 November, 1981. This MOU states in article 4 that

> the objective of the Norwegian investigation is to contribute to the demonstration and evaluation of satellite-aided techniques for Search and Rescue designed to improve distress monitoring coverage, reduce detection time and provide more accurate initial location of distress incidents, thereby offering the potential for significantly (a) improving chances of saving lives and (b) reducing resources expended in search and rescue operations.

In order to achieve this Norway established a LUT (on its own and Sweden's behalf), as has the U.K. In addition, Finland and Bulgaria are participants, with Brazil and Denmark expected to do so also, see US-Soviet Cooperation, op.cit. supra note 133, 109.

141. 'Understanding Among the Department of Communications of Canada, CNES of France, the Ministry of Merchant Marine of the USSR and NASA Concerning Cooperation in a Joint Experimental Satellite-Aided Search and Rescue Project', signed at Leningrad 23 November, 1979, and confirmed by exchange of notes, EIF 13 August, 1980.

systems[142] pursuant to an implementation plan developed and coordinated by the COSPAS-SARSAT Coordinating Group (CSCG).[143] Each of the partners was accorded two members to serve on the CSCG, one of which would be a designated representative. Decisions are to be taken by mutual agreement with referral to the signatory States in the event of inability to resolve issues.[144] During the demonstration and evaluation phase of the COSPAS-SARSAT project, the USSR orbited three satellites and the USA two.[145] Ten LUTs[146] and six MCCs were established to carry out the

142. Ibid., article 3.

143. Ibid., article 13.

144. Ibid.

145. The Soviet satellites were COSPAS I (Kosmos 1383) June 1982, COSPAS II (Kosmos 1447 - March 1983, and COSPAS III (Kosmos 1574) June 1984, while those of SARSAT launched by the USA were NOAA-8 March 1983, (failed prematurely in June 1984), and NOAA-9 December 1984, 'COSPAS-SARSAT Services Agreement to continue to end of 1990, unless replaced by New International Instrument', ICAO Bulletin, February 1986, 20.

146. Ibid., The LUTs were based at: Ottawa, Canada; Toulouse, France; Tromsoe, Norway; Lasham, U.K.; three in the USA, Kodiak-Alaska, Point Reyes-California, and Scott A.F.B. Illinois; and three in the USSR - Moscow, Arkhangelsk and Vladivostok.

project.[147] This phase was intended to "permit the Parties to make recommendations on follow-on global operational applications."[148]

The progression to an operational system was implemented by a 1984 MOU between the NOAA, the Canadian Department of National Defence (DND), CNES and MORFLOT.[149] This substantially reiterates the provisions of the 1979 MOU, with the objective clearly stated to be "to establish the COSPAS-SARSAT system as an international operational global search and rescue satellite system".[150] This includes a commitment to "actively encourage the operational use" of the system "by other countries as the basis for" a global network.[151] This includes cooperation with interested international organizations such as the International Maritime Satellite Organization, ICAO and the

147. Ibid. The six MCCs were at the same locations, in each of the States mentioned ibid, the US one being at Scott AFB and the Soviet one at Moscow.

148. COSPAS-SARSAT MOU op.cit. supra note 141, article 3.2.

149. 'Memorandum of Understanding... Concerning Cooperation in the COSPAS-SARSAT Search and Rescue Satellite System', signed at Leningrad 5 October, 1984, EIF 8 July, 1985.

150. Ibid., article 3.1.

151. Ibid., article 3.3.

International Telecommunications Union.[152] The CSCG is replaced by a COSPAS-SARSAT Steering Committee (CSSC) although the constitution and operational methodology remains the same as before.[153] The CSSC mandate is the technical and operational coordination of the system with the goal of "developing as soon as possible recommendations regarding the establishment of _the_ international operational global COSPAS-SARSAT search and rescue satellite system".[154] Also, in anticipation of the encouraged wider participation, a permanent secretariat has been provided by INMARSAT pursuant to a MOU affiliating it with the COSPAS-SARSAT system.[155]

The MOU will be in operation until either another international framework is agreed or 31 December, 1990, whichever is the earlier.[156] Discussions are under way regarding future institutional arrangements, though a July 1985 meeting of the CSSC declared that the system is not a commercial one, and so is open to participation by all

152. Ibid., article 3.6. A MOU was signed in January 1987 with INMARSAT acceding to the COSPAS-SARSAT network Telephone conversation with representative of the Canadian Search and Rescue Secretariat, Ottawa, February 1987.

153. Ibid., article 10.

154. Ibid., emphasis added.

155. Ibid.

156. Ibid., article 14.

countries.[157]

3. THE REGIONAL APPROACH - ESA AS A MODEL

Due to its unique regional nature, ESA cannot be considered as a precedent in its entirety for the US/-International Space Station. Nevertheless, there are certain aspects of the ESA structure which are worth emphasis in this context. The basic point relates to ESA's ability to function cohesively, in particular with respect to commercially-oriented applications programmes. This is despite its disparate membership and large variations with respect to financial contributions. The wise provision of an à la carte choice of optional programmes[158] not only gives member States some freedom of action in targeting their resources for industrial returns, but also enables non-member States, such as Canada, to participate, as we have seen with the ERS and L-SAT programmes outlined above. The fundamental recognition of the equality of member States is not detracted from by the variations in the percentage of contributions, due to the equitable "fair return"

157. ICAO Bulletin, op.cit. supra note 145, 22.

158. See supra Chapter I B 2(a), and Chapter II B 4.

principle.[159]

The chief organ of ESA, the Council, is composed of representatives from all member States and votes are taken variously as follows: unanimously regarding the level of resources to be made available by the member States to the Agency and for the approval of international cooperative ventures; by two-thirds majority on other budgetary issues; and by simple majority for the approval of optional programmes and as a general rule.[160] Each member State is accorded one vote, except with respect to optional programmes in which it does not take part.[161] However, the complexity of the ESA framework, especially the observance of the "fair return" principle has led Dr. Wolfgang Finke, until recently the Director General of the West German Ministry of Research and Technology (BMFT), to state that

> this type of collaboration is worthwhile only under specific political circumstances.... One must, however, realize that [ESA] was created and operates under exceptionally favorable conditions. I, therefore, fail to see that this form of international collaboration can be transferred to other groups of nations and I

159. Ibid., Chapter I B 2(a).

160. 'Convention for the Establishment of a European Space Agency', Basic Texts of the European Space Agency op. cit., supra., note 47, Volume I, A6. These are selected issues only to exemplify the voting variations; see further article XI 5(a)-(m).

161. Ibid., article XI 6(a).

> have even doubts whether ESA itself could be substantially enlarged beyond its present scope.[162]

Bearing this caveat in mind, it is nevertheless true that ESA has been remarkably successful at accommodating the varying interests of a substantial heterogenous group of nations on two continents. This augurs well for the US/-International Space Station project.

4. GLOBAL ACTIVITIES

Although manifestly not a universal activity, the US/International Space Station project does envisage the participation of up to sixteen nations from three continents. Thus, a brief consideration of certain elements of the global methodology may be appropriate.

(a) Elements of INTELSAT

It is not proposed herein to deal with INTELSAT in more than a very peripheral manner. It has generated a considerable volume of legal comment, since its inception in 1973 as a continuation of global commercial telecommunica-

162. See International Space Activities, op.cit. supra note 33, 139.

tions activities begun in 1964.[163] Due to the fact that telecommunication is a unique space application, from the perspectives of its commercial profitability, its inherently global public service rationale and its largely apolitical and passive space segment, it may not transpose too readily to other areas.[164] The aspects of the INTELSAT structure which do bear inclusion in this context, however, are the constitution and functioning provisions for its Board of Governors. The third of a four tier structure,[165] the

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163. A recent, perhaps definitive, article concerning INTELSAT, which inter alia traces its history and politico-economic development is by a former Director General thereof Richard R. Colino, 'A Chronicle of Policy and Procedure: The Formulation of the Reagan Administration Policy on International Satellite Telecommunications', 13 J.Space L. 103 (1985). See also N.M. Matte, Aerospace Law - Telecommunications Satellites (1982, Butterworths) pp. 107-141 for an account of INTELSAT structure and how it functions.

164. See the comments of former NASA Administrator Dr. Robert A. Frosch in International Space Activities, op.cit. supra note 33, 282, where he states that "in some ways communication is a particularly straightforward area to start with. The reason is that it is one in which the operating unit is not, in a sense, doing anything with the product; communications simply provides a service, and it is the two ends that worry about the policy". This is then distinguished from remote sensing activities and the operation of an 'Enterprise' in the common heritage of mankind context.

165. The others being: the Assembly of Parties; the Meeting of Signatories; and the Executive Organ.

Board is the principal managing organ of INTELSAT, responsible for the conduct of phases A-E of the Space Segment.[166] The provisions concerning its composition are both extensive and drafted with archetypal legal complexity.[167] From a synoptic viewpoint, there are three categories among 27 Governors: one per State with an investment share not less than a determined minimum; one per group of States not represented in the prior category; and one for any group of five States not otherwise represented, up to a total of five, to foster regional participation.[168] Minimum investment shares are adjusted annually based on the actual utilization of INTELSAT services by each State over the course of the previous year.[169] Each Governor has voting power equal to the investment share achieved by the State which he represents, so-called weighted voting.[170] In the conduct of its business, the Board

166. International Telecommunications Satellite Organization (INTELSAT) Agreement, OFS Washington, ~~20 August~~, 1971, EIF 12 February, 1973, 23 UST 3813; TIAS 7532, article X(a).

167 *Ibid.*, article IX.

168. *Ibid.*, paragraph (a)(i)-(iii).

169 Article IX (b)(ii) and (iii), and (f).

170. *Ibid.*, article IX(f).

endeavours to render unanimous decisions.[171] Failing this, a formula is provided whereby: decisions on purely procedural questions are taken by a simple majority of Governors present and voting, each having one vote;[172] while decisions on substantive matters require either an affirmative vote by at least four Governors representing two thirds of the total votes available, or by all the Governors less three, regardless of their voting shares.[173] The Chairman of the Board decides which category - procedural or substantive - an issue falls within, but can be overruled by a two thirds majority of Governors present and voting, each possessing one vote.[174]

This may seem an excessive level of formality to subject the US/International Space Station project to. However, as we shall see in the final part of this chapter, the current procedure errs on the side of informality given the momentous issues involved.

171. Id., paragraph (j).

172. Id., para. (j)(ii).

173. Id., para. (j)(i).

174. Id., para. (k).

(b) Consortia Theories for Remote Sensing

As an extension of the arrangements adopted for telecommunication, there has been widespread discussion of global consortia arrangements for remote sensing. This occurred prior to the advent of the European SPOT Satellite as an alternative to the US LANDSAT system in 1985. Since this event, the beginnings of competitive activity, with EOSAT Corporation in the USA marketing LANDSAT data and SPOT Image in Europe marketing SPOT data, would suggest the improbability of a global consortium materializing.[175] Nevertheless, one can anticipate the resurrection and reconfiguring of such notions in the space station context. Several concepts have been ventured, a few of which will now be highlighted.

"Globesat" was suggested by the US Congressional Office of Technology Assessment in a 1982 Report.[176] This global consortium was to be the result of a US

175. See International Cooperation and Competition in Civilian Space Activities (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-ISC-239, July 1985), pp. 253-324 for a discussion of the entire spectrum of remote sensing issues.

176. Civilian Space Policy and Applications (Washington D.C.: U.S. Congress, Office of Technology Assessment, OTA-STI-177, June 1982), pp. 298-300.

initiative

> to join together with other nations in launching and operating a common set of data collection platforms, with revenue to be obtained from the sale of raw or processed data. The returned data stream from the common operational platforms would be encoded so that only consortium members would have direct access to the data. Others would be able to purchase data from the central organization at established prices.[177]

Citing the broad international interest and economies of scale inherent in such a venture, the INTELSAT structure was offered as a precedent.[178]

Four years prior to the Globesat theory, Dr. Delbert Smith expounded a much more detailed conception before the US Congress.[179] This concerned the institutional structures to govern the operation of international large multi-purpose space platforms, including GEO "antenna farms" for telecommunication.[180]

Four such platforms were suggested; operating on a regional

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177. Ibid., 298.

178. Ibid., pp. 298-299.

179. 'Multipurpose Space Platforms: Institutional Alternatives', in Panel Discussions on International Space Activities, Hearings before the Sub-Committee on Space Science and Applications of the Committee on Science and Technology, U.S House of Representatives, 95th Congress, 2d sess., 20 and 21 June, 1978, No 75, pp. 70-131.

180. Ibid., 85.

basis.[181] Each platform was to be constructed in a modular fashion, with ownership of each module to be decided by reference to its funding source.[182] In addition, an international organization called "AMCOM" was then outlined largely mirroring the INTELSAT provisions, including those on weighted voting keyed to utilization.[183]

Finally in this vein, a recent Spaceflight article recommends early discussion of an International Space Station Organization (ISSO).[184] In the interests of reducing the cost of space operations and developing commercial activities, it is stated that:

> [t]he Space Station infrastructure is on such a scale that it has to require the closest collaboration among all the participating nations, perhaps even leading to a new international organization with all the political complications that implies.[185]

181. Ibid. 99.

182. Id., pp. 101-102.

183. Id., pp. 109-117.

184. 'In Business with the Space Stations', Spaceflight Vol. 28, February 1986, 50-51.

185. Ibid.

C. THE PHASE C/D/E NEGOTIATING TEXT - PROBLEMS AND ALTERNATIVE SOLUTIONS

1. AN ANALYSIS OF THE DRAFT PROVISIONS RELATING TO STRUCTURE

The ensuing analysis is based on an unclassified copy of the 26 September, 1986 Draft Inter-governmental Agreement between the USA and Canada on 'Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Space Station'. Furthermore, elements of an accompanying MOU of 6 October, 1986 between NASA and the Canadian Ministry of State for Science and Technology (MOSST) are also discussed.[186] Article 1 of the Agreement states that the two Governments "shall cooperate and participate as partners". The terms of this partnership regarding operation and utilization of the space

186. At the time of writing (February 1987) these texts were still under negotiation and the final versions will not be the same if they emerge at all. Regardless of the outcome of negotiations or the actual terms which are ultimately agreed it is believed that the study of the original formulations of the parties will remain instructive. Parallel negotiating texts are being discussed bilaterally between the USA and ESA and Japan respectively. In addition, the first multilateral meetings have taken place to reach some level of accommodation of the various differences which have arisen.

station are contained in the accompanying inter-agency MOU and incorporated by reference into the Agreement by articles 7 and 8 of the latter. Article 1 of the MOU clearly accords Canada the status of a "full participant", reminiscent of the phraseology of the Canada-ESA optional programmes mentioned above.

A Multilateral Coordination Board (MCB) is provided for in Article 8 of the MOU. The MCB would comprise the NASA Associate Administrator for Space Station, the MOSST Director of Space Policy and Plans, the ESA Director of Space Station and Platforms and the Science & Technology Agency (STA) of Japan's Director-General of the Research Coordination Bureau. The NASA representative would be the permanent Chairman and

> [t]he normal mode of MCB decision-making on issues affecting the interaction among the partners shall be through consensus; should a consensus not emerge, decisions will be taken by the Chairman. The Parties agree that the operation and utilization of the Space Station will be most successful when consensus is reached. The Parties further agree that on issues affecting only one partner, the other parties will take fully into account the interests of the partner.[187]

The MCB's initial function would be to develop charters for two subordinate bodies, a System Operations Panel (SOP) and a User Operations Panel (UOP), see

187. MOU article 8.1.

Figure III-1. The SOP would be responsible for the efficient maintenance and resupply of the space station pursuant to an Operations Management Plan which it formulates to govern the apportionment of costs and responsibilities among the partners. This would replace the IOCWG established in the Phase B MOU discussed above.[188] The SOP is to take decisions by consensus, but in the event of failure to reach such consensus, the issue is to be forwarded to the MCB for resolution. The UOP would be set up on the same basis, with the same appeal procedure, and would apportion annual utilization resources under the auspices of a Utilization Management Plan which would include both housekeeping resources (e.g. those to maintain the habitability of the modules) and utilization resources.

> Shares of utilization resources will be based on each partner's investment in the design and development of cooperative elements... <u>including their launch</u>. The utilization resources, which will be allocated on an annual basis, could include such items as crew time (EVA and IVA), power, mass, pressurized volume, accommodation on platforms, attachment point occupancy time, servicing time, and MSC [Mobile Servicing Centre] time.[189]

This formulation is reminiscent of the limited partnership agreements relating to Space Telescope and the

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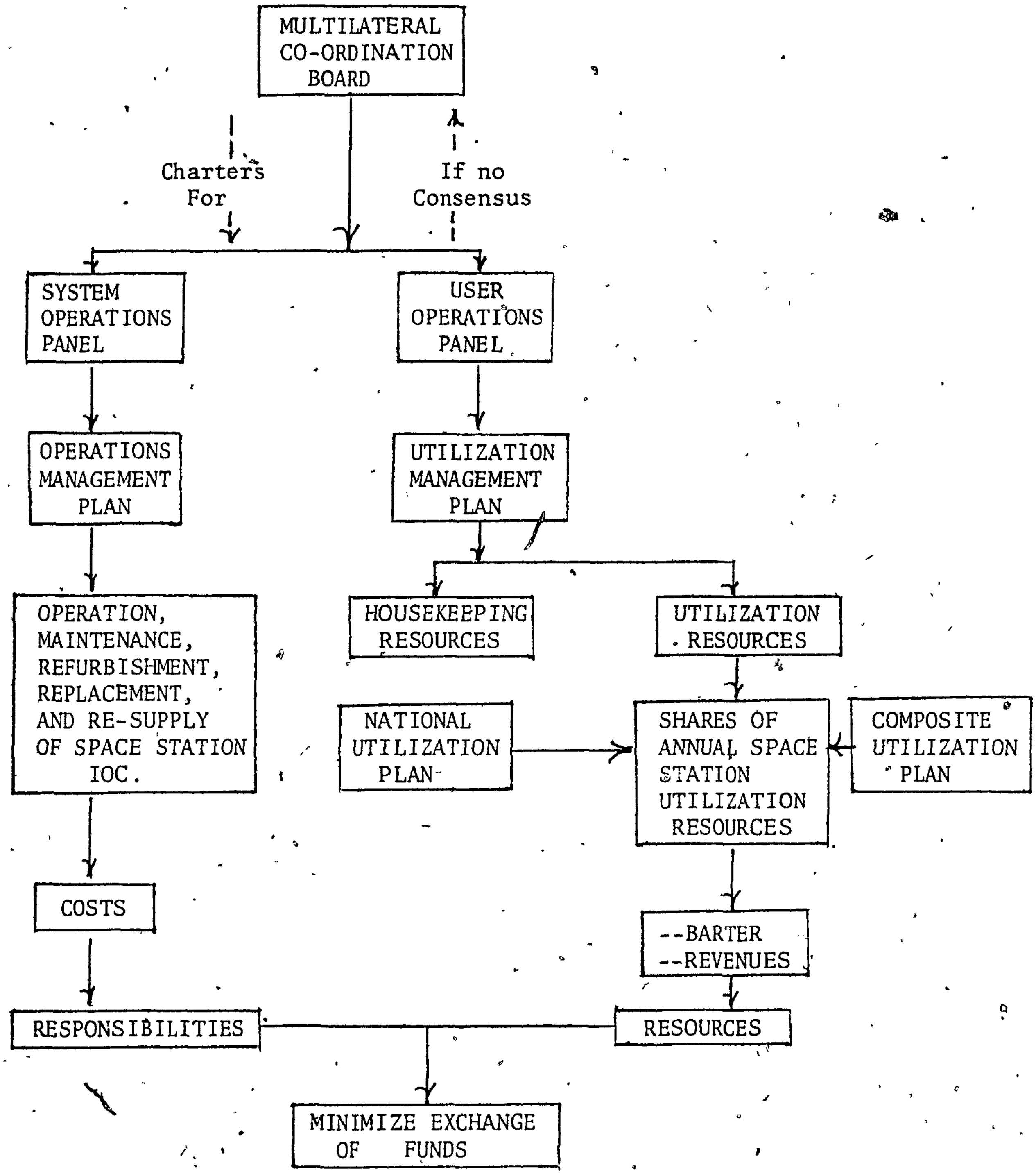
188. <u>Supra</u>, this chapter part A.

189. MOU article 8.3.a, emphasis added.

Figure III-1

US/INTERNATIONAL SPACE STATION MOU MANAGEMENT REGIME.



Source : Personal formatting of draft MOU for Phase C/D/E, article 8.

ISPM,[190] in its a priori setting of utilization shares based on pre-operational contributions. This places undue gravity on the negotiation of such shares and was undoubtedly one of the main underlying reasons why agreement had been delayed past its December 1986 deadline and prior to the delays engendered by the SDI association with the space station in February 1987.[191] Thus, each of the non-US partners is attempting to include as much as possible in its share of contributions to the station. This is in particular with respect to transportation and communications. The negotiating texts contain clauses whereby both NASA's Space Transportation System and its Tracking and Data Relay Satellite System, and their follow-on versions as appropriate, "shall be the primary" space station system.[192] These services would be provided by the USA on a cost-reimbursable basis to the partners.[193] Although there is a recognition that Japan and ESA are developing their own systems, which would not necessarily be precluded from use with the space station, there is merely a commitment to establish a

190. See supra, this Chapter B 1(b) (ii) and (iii).

191. See supra Chapter I B 1(b)(vii) and infra Chapter V B2 (b) and B3.

192. Agreement articles 11 and 12, MOU article 12.

193. MOU article 12.1.

policy in the MCB with respect to such access if compatible with US systems and the station itself.[194]

A partner may augment his allocated share of the total station utilization resource by barter or purchase from other partners, and each partner is free to market its share freely and retain the revenues.[195] Regarding the allocation process, the UOP would formulate a Composite Utilization Plan coordinating the several national utilization plans for their respective contributions to the station infrastructure, submitted on an annual basis. This replaces the IUCWG set up in the Phase B MOU.

Regarding access within the station, article 9 of the Agreement states that

> [t]he Parties shall make their cooperative elements, including both flight elements and Space Station-unique ground elements, available for use by each other and the other Partners. Access to and use of all such cooperative elements of the Space Station... shall be on a non-discriminatory basis. The Partners' utilization of flight elements... shall be equitable.

This is an expression of the mutual access principle referred to at the beginning of this chapter, but excludes transportation and communications. Article 9 also provides that each partner bears its own costs with respect to its contribution to the space station and "common system operation

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194. Ibid.

195. MOU article 8 3 a.

costs" are allocated "according to their shares of Space Station utilization resources". Failure to meet its share of costs could result in the forfeiting of a partner's share in utilization resources if the MCB so decided.[196]

The latest phase C/D/E texts emerged on 3 February, 1987.[197] The principal aspects of the US negotiating position can be summarized as follows:[198]

- the principle of mutual access is abandoned, in its place is a territorial division whereby the USA would not permit access to any of its station elements by any of the partners, except for limited Canadian access in return for the MSC, and Japan and ESA would only be allowed to use

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196. MOU article 9 (7).

197. 'U.S. Proposal Would Restrict European, Japanese Station Use', T.M. Foley, AW&ST, 16 February, 1987, 23.

198. Ibid., pp. 24-25. The summary is derived entirely from this source, which may be taken as authoritative since the article states that Aviation Week & Space Technology is privy to the latest negotiating texts, which are not available to this writer at this time. In questions by this author to The US/International Space Station - Aspects of Technology and Law panel of the 81st Annual Meeting of the American Society of International Law, Boston, Mass., in April, 1987, Dr. Terence Finn, Deputy Director, Policy Division Office of Space Station, NASA, confirmed that the principles of functional allocation and mutual access have been abandoned. See the account by this writer of the Panel discussion in Proc's of the 81st Meeting Am. Soc. International L. (1987) (in press).

their modules 50 per cent of the time;

- the corollary principle of functional allocation is also relinquished;

- partnership is interpreted in a regressive manner, with Canada being accorded 3 per cent of the utilization and all of the costs of its MSC in view of that element's 3 per cent share of the station as a whole, ESA and Japanese contributions are set at 15 per cent and 7-8 per cent respectively both in relation to their modules and their shares of overall station operating costs, and they must bear all the costs associated with these elements despite only being permitted to use them half the time;

- the constitution of the MCB remains unaltered, as does the primacy accorded to US transportation and communications facilities to be paid for on a cost-reimbursable basis.

Thus, the trend is toward a protectionist station, based upon a very limited partnership dominated by the USA. This marks a continuation of what has gone before in US-associated cooperation and it is submitted that the other partners cannot and should not participate under these terms.

2. ALTERNATIVE SOLUTIONS BASED ON PREVIOUS EXPERIENCE

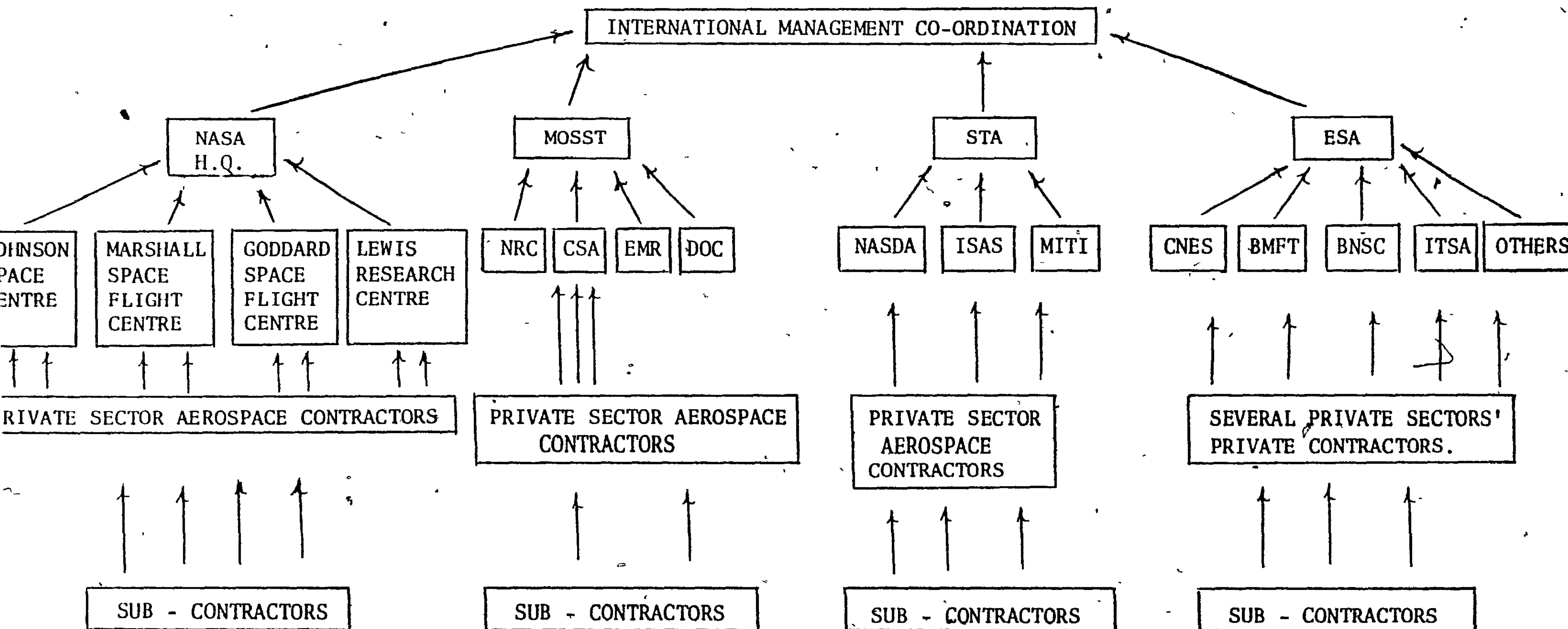
To assist in conceptualizing the complexity of arrangements for the management of the space station project, reference to Figure III-2 is suggested. Difficult as this may prove, the successful coordination of the utilization of space station resources is a formidable task. Figure III-3 outlines a suggested division of resources to the respective agencies to fulfill both their mandates and the principal rationale of the station to encourage terrestrial industry participation and development. It is submitted that for the foreseeable future such government involvement both through agency coordination and some form of public sector subsidization, at least at the R&D level, will be necessitated.[199] Further, the present writer believes that the provisions in the current negotiating texts with respect to management and utilization of the station are unsatisfactory. The reasons will become apparent from the following suggested modifications to render the structure more acceptable to all the partners.

To the ESA experience in maintaining equality with equity, should be added the weighted voting aspects of the

199. See *infra* Chapter IV A 2(6) where this is expanded upon.

Figure III-2

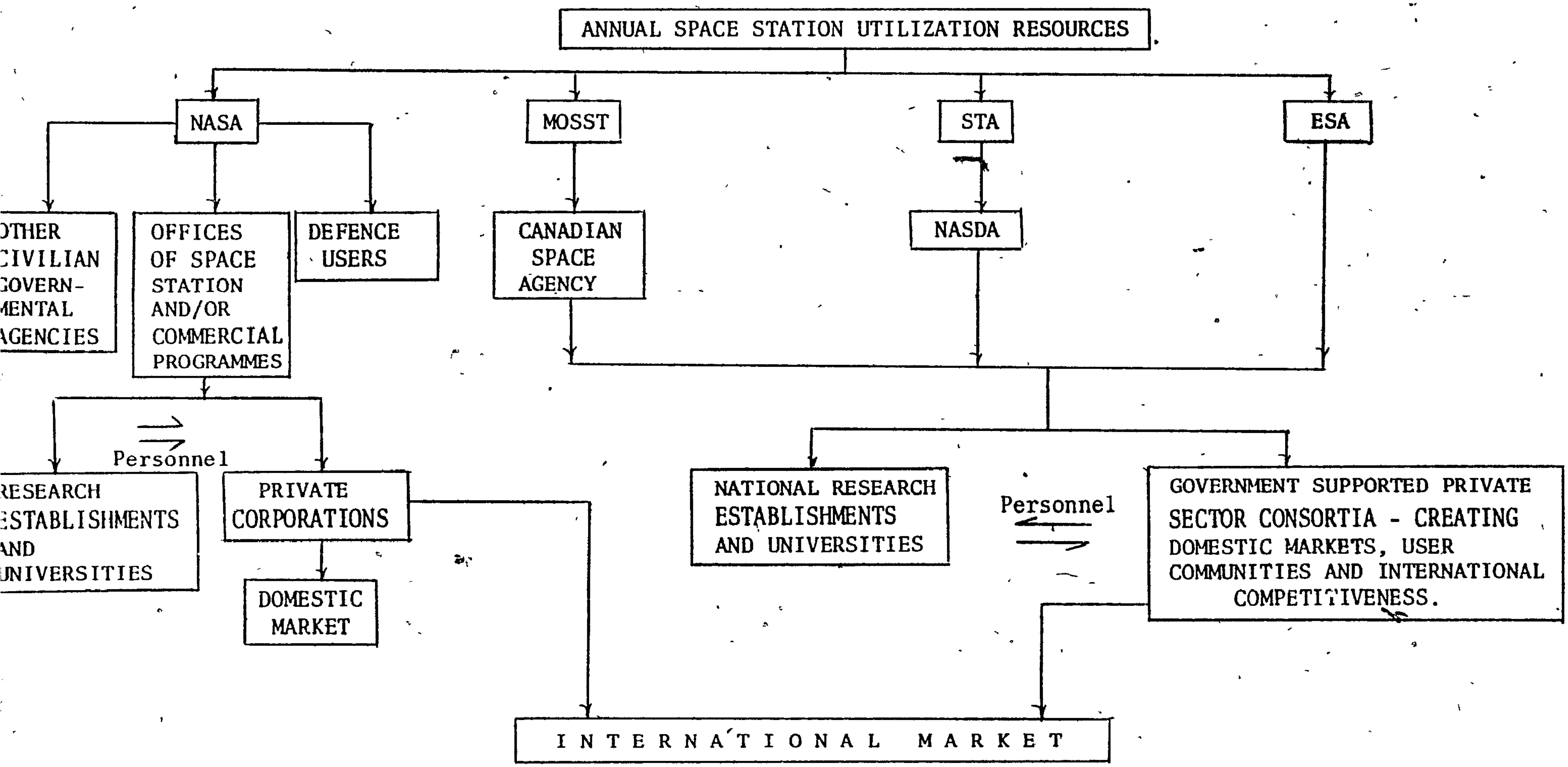
HIERARCHICAL STRUCTURE FOR THE CONSTRUCTION AND OPERATION OF THE US/INTERNATIONAL SPACE STATION



Note: Cross reference to the List of Acronyms at the beginning of this thesis.

Figure III-3

A SPACE STATION UTILIZATION MATRIX



INTELSAT structure to amend the MCB. The aim would be to create an equitable partnership. Instead of the <u>a priori</u> fixing of shares of future space station utilization resources, there should be inbuilt flexibility to expand the contributions of the partners as the station evolves. Thus, the shares of utilization resources on which voting power in the MCB would be based could be reviewed and updated on an annual basis. Regarding the functioning of the MCB, consensus should remain the guiding principle, with resort to a weighted voting procedure in the event of its absence. An initial apportionment based on contributions to the space station, mindful of the desire to give meaning to the concept of equality, could be the following:

- USA - 4 Representatives (e.g. Departments of State, Defence, Commerce or Transportation and NASA), each with one vote;
- ESA - 2 Representatives each with one vote;
- Japan - 1 Voting Representative;
- Canada- 1 Voting Representative.

Collectively, the non-US partners are contributing about half the amount (US $4 billion approximately) which the USA will contribute to the Station ($8 billion).[200] However,

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200. See however, <u>supra,</u> Chapter I B1(b)(iii) for other figures being quoted.

in order to avoid an unacceptable level of US dominance of the project, which will not be tolerated by the other partners (as evidenced by developments outlined in Chapter I of this thesis), voting power is equalized between the USA on the one hand and the three non-US partners representing some sixteen nations on the other. In the event of lack of consensus, the USA has merely to persuade one of the other partners to its point of view to carry the issue. The chairmanship of the MCB should be on a yearly basis among the partners, and the chairman should have a casting vote in the event of a deadlock. However, it should be clearly stated in the Agreement that the mandate of the chairman is to place the interests of the conduct of the project as a whole above those of the individual partners, in particular the one to which he or she is affiliated. In this way, the consensus procedure can be encouraged safe in the knowledge that no single interest can dominate this cooperative venture. Given the open-ended nature of this cooperation, allowing utilization shares to expand would go a long way towards producing a mutually acceptable cooperative programme without precedent in the civilian space arena.

However, this involves a level of altruism which the USA may not be prepared to accept in view of the performance of the Japanese and West German economies which it fuelled in the post-World War II period. Even the mighty US economy may not be able to withstand a second onslaught, this time in the high technology space station-associated industrial technologies which will dominate the 21st century. Nevertheless, if such a commitment can be made, it could lay the foundations for the participation of additional nations at some future date. The accession provisions of the ESA and AEROSAT agreements could serve as a precedent. It must be realized that there is a public policy or public service element to the space station project and some recognition of this could serve to assuage fears which have gained currency in the U.N. of a renewed era of colonialism through the commercialization of space.[201]

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201. This issue is discussed <u>infra</u> Chapters IV and VIII.

IV. COMMERCIAL ACTIVITIES AND THE LEGAL REGIME FOR THE US/INTERNATIONAL SPACE STATION

erchants will manage commerce the better, the more they are left free to manage for themselves.

Thomas Jefferson, 1800

A. INTRODUCTION - THE COMMERCIAL RATIONALE

It will be apparent from a perusal of Chapter 1 of this thesis, that those States participating in the US/ International Space Station desire by so doing, above all, to stimulate their terrestrial industries. This stimulus will create a preparedness to compete in the 21st century high-technology markets that are anticipated by informed observers. Thus, according to one commentator, a suite of technologies including

> artificial intelligence, robotics, remote manipulators, high-speed communications, light-based computation and communication, and cryogenics...[are]...the base of the next wave of industrial expansion and growth, steel having been one wave, aerospace and computers and electronics in general another.[1]

As a corollary to these developments, there is a strong belief in the potential for space-based industries

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1. 'Business in Space", D. Osborne, Dialogue #71, January 1986, 49, 54.

both as a complementary extension of terrestrial space-related industries and as suis generis space industries. It is due to the strength of the commitment to the potential of such developments that the space station project is being pushed towards the competitive end of the co-operative-competitive continuum.[2] Naturally, where there is technology, so too is there law. Indeed, a US attorney, Bruce Brumberg, has stated pithily that

> [i]t is already too late to keep lawyers out of space. Although the enforcement of the space treaties, their interpretation and the US regulation of commercial activity are still evolving, space law will soon join computer law as a new category of modern business law.[3]

This process is not confined to the USA, but is widespread among all the nations involved in space station activities, including the Soviet Union.[4] The prime examples and principal laws of this concerted attention are in an area of activity grouped under the rubric materials

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2. See supra Chapter I B5.

3. 'Law Takes to the High Frontier', B. Brumberg, Boston Business Journal, Vol. 5, No. 27, 2-8 September, 1985, (unpaginated).

4. See supra, Chapter IA and B2(a), 3(b) and 4(a).

processing in space.[5]

1. MATERIALS PROCESSING IN SPACE (MPS) - THE STATE OF THE ART

To appreciate the nascent MPS industry, it is necessary to be conceptually aware of some basic science. This is a highly technical milieu and will require the utmost diligence on behalf of the legal profession, to understand the technology involved to a degree sufficient to enable the development of appropriate legal prescripts.

(a) The Environment

The unique nature of the space environment is fundamental to all future MPS activities, indeed, it is a <u>sine qua non</u> of their existence. Interplanetary space[6] possesses characteristics which do not exist or are extreme-

5. This term was replaced by NASAs "Microgravity Science and Applications", but MPS has gained greater currency internationally and will be used herein.

6. This includes Near Earth Space. Low Earth Orbit (LEO) is a subset of the latter, in which MPS-related activities will be conducted for the foreseeable future, including both manned stations and unmanned free-flying platforms.

ly costly to duplicate on Earth. Its principal advantageous properties include the following:

- microgravity (near weightlessness);
- high vacuum, free from contamination;
- unlimited capacity for cooling by heat radiation;
- vibration free;
- extreme temperature gradients;[7]
- unlimited supply of high energy particles;[8]
- and solar radiation, unfiltered by the ozone layer, available for power generation and limited only by the level of efficiency of existing technology to exploit it.

(b) The Technology

An *a priori* assumption underlying much of the predictive activity regarding MPS activities in space is that the environmental properties as outlined above will permit the development of revolutionary new technologies. Only on orbit time and experience will reveal if such

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7. See "Present and Future Scenarios for Canadian Materials Processing in Space", paper presented by Canadian Astronautics Ltd. (CAL) to the *Space Station: Gateway to Space Manufacturing* Conference, Orlando, Fla., 7-8 November, 1985, 1.

8. *Ibid.*

assumptions are correct. However, even at this early stage in MPS development, a number of areas targeted for initial concentrated research have been identified and significant research has already been conducted. At this juncture, however, it is intended to summarize the generic technologies involved and provide a perspective on their industrial application.

(i) Biological Materials Processing - Separation - In the terrestrial production of biological pharmaceuticals, probably the most widely known being Interferon,[9] several factors inhibit purity and restrict the quantity of the product and the overall efficiency of the process. In the space environment, however, the isolation of highly pure products of specific cells or proteins is facilitated.[10] The key concept in this process is separation. Thus, the constituent elements of source material must be separated with such precision that the desired element may be "siphoned off" in an efficient manner. There are a number

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9. This is a protein developed from white blood cells which inter alia inhibits viral growth in cells.

10. See International Co-operation and Competition in Civilian Space Activities (Washington D.C.; US Congress, Office of Technology Assessment, OTA-ISC-239, July 1985), 338.

of ways to achieve this, one of which being a process termed "Continuous-Flow Electrophoresis". By the application of an electrical field to a sample which is flowing through a solution, its constituents, which all have different electrical charges, can be collected at different outlet points.[11] In space, the efficiency of this process is greatly enhanced due to the lack of gravity distortion in the separation process. This in turn permits the process to be continuous, instead of the static samples used on Earth, thereby increasing the output enormously.[12]

(ii) Crystal Growth - Heat Extraction - Crystals are essentially produced from a melt of source elements by seeding and the progressive build-up of layers of material

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11. Thus, one side is negatively charged and the other positive. The source sample elements are attracted or repulsed to different degrees by these two poles and are, therefore, separated from each other. See D.W. Richman, "EOS-Electrophoresis Operations in Space - A Promising New Era of Business in Space", in L. Kops, (Ed.), Manufacturing in Space (1983, American Society of Mechanical Engineers publication) 139 et seq.; and ibid., the 1985 OTA Report, pp. 354-355.

12. Some 463 times more material can be separated in space than in similar operations on Earth, ibid., Richman, 141.

around the seed as cooling takes place.[13] In industrial processes, the melt is often composed of metals at very high temperatures, and the desired crystal is one whose molecular structure is perfectly uniform. However, a number of factors militate against this perfection on Earth. The essence of the process is uniform heat extraction (cooling) and one of the major obstacles to this is the presence of convection currents.[14] The latter are naturally-occurring heat variations which result in the formation of defects in the crystal.[15] An industry requiring a large supply of pure crystals is that of semiconductor production. One application of semiconductors is in computers. Although current technology employs silicon, promising substances for

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13. At its simplest, high school physics experiments in the growth of, for example, copper sulphate crystals exhibit the basic principles. Thus, a melt, or warm solution, of copper sulphate is taken, into which is placed a seed crystal. As the mixture cools, the layers of copper sulphate form around the seed, so producing the crystal.

14. See A.F. Witt, "The Impact of Space Research on Semiconductor Crystal Growth Technology", in Manufacturing in Space, op.cit., supra, note 11, pp. 43-52. These occur throughout materials processing operations, see CAL, op.cit., supra, note 7, 3.

15. See R.J. Naumann, "Space Station: The Base for Tomorrow's Electronic Industry", paper presented at the Space Station: Gateway to Manufacturing Conference, op.cit., supra, note 7, (un-paginated), (25ff).

the future include Gallium-Arsenide (GaAs) and Mercury-Cadmium-Telluride (HgCdTe). These cannot be produced to a sufficiently high standard or in economical quantities on Earth.[16] In space, it is believed that the defects caused by convection can be eliminated by controlling heat extraction with extreme precision, resulting in perfect uniformity. The crystals would then be sliced into wafers for use as semiconductors, thereby inter alia increasing computational speed and power.[17]

(iii) Glass and Ceramics - Containerless Processing - In order to produce ultra-pure samples of certain glasses and ceramics, impurities developed by contact with the crucible in which the melt is contained must be eliminated. A wide range of containerless processing techniques are already in use on Earth.[18] Containerless processing can be defined as "the ability to melt, solidify, or otherwise process a specimen without physical contact with walls or other holding devices".[19] A major application of this

16. Op.cit., supra, note 10, 355.

17. Op.cit., supra, note 15.

18. See T.G. Wang, "Progress in Containerless Science and Technologies", op.cit., supra, note 11, 77 et seq.

19. Ibid.

technique is in the production of glasses. On Earth, a sample is kept levitated by the use of sound waves (acoustics), static electricity, or electromagnets.[20] However, due to the physical forces inherent in each of these methods, undesired variations are imparted. In glass formation for high-technology uses, such as the next generation of fibre-optics, these variations significantly reduce efficiency. In the space environment, it is thought that they can be largely eliminated, since a material does not have to be levitated, this occurring naturally in microgravity.

(iv) <u>Metallurgy - Suspension and Alignment</u> - The most speculative of the four concepts discussed herein, is the production of certain high value metals and new alloys. There are two main avenues of thought. In the first, it is believed that the suspension of molten components of widely differing densities will enable the production of new alloys on cooling.[21] The natural gravitational separation on Earth is avoided in space, permitting new alloys and composites to be formed. These could have numerous applica-

20. *Ibid.*, 78-83.

21. E.R. Finch Jr. & A.L. Moore, *Astrobusiness: A Guide to the Commerce and Law of Outer Space*, (1984, Praeger) 11.

tions in, for example, aircraft construction. The other avenue being considered, is the production of super-hard metals.[22] By the controlled solidification of molten metals, their atomic and molecular structures could be uniformly aligned. This uniformity in structural links would result in a given sample of a metal being more difficult to break down, rendering it more resistant in, for example, drilling operations.[23]

2. THE STATE OF THE MPS INDUSTRY

(a) The Infrastructure Array

(i) Terrestrial and Suborbital Activities - Three basic areas can be identified under this heading. The first, are NASA KC-135 aircraft, which fly a series of parabolic manoeuvres during each mission. At the apex of each curve, there are 20 to 25 seconds of weightlessness, with each mission lasting some 2-3 hours, during which time 30-40 manoeuvres are flown.[24] Conducted by NASA's Johnson Space Centre, under its Reduced Gravity Programme,

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22. Ibid., 12.

23. Ibid.

24 See T.B. Wang op. cit., supra, note 8, 85.

the KC-135 aircraft have been used extensively for preliminary MPS experimentation, although the brevity and inconstancy of the period of weightlessness is a considerable handicap to efficiency.

In the second category are facilities entitled "drop tubes". NASA's Marshall Space Flight Centre operates a 33 metre long vertical tube which permits up to 2.6 seconds of zero-gravity, and is "ideally suited for investigations of contactless melting and solidifying of high temperature refractory metals and alloys."[25] A second drop tube is being installed which would increase zero-gravity time to 4.3 seconds. Again, however, like the KC-135 this permits preliminary research only to be conducted, for the same reasons.

Sounding rockets make up the third element herein. In the USA these are conducted by NASA in its Space Processing Application Rocket (SPAR) programme employing Black Brandt rockets.[26] The SPAR provides up to five minutes of weightlessness and each can carry four small experiment packages.[27] This is mirrored by the TEXUS Programme in

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25. Ibid., pp. 83-84.

26. R.E. Halpern 'The Materials Processing Program of NASA: An Overview', in L. Kops ed. op. cit., supra, note 11, 1, 2.

27. Ibid.

Europe. A co-operative venture including West Germany, Sweden and the United Kingdom, TEXUS payloads have flown aboard some 100 British Skylark sounding rockets launched from the Esrange at Kiruna, in Sweden.[28] Although not quite as transitory as the previously mentioned facilities, this is also merely an interim measure preparatory to more efficient facilities becoming available for research.[29]

(ii) SPACELAB - Developed by an industrial consortium led by Erno-VFW-Fokker (now Messerschmitt-Boelkow-Blohm (MBB-ERNO)) in West Germany for ESA, SPACELAB was first flown on STS-9 on 28 November, 1983, aboard the US Shuttle Columbia (Mission SL-1). SPACELAB is carried in the Shuttle payload bay and remains attached to the Orbiter during all

28. See Twenty Years of European Co-operation - An ESA Report '64-'84 (1984, ESA Publication), 143.

29. Additional terrestrial facilities, such as the Microgravity Materials Science Laboratory (MMSL), operated by NASA's Lewis Research Centre in Cleveland, Ohio, are also worth note. The MMSL is designed to stimulate private sector interest, research and future activity in the MPS field. It comprises several facilities, including: a metallography lab; a crystal growth lab; and a melting and solidification lab. Preliminary experimentation can be conducted in order to inexpensively eliminate avenues of research that are likely to be unproductive and prepare more extensive researches in more promising areas, to be conducted on orbit. See Microgravity Materials Science Laboratory, NASA Lewis Research Center, publication, September, 1985, 2.

phases of its mission.[30] The core pressurized unit permits experimentation by non-astronaut personnel, with minimal space training.[31] There are eight basic configurations ranging from a long module with 22 cubic metres available for payload equipment to the five pallet configuration.[32] The latter are "U" shaped and accommodate experiment equipment designed for direct exposure to space and were developed by British Aerospace in the U.K.[33]

In the aforementioned Mission SL-1, responsibility was shared between NASA and ESA, with ESA payload specialist Dr. Ulf Merbold aboard. MPS research was one of the major

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30. Space Transportation System User Handbook, NASA pub. May 1982, 2-25.

31. Eg. Charles Walker; employee of McDonnell-Douglas Astronautics Co. (MDAC) who flew aboard Mission 41-D, 30 August, 1984, to conduct electrophoresis experiments.

32. Op.cit., supra, note 30, pp. 2-27 - 2-28.

33. See Space Shuttle Facts, Rockwell International Office of Public Relations, June 1982, pp. 8-12.

activities conducted during this mission.[34] SPACELAB Mission SL-3 (51-B) the next to be flown on 29 April, 1985, included a French MPS experiment as one of the 15 carried out.[35] However, the most extensive use of SPACELAB in the MPS context came during Mission D-1 (61-A). This mission was entirely financed by the West German Ministry of Research and Technology (BMFT) was co-ordinated by its national space agency, the DFVLR,[36] and all payload operations were conducted from the German Operations Control Centre at Oberpfaffenhofen.[37] The entire mission was devoted to microgravity experimentation across the whole

34. See Spacelab Info, #9, February 1984 and Spacelab Info, #10, June 1984, (ESA publications, produced by EUROSAT in Geneva) e.g. a large protein crystal of Lysocyme, some 1000 times larger than that able to be produced on Earth, was grown, permitting structural analysis.

35. A Mercury Iodide Crystal was grown in an experiment provided by the Laboratoire Physique Les Cezeaux, see Columbus Logbook, #1, September 1985, (ESA quarterly publication).

36. Deutsche Forshungs-und Versuchsanstalt für Luft-und Raumfahrt.

37. "Europeans Show Mission Control Capabilities With Spacelab D1", Aviation Week and Space Technology (AW & ST) 4 November, 1985, 19. See supra, Chapter I B2(a).

spectrum of MPS research.[38] A panoply of European-developed hardware was employed, including the following:-

- The Biorack - "a multi-user facility for experiments in cell and developmental biology, botany and radiology";[39]
- ~~The~~ Improved Fluid Physics Module - used to observe the behaviour of liquids in microgravity;[40]
- and the Material Sciences Double Rack - an integrated facility comprising furnaces for metallurgical experiments,[41] crystal growth facilities and a fluid physics component.

(iii) The Long Duration Exposure Facility (LDEF) - As harbingers of industrial activity in space stations, free-flying platforms are indispensable for present scientific and later commercial purposes. The first of these platforms to be orbited was the Space Pallet Satellite, SPAS-01, developed commercially in West Germany

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38. Spacelab Info, #1, October 1984, 6.

39. ESA Report, op.cit., supra, note 28, 143.

40. Ibid., 144.

41. This incorporates a French Gradient Heating Facility, German components - the Isothermal Heating Facility and the Mirror Heating Facility, and an Italian Fluid Physics Module, see ibid.

by MBB-ERNO.[42] Its deployment from Challenger on 22 June, 1983, during STS 7 established the capability of on-orbit repair and retrieval.[43]

Thus proven, this technology was employed in the MPS field in a follow-up platform, the Long Duration Exposure Facility (LDEF). The latter was deployed on Shuttle Mission 41-C on 6 April, 1984.[44] Designed and built by NASA Langley Research Centre, the LDEF is a "free-flying cylindrical rack" which is placed on orbit by the Shuttle, left for up to a year, and collected on a later Shuttle mission.[45] The LDEF provides minimal power needs for those experiments that require power, and acts as a receptacle for those requiring merely exposure to the conditions of microgravity and vacuum prevalent in space.[46]

42. See M. Craig, T. Murtagh & C. Jacobson, "Shuttle Small Self-Contained Payloads: 'Getaway' to the Educational Opportunities of Space", Am. Astronautical Soc. (ASS) paper No. 78-135, 1978, passim.

43. "Orbiter Deploys, Retrieves SPAS", C. Covault, AW&ST, 27 June, 1983, 14.

44. Ibid.

45. "The LDEF Benefits", W. H. Kinard, Chief Scientist and Experiments Manager LDEF Project Office, NASA Langley Research Centre, Hampton, Va. in 19th AIAA Space Congress, Cocoa Beach, Fla., April 28-30, 1982.

46. Ibid. For a list of the 19 Material sand Structures experiments flown on the LDEF, see Space Business News, 9 April, 1984.

The LDEF permits empirical research and experimentation by commercial ventures of any size, without the necessity for a large capital commitment to unproven technology.[47]

Launched initially in April 1984 for a one year stay in orbit, the LDEF is set to be retrieved in November 1990 following the post-Challenger restructuring of the shuttle manifest.[48]

(iv) The European Retrievable Carrier (EURECA) - This free-flying platform was developed by MBB/ERNO in West Germany for ESA[49] as part of the SPACELAB Follow-on Programme.[50] It is capable of supplying 1.7 kw of power and can carry a payload of some 1100 kg.[51] EURECA has

47. See NASA Facts - A New Dimension in Space Experimentation - LDEF, NASA Publication, NF-140 (12 ff), (undated).

48. 'NASA Releases Manifest', Space Business News, 6 October, 1986, 8.

49. "Eureca Marketing Keyed to Platform Cost", J.M. Lenorovitz, AW & ST 25 June, 1984, 145.

50. Statement of Ian Pryke, Head of the ESA Washington Office, before the US House of Representatives Sub-Committee on Space, Science and Applications, Committee on Science and Technology, on 23 February, 1984, in 1985 NASA Authorization Hearings, 98th Congress, 2nd Sess. #84 Vol. II, 702 at 706.

51. Ibid., 707.

been designed to be launched by the US Shuttle, to operate in a free-flying mode for up to 9 months and then to be retrieved by a subsequent shuttle mission. Its first payload is largely comprised of MPS experiments investigating the effects of microgravity. As with SPACELAB, it contains multi-user facilities, including two furnaces,[52] the Botany Facility,[53] the Protein Crystallisation Facility and the Solution Growth Facility.[54] Originally intended to have its first launch in March 1988, it is now scheduled for an April 1991 deployment, with a retrieval in the third quarter of that year.[55]

(v) <u>The Industrial Space Facility (ISF)</u> - The logical conclusion of the latter type of platform is a facility being marketed by Space Industries Inc. of Houston, Texas. The ISF is a cylindrical spacecraft, designed to be

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52. The Automatic Mono-Ellipsoidal Mirror Furnace Facility - for crystal growth experiments, and the Multi-Furnace Assembly - for a variety of MPS experiments requiring extreme heat, see <u>ESA Report</u>, <u>op.cit.</u>, <u>supra</u>, note 28, 146.

53. For studying the effects of microgravity on various plants and fungi.

54. <u>Op. cit.</u>, <u>supra</u>, note 52, 147.

55. <u>Op. cit.</u>, <u>supra</u>, note 48.

a man-tended processing platform.[56] Developed by Dr. Maxime Faget, the first ISF is scheduled for a third quarter of 1992 launch, to be followed by a second and third facility in the first and third quarters of 1993 respectively.[57] They will operate as free-fliers, but will provide a pressurized environment for periodic manned harvesting, replenishment and restocking.[58]

(vi) SPACEHAB - Developed by Spacehab Inc. based in Seattle, Washington, "SPACEHAB" manned augmentation modules are being constructed by main subcontractor Aeritalia, in Italy.[59] They are designed to fly in the shuttle payload bay, taking up approximately one quarter thereof, still permitting use of the bay for other purposes.[60] Its extension of shuttle pressurized volume for experimentation is merely the first step predicted for SPACEHAB. Improved versions are expected to be on line in the 1994-

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56. 'The Industrial Space Facility', M. Sheehan, Spaceflight, Vol. 28, January 1986, 39.

57. Op. cit., supra, note 48.

58. Op. cit., supra, note 56.

59. 'US Company Proposes Manned, Middeck Module for Space Shuttle', AW&ST, 21 October, 1985, 137.

60. Ibid.

1995 timeframe, which would permit the independent operation of SPACEHAB modules deployed from the shuttle.[61] These may be used as docked station-integral elements for logistics, additional habitability volume, "secure zones" for sensitive military activity, or emergency safe harbours.[62]

(vii) Space Stations - All the aforementioned activities are a prelude to permanent manned facilities in Earth orbit. They will all assist in definition of missions and activities to be performed aboard the station. Thus, a graduation process may be anticipated, whereby a concept is tested in the less expensive terrestrial, shuttle-integral and man-tended facilities, before qualifying for station operation. Indeed, it is likely that only those activities requiring continuous manned presence will employ the station. Furthermore, some processes are impaired by human and other vibrations, hence the inclusion of free-flying associated platforms in the US/International Space Station baseline concept.[63]

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61. 'Production Expected Next Spring for Shuttle Spacehab Modules' AW&ST, 23 June, 1986, 24.

62. Ibid.

63. See supra, Chapter I B 1(b)(i).

(b) Some Caveats Concerning Maturity and Access

A reference to Figure IV-1 will indicate the infancy of the MPS industry on the economic scale of commercial development. There have been heady predictions of the riches which will be gained through MPS activity.[64] However, this writer believes that the timescale involved is much more extensive than some aerospace corporations would have us believe. This delay was exacerbated by the Challenger loss in January 1986. The ensuing retrenchment of access to space has revived the former practice of strictly non-civilian manned participation in the shuttle programme. The fragility of and danger associated with space vehicles have set the commercial programme back a number of years. Since the shuttle is crucial to all of the significant activities mentioned above, its severely curtailed operational frequency due to safety hazards must have a sobering influence upon those who dream of factories in space in the near future. They may well come, and if we are to develop as a species they must come.

However, it is necessary to appreciate that there

64. See e.g. 'Status of Space Commercialization in the USA', J.M. Logsdon. Space Policy, February 1986, 9.

RELATIVE ROLES OF INDUSTRY AND GOVERNMENT IN COMMERCIALIZATION

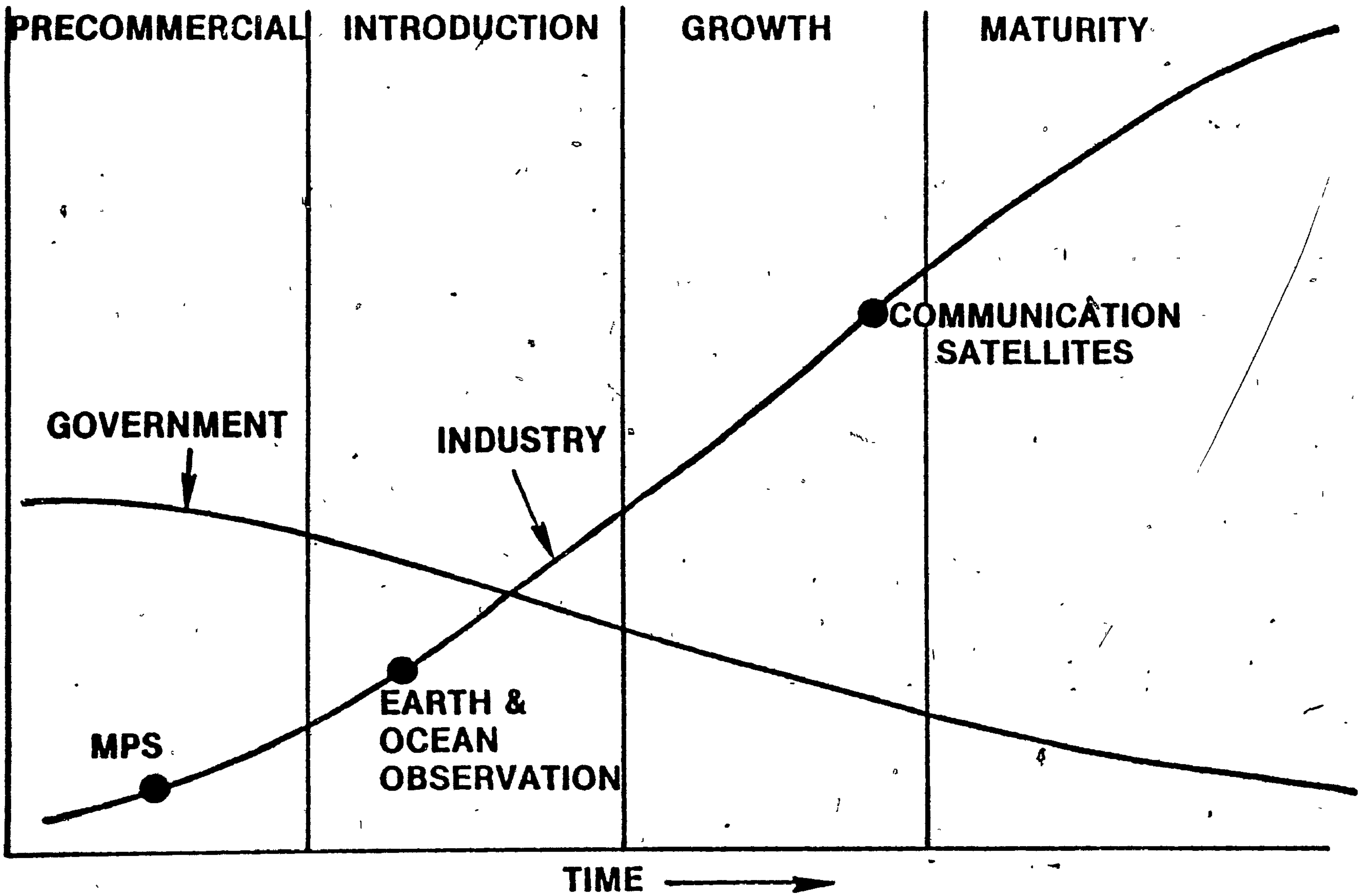

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Figure IV-1 Source : D.L. Christensen Wyle Laboratories "Commercial Opportunities in Space, Key Steps to Success" paper presented at The Space Station - Gateway To Space Manufacturing Conference, Orland , Fla. 7-8 November, 1985. (unpaginated)

WYLE LABORATORIES

are major impediments to the much vaunted commercialization of LEO. The first concerns the level of maturity of the science, let alone the technological application thereof. Thousands of man hours of research still need to be performed *in situ* before beginning to develop anything approaching a commercial manufacturing capability. This experience is extremely costly to win, and not even the formidable US private sector can go it alone for decades to come. There are a host of contributory factors to this, the chief ones being: the availability and price of man-rated launch capacity together with access thereto; and the long delay in return on the huge investments required to operate in this arena. This brings us to the second impediment, namely manned access to space. The aforementioned safety concerns in the post-Challenger era are only part of the tale, for, in addition, there is the finite availability of station facilities once they are in place. The priority access accorded the US DOD and other US government users of space transportation will undoubtedly be reflected in utilization of the space station. It will be recalled from Chapter 1 of this thesis that the other participating States have set in motion a trend towards government sponsorship, encouragement, facilitation and/or subsidization of its private sector depending upon one's point of view. Even in the USA, heavy government involvement is unavoidable.

Whilst there are some private entrepreneurs such as Space Industries Inc. and Spacehab Inc., as outlined above, these represent a distinct minority. Furthermore, their dependence on shuttle transportation, which surely cannot now be privatized due to its imperfections (apart from its strategic value) is a major drawback. This is certainly the principal motive force behind European and Japanese development of their own manned launch capability as mentioned above.[65] They are fully aware, as must be even the most optimistic US aerospace corporations, that access to transportation is the key to participation in the space environment. The latter in turn dictates the pace of commercial development in space and that pace is set by the governments involved.

It will be recalled that the US/International Space Station, if it materializes at all, will be on orbit in the mid-1990's. The ISF, SPACEHAB, EURECA, etc. will be in operation before this period. However, their use cannot be maximized due to shortages in manned transportation availability due to the preponderance of military and station construction tasks which occupy the shuttle manifest. A realistic perspective on the MPS industry may see its progression to the introduction phase, as outlined in Figure

65. See *supra*, Chapter I B 2(b) and 3(b).

IV-1 *supra*, by the turn of the century at the earliest.

Nevertheless, there is already a clear perception in the USA that commercial potential must be protected. Thus, for example, former NASA Legal Counsel Neil Hosenball has stated that

> as space activities become commercialized it will be necessary for private enterprise to feed into government more information about their activities to assure that international treaties are not developed that will in any way interfere with the development of a strong, viable and profitable commercial space business.[66]

Some of the legal groundwork is being laid in the negotiations for phase C/D/E of the Space Station. Many issues are being confronted now whose resolution is crucial for the project to proceed at all. At the same time, it is submitted that some issues are being addressed prematurely. In this chapter the most significant of these concerns will be discussed, problems highlighted and solutions suggested for the Space Station to proceed logically and efficiently with a minimum of legal and regulatory interference.

66. 'NASA and the Practice of Space Law', S.N. Hosenball, 13 *J. Space L.* 1, 6 (1985).

B. STATE RESPONSIBILITY AND SPACE STATION JURISDICTION

1. STATE RESPONSIBILITY FOR ACTIVITIES IN SPACE

(a) A Preliminary Point Regarding Private Sector Participation

In 1962 both the USA and the Soviet Union drafted separate sets of principles for submission to the UN Committee on the Peaceful Uses of Outer Space (COPUOS), which were the precursors of the landmark 1963 Declaration of Legal Principles for Outer Space.[67] Paragraph 7 of the Soviet draft stated that "[a]ll activities of any kind pertaining to the exploration or use of outer space shall be carried out solely and exclusively by States."[68] This was an attempt to stifle the nascent US COMSAT Corporation which had been statutorily created the same year.[69] The precedental COMSAT was the executor of the US policy commitment

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67. UNGA Res. 1962 (XVIII) 13 December, 1963, 'Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space'.

68. <u>U.N. Doc.</u>, A/AC.105/C.2/L.1, 6 June, 1962, 3.

69. Communications Satellite Act, 1962, 76 <u>Stat.</u> 419.

to a "commercial communications satellite system"[70] to provide for the "widest possible participation by private enterprise"[71] and was motivated in part by profit.[72] Despite obvious ideological objections, the Soviet States-only limitation did not appear in the 1963 Declaration. Paragraph 5 of the latter subsequently reappeared practically verbatim in the 1967 Outer Space Treaty[73] as article VI which provides in part that:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space... whether such activities are carried on by governmental agencies or by non-governmental entities.[74]

There is some divergence of opinion regarding the meaning of this part of article VI. The US position was authoritatively stated by S. Neil Hosenball, then NASA General Counsel, during the 1983 International Institute of Space Law Col-

70. Ibid., s. 102(a).

71. Ibid., s. 102(c)

72. Id., s. 307.

73. 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies', OFS 27 January, 1967, EIF, 10 October, 1967, 18 UST 2410, TIAS 6347 UNTS 205.

74. Ibid., emphasis added.

loquium in Budapest.[75] In a paper lacking the usual disclaimer clause and declared to be "a work of the US Government,"[76] Mr. Hosenball stated that article VI, when read with article IX of the Outer Space Treaty,[77] "may be viewed as conclusively establishing that private non-governmental space activity is not prohibited by international law."[78]

Regarding the Soviet position, there is a dichotomy of opinion. On the one hand Academician Vladlen S. Vereshchetin is of the opinion that

> [t]he compromise wording, contained in Article VI of the Space Treaty shall in no way be interpreted as the admission of the principle of 'freedom of private enterprise in outer space'. International space law does not at all provide any rights or freedoms directly to private

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75. Procs. of the Twenty-Sixth Colloq. on the Law of Outer Space, Int'l. Inst. of Space Law; of the Int'l Astronautical Fed. (hereinafter Colloq.) 10-15 October, Budapest (1983, American Institute of Aeronautics & Astronautics publication).

76. Ibid., 'The Law Applicable to the Use of Space for Commercial Activities', 143.

77. Article IX refers to undertaking international consultation 'if a State Party... has reason to believe that an activity or experiment planned by it or its nationals, in outer space... would cause potentially harmful interference with the activities of other States Parties...' (emphasis added).

78. Op. cit., supra, note 76, 144.

enterprises and national persons.[79]

Far from countenancing the commercialization of space, Professor Vereshchetin would hold that the Outer Space Treaty contemplates an "indirect admission", in exceptional circumstances, of non-governmental activity.[80] On the other hand, a contrasting viewpoint is articulated by Academicians Gennady P. Zhukov and Yuri M. Kolosov in their 1984 book International Space Law.[81] Cognisant of the reality of uniform State practice, they admit that

> if any state, by virtue of the social features of its structure, permits private companies to operate in space, that is its internal affair. What is important for international cooperation is that it should develop on the level of relations between states and not on the level of relations between states and private businessmen. It is for that reason that the Space Treaty provides for the international responsibility of states for all types of national activities in space, irrespective of whether these activities are conducted by governmental agencies or non-governmental organizations.[82]

In view of the advent of Glavkosmos and its related commer-

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79. "Space Activities of 'Non Governmental Entities': Issues of International and Domestic Law", 26th Colloq, 1983, 261, 262, emphasis added.

80. Ibid.

81. Trans. from the Russian by Boris Belitzky, (1984, Praeger).

82. Ibid.

cial activities[83] it cannot any longer be realistically disputed that private sector activities, such as those of Space Industries Inc. and Spacehab Inc., are permissible in the Space Stations' Era.

(b) Authorization and Continuing Supervision

Article VI of the Outer Space Treaty goes on to provide that the "activities of non-governmental entities in outer space... shall require authorization and continuing supervision by the appropriate State Party to the Treaty." (emphasis added). An interpretation of this was necessitated due to the anticipation of private sector launch activities in the USA. Thus, the 1984 Commercial Space Launch Act[84] states at Section 2(7) that

> the United States should encourage private sector launches and associated services and, only to the extent necessary, regulate such launches and services in order to ensure compliance with international obligations of the United States....[85]

The link with article VI may be clearly displayed by the comments of the aforementioned Mr. Hosenball, who states

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83. See supra, Chapter IA.

84. P.L. 98-575, 30 October, 1984 98 Stat. 3055, see infra Chapter VII B 2(a).

85. Ibid., emphasis added.

categorically that

> [i]t is the position of the Legal Advisor, US Department of State, that under US law Article VI is self-executing. That is, that even in the absence of implementing domestic law, private concerns must obtain United States Government permission prior to conducting a space launch.[86]

This is reflected in the United Kingdom Outer Space Act 1986[87] whose long title reads as follows:

> An Act to confer licensing and other powers on the Secretary of State to secure compliance with the international obligations of the United Kingdom with respect to the launching and operation of space objects and the carrying on of other activities in outer space by persons connected with this country. (Emphasis added)

By the institution of a licensing system applying to all activities conducted in space by U.K. nationals, the "authorization" and "continuing supervision" requirement is fulfilled. A third example of State practice is that with respect to Arianespace S.A. It will be recalled that ESA is an international inter-governmental organization[88] which, as a separate entity is declared in article VI of the Outer Space Treaty to share responsibility, for its compliance with the Treaty, with its several Member States. This is

86. Op. cit., supra, note 76, 144.

87. Elizabeth II, C.38, 1986., see infra, Chapter VII B 2(a), for further discussion of this statute.

88. See supra, Chapter II B4.

augmented by article XIII of the latter Treaty.[89] Thus, ESA and its Member States are jointly charged with the obligations of authorization and supervision of non-governmental activities carried on under their respective auspices. The 1980 'Declaration by Certain European Governments on the Production Phase of the Ariane Launcher'[90] incorporates a collective authorization of "an industrial structure, named Arianespace, with the execution of the Ariane Launcher production phase".[91] Thus, it quite clearly fulfills the first criterion of State responsibility. As to 'continuing supervision', paragraph 1.2 of the Declaration states that

> the Participants agree that the objective of [the] production (i.e. commercial) phase will be to meet all the launch requirements of the world market subject only to:

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89. Article XIII(1) states that
> [t]he provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, including the Moon and other celestial bodies, whether such activities are carried on by a single State Party to the Treaty or jointly with other States, including cases where they are carried on within the framework of international intergovernmental organizations.

90. ESA Doc. C(80)8 rev. 1, reproduced in <u>Basic Texts of the European Space Agency</u>, (1980, ESA Publication), Vol. II, G2V <u>et seq</u>.

91. <u>Ibid.</u>, para. 1.1, G2V/3.

> (a) the proviso that it is carried out for peaceful purposes in conformity with the obligations under the Convention (i.e. the ESA Convention)[92] and with the Articles of the [Outer Space Treaty].

This is amplified by paragraph 1.6 which embodies an undertaking to set up a Committee within ESA to determine compliance with international obligations by Arianespace. This Committee comprises one representative from each participating Government and the Director General of ESA is to keep the Committee informed of all projected launches.[93] A two-thirds vote of the Committee (representing at least 15 per cent of the contributors to Ariane development) that a proposed launch is prohibited due to non-compliance with the aforementioned paragraph 1.2 is binding on Arianespace. The French Government is mandated with the enforcement of such a negative decision. France is also designated as the "launching state" for the purposes of the space treaties.

The other element contained within article VI is

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92. 'Convention for the Establishment of a European Space Agency' Basic Texts of the European Space Agency (1980, ESA Publication) Vol. I A6/1, which states in article II that 'the purpose of the agency shall be to provide for and to promote for exclusively peaceful purposes, cooperation among European States in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space applications systems...' emphasis added.

93. Para. 1.6(a).

the determination of the "appropriate State Party". This may prove complex in the Space Stations' Era if a logical system is not provided for. Professor Vereshchetin would hold that it envisages "both the State whose nationality the entity has and the State or States on whose territory its activities are done."[94] This conclusion is drawn from reading articles VI and VII of the Outer Space Treaty together.

Article VII affixes international liability on the State which performs, procures, or permits its territory to be used for a launch. However, there are several elements to international State responsibility as articulated in article VI. It certainly embraces the liability provisions of article VII and thus, logically, a State is liable for the activities of its private corporations.[95] This follows from the elaboration of article VII of the Outer Space Treaty in the 1972 Liability Convention,[96] article VIII of which confines the pursuit of a cause of action to States

94. Op. cit., supra, note 79, 264.

95. See N.M. Matte, Aerospace Law - From Scientific Exploration to Commercial Utilization, (1977, the Carswell Co. Ltd.)., pp. 162-163, footnote no. 24.

96. 'Convention on International Liability for Damage Caused by Space Objects', OFS 6 October, 1972, EIF 9 October, 1973, 24 UST 2391, TIAS 7762.

only, on behalf of its injured nationals. As a corollary to this, a State must thus be liable for the delicts of its nationals, including its corporate personalities. These are respectively the positive and negative aspects of the obligations inherent in State responsibility.[97]

2. THE JURISDICTIONAL BACKGROUND

Another positive aspect of State responsibility in International law, is in the exercise of jurisdictional authority, which is an expression of sovereignty. There are many bases for the assertion of jurisdiction, and a brief excursus to highlight the chief ones is necessitated.

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97. See I. Brownlie, Principles of Public International Law (1979, Oxford), (3rd Ed.), 433., where Professor Brownlie relates, in the context of the law of Responsibility of States, the Permanent Court of International Justice decision in the 1927 Chorzow Factory case wherein it is stated that

> it is a principle of international law that the breach of an engagement involves an obligation to make reparation in an adequate form. Reparation therefore is the indispensable complement of a failure to apply a convention and there is no necessity for this to be stated in the Convention itself.

This reasoning is the obverse of that applied to article VIII of the Liability Convention in the main text.

(a) **Jurisdictional Competence in International Law**

(i) The Territorial Principle - Flowing from the territorial basis of sovereignty itself, this principle permits the courts of the place where a crime or tort is committed to exercise jurisdiction.[98] In the criminal context, this is applied as the "objective territorial principle" whereby "jurisdiction is founded when any essential constituent of a crime is consummated on state territory".[99]

(ii) The Nationality Principle - This is used to permit a State to regulate the activities of its nationals irrespective of their location. "Nationality, as a mark of allegiance and an aspect of sovereignty, is also generally recognized as a basis for jurisdiction over extra-territorial acts."[100] This may be expressed in terms of domicile or residence of nationals including bodies corporate.

98. Ibid., 300.

99. Ibid.

100. Id. 303.

(iii) <u>The Passive Personality Principle</u> - Under this principle, where a national of the State is the victim of an offense, jurisdictional nexus is claimed.[101] However, many States, including the USA, reject this principle.[102]

(iv) <u>The Protective Principle</u> - Where acts committed abroad have adverse effects on the security of a State, jurisdiction is claimed.[103] This has found its expression in the extra-territorial application of US Anti-Trust Laws under the "economic effects doctrine."[104]

(v) <u>The Universality Principle</u> - This relates to conduct which is universally condemned by all nations, such as piracy, murder and hijacking. Thus States can try persons committing such crimes without more.

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101. <u>Id.</u>

102. 'The Status of Criminal Jurisdiction in Outer Space', Maj. General T.B. Bruton, The Judge Advocate General, US Air Force, paper prepared for the XXIVth Conference of the Inter-American Bar Association, Panama City, February 1984, (unpaginated).

103. Brownlie <u>loc. cit.</u> <u>supra</u>. note (100).

104. <u>Id.</u>

(vi) The Floating Territorial Principle - A State may assert jurisdiction over vessels and aircraft appearing on its registry. According to Professor Brownlie,

> [t]he view that a ship is a floating part of the State territory has long fallen into disrepute, but the special character of the internal economy of ships is still recognized, the rule being that the law of the flag depends on the nationality of the ship and the flag state has responsibility for and jurisdiction over the ship.[105]

(b) Jurisdiction in Space Law

In the space context, article VIII of the Outer Space Treaty provides that

> [a] State Party on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object and over any personnel thereof, while in outer space....

The concept of registration is discussed elsewhere in this thesis,[106] and at this juncture it is enough to assert that the floating territorial principle is the one made expressly applicable to activities in outer space. This probably does not exclude the other bases of jurisdiction, given the clear statement in article III of the Outer Space Treaty that States "shall carry on activities in the exploration and use of outer space... in accordance with

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105. Id. 316, see Bruton, op. cit., supra, note 102.

106. See infra. Chapter VII B 2(d)(ii).

international law...." Heretofore, the relatively straightforward assertion of jurisdiction based on registration as denoting nationality has proved adequate. However, with the advent of the Space Stations' Era, there is a potential for the wholesale application of all of the other concurrent bases for jurisdiction. It is submitted that this exports unnecessary complexity to a milieu which does not require it.

(c) State Practice and Draft Solutions for Phase C/D/E of the US/International Space Station

In the USA, the Uniform Code of Military Justice applies to military personnel wherever they may be, including in outer space.[107] Regarding criminal jurisdiction over civilians, both American and foreign, the "special maritime and territorial jurisdiction of the United States" has been legislatively extended to

> [a]ny vehicle used or designed for flight or navigation in space and on the registry of the United States pursuant to the [Outer Space Treaty and the Registration Convention] while that vehicle is in flight, which is from the moment when all external doors are closed on Earth following embarkation until the moment when one such door is opened on Earth for

107. Bruton op. cit., supra, note 102.

disembarkation...[108]

In the liability context, the 1958 National Aeronautics and Space Act (NAS Act)[109] defines "space vehicle" as

> an object intended for launch, launched or assembled in outer space, including the Space Shuttle and other components of a space transportation system, together with related equipment, devices, components and parts.[110]

This would certainly include the Space Station. Thus, the key to the exercise of jurisdiction over personnel working on the Space Station is the registration of the module within which an incident takes place. This flows from the current concept contained in the draft phase C/D/E negotiating texts, whereby each participant registers its own hardware contribution pursuant to article II of the Registration Convention.[111] However, the texts also provide for a "legal regime" to govern jurisdiction, thus employing the "escape clause" in article II(2) of the Registration Convention[112] which permits "appropriate

108. 18 U.S.C. 7(6) (1981).

109. P.L. 85-568, 72 Stat. 426, 29 July, 1958.

110. Ibid., Section 308 (f)(1) (emphasis added).

111. 'Convention on Registration of Objects Launched into Outer Space', OFS 14 January 1975, EIF 15 September, 1976, 28 UST. 695, TIAS 8480; see supra, Chapter III C for a more extensive treatment of the phase C/D/E negotiating text.

112. See infra, Chapter VII C 2(a).

agreements" to be concluded among participants in joint launchings. The "legal regime" divides jurisdiction into four sectors: - civil causes of action; and criminal, tax, and patent jurisdictions. Patents will be dealt with later in this chapter.[113] Regarding civil and tax jurisdiction, the state of residence is the criterion advocated, of the "person bringing the civil cause of action" or the "person, national or juridicial, deriving income from the activity" respectively. Criminal jurisdiction would rest entirely with the USA over "all persons on board the Space Station". Assistance with the definition of "on board" may be derived from the practice with respect to the US Space Shuttle. Thus, US federal regulations for the STS state that

> [p]ersonnel on board refers to those astronauts or other persons actually in the Orbiter or Spacelab during any flight phase of an STS flight (including any persons who may have transferred from another vehicle) and including any persons performing extra-vehicular activity associated with the mission.[114]

It is submitted that this arrangement is entirely logical and adequate for the foreseeable future of the US/International Space Station. In the unlikely event of

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113. See *infra*, section D 2.

114. Title 14 C.F.R., Chapter V, sub-part 1214.701(f), emphasis in original.

criminal activity occurring among such highly trained and dedicated personnel, the election of a single jurisdiction promotes uniformity. It will then be a simple matter for the legal representatives of the participants to familiarize themselves with US Criminal law. The resulting legal certainty is very attractive and obviates a host of problems of concurrent jurisdiction. This may not be sufficient in the mid- to long-term future, and some ultimate flexibility is desired. This will be amplified later in this chapter[115] and applies equally to the State of residence criterion in civil and tax matters. This is as logical as any other rubric denoting nationality of individuals. Special problems may occur in its application to corporations. However, guidance has been supplied by the International Court of Justice, which asserted in the Nottebohm[116] and Barcelona Traction[117] cases that International law must "guard against giving effect to ephemeral, abusive and simulated creations".[118] Thus, there must be a "real", "genuine" and/or "substantial" connection between a State

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115. See infra, Part F.

116. I.C.J. Reports 4 (1955).

117. I.C.J. Reports 183 (1970).

118. Brownlie, op. cit., supra, note (97), 490.

and its alleged private corporation.[119] Factors include where the "seat of management or centre of control" is situated and whether "a majority or a substantial proportion" of the shares are owned by nationals of the State concerned.[120]

It will be recalled that article VIII of the Outer Space Treaty speaks of "jurisdiction and control". The day-to-day exercise of control aboard the Space Station will no doubt follow the precedent set by US practice with the STS. Thus, the authority of the STS Commander is clearly prescribed by regulations[121] which provide inter alia that:

> (a) During all flight phases of an STS flight, the STS commander shall have the absolute authority to take whatever action is in his/her discretion necessary to (1) enforce order and discipline, (2) provide for the safety and well being of all personnel on board, and (3) provide for the protection of the STS elements and any payload carried or serviced by the STS.[122]

Furthermore, this authority extends "to any and all personnel on board... whether or not they are US nationals".[123]

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119. Ibid.

120. Ibid., pp. 485-495.

121. Title 14, C.F.R. Chapter V, sub-part 1214.7.

122. Ibid., 1214.702.

123. Ibid.

In addition, a "chain of command"[124] is prescribed in the following order: commander; pilot; and mission specialists in a pre-flight arranged pecking order.[125] Wilful or attempted violation of or conspiracy to violate the commander's authority can attract a fine of US $5000 and/or imprisonment for up to a year.[126] At the very least, this would cover the period of transportation to and from the Station, and it is likely to be extended by subsequent regulation to the Station itself <u>a fortiori</u> if criminal jurisdiction is vested in the USA as planned.

Finally, in this context it is worth mentioning that a concept of host commander responsibility was developed for the Apollo-Soyuz Test Project. Thus, it was agreed between the USA and the Soviet Union that during the period when the two modules were linked together and crew interchange was taking place

> [t]he host country control centre or host country spacecraft commander will have primary responsibility for directing the appropriate pre-planned contingency course of action.... In situations requiring immediate response or when out of contact with ground personnel, the decision will be taken by the commander of the host ship according to the pre-planned contingency

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124. <u>Ibid.</u>

125. <u>Id.</u>, 1214.703.

126 <u>Id.</u>, 1214.704(b).

course of action.[127]

This will no doubt be persuasive as a precedent for international space station activities.

C. ISSUES OF LIABILITY FOR STATION ACTIVITIES

1. THE LIMITED SCOPE OF THE LIABILITY CONVENTION

Article VII of the Outer Space Treaty imposes international liability "for damages to another State Party ... or to its natural or juridical persons" upon the State which "launches" or "procures the launching" of a space object. This is amplified in article I of the Liability Convention, where launching State is defined as also including a State "from whose territory or facility a space object is launched." Thus, if plans to use the US Space Shuttle to launch all of the components of the Space Station, including those of the three participants, materialize, the USA is potentially liable for such separately

127. See M. Bourély, 'The Legal Framework of the Spacelab/ Space Shuttle Programs in Comparison with the Apollo/ Soyuz Test Program', 4 J. Space L., 77, 80 (1976).

registered space objects[128] a fortiori in view of article V of the Liability Convention. The latter provides that "[a] State from whose territory or facility a space object is launched shall be regarded as a participant in a joint launching." This results in joint several liability for any damages caused by a space object which is launched by two or more States. An example would be the US launching of the ESA pressurized module which, according to the current position, would be separately registered as an ESA space object.[129] Any physical damage which this module causes to another State or its natural or juridical persons would result in joint absolute liability if occurring in air space or on Earth,[130] and fault liability if occurring in outer space.[131] In the latter case, a joint assessment of levels of culpability would result in the apportionment of the burden of compensation.[132]

However, the ambit of the Liability Convention is

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128. See supra, Chapters I B passim and III C(a), where the station construction schedule and the draft provisions regarding registration of the Space Station are respectively discussed.

129. Ibid., Chapter III C(a).

130. Liability Convention, Article II.

131. Ibid., Article III.

132. Ibid., Article IV 2.

circumscribed by its non-applicability to

> damage caused by a space object of a launching state to: (a) Nationals of that launching State; [and] (b) Foreign nationals during such time as they are participating in the operation of that space object....

This leaves open the application of existing national laws. If it is accepted that the manned nature of the Station will attract the most technically advanced safety features possible to prevent collision with other objects in orbit, the likelihood of physical impact is minimized. If damage occurs, it is more probable that it will be to personnel conducting activities on board the Station. Thus, in practical terms the Liability Convention will scarcely be applicable. In recognition of its limited scope, the drafters of the Convention included article XXIII(2), which provides that States may conclude "international agreements reaffirming, supplementing or extending its provisions."

2. US PRACTICE WITH THE STS

(a) The SPACELAB Agreement[133]

Article II of this Agreement sets out the liability provisions among the USA and the 'European Partners', whereby each would have "full responsibility for damages to their nationals and to their governmental property" arising from the implementation of the Agreement. The article goes on to provide that when SPACELAB is in use with the Shuttle, it would be characterized as a joint launching between the USA and ESRO for the purposes of the Liability Convention.

(b) Launch Contracts

Article V section 3 of the Standard Form NASA Launch Services Agreement[134] states in part that

> [t]o simplify the allocation of risks among NASA and all users of the Space

133. Other aspects of this agreement are discussed elsewhere in this thesis, see supra Chapters II B 1(c) and III B 2(a).

134. See e.g. 'Agreement Between the United States of America Represented by [NASA] and Satellite Business Systems for Launch and Associated Services', 17 June, 1980, reproduced in S. Gorove (Ed.), United States Space Law (1982, Oceana Publications Inc.), Vol. I, 37.

> Transportation System and to make the use of the Space Transportation System feasible for the use and exploration of outer space by all potential users, the parties agree to a no-fault, no-subrogation inter-party waiver of liability under which each party agrees to be responsible for any Damage which it sustains as a result of Damage to its own property and employees involved in STS Operations during such operations, which Damage is caused by NASA, the User or other users involved in STS Operations during such operations, whether such Damage arises through negligence or otherwise.[135]

Thus, liability for damage as between NASA and a user of the shuttle is excluded on the basis of contract, the consideration being the mutual exchange of waivers. This mutual agreement to refrain from making claims or suing one another is further extended to sub-contractors of each party through an agreement to include the inter-party waiver in such subsequent contracts.[136] This form of clause has since been extended to the so-called Joint Endeavor Agreements (JEAs)[137] whereby NASA and private sector corporations work together in the promotion of MPS activities. NASA provides the facilities and flight opportunity and the

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135. Ibid., para. 3(a) (emphasis added).

136. Ibid., subpara. (b).

137. For further information on the nature of JEAs see for example R.A. Williamson 'The Industrialization of Space: Prospects and Barriers', in M. Schwartz & P. Stares (Eds.), The Exploitation of Space (1985, Butterworths), 64, 72 et.seq.

corporation the investment in R & D. A recent JEA with Fairchild Industries Inc. for a free-flying platform[138] stated the rationale for the inter-party waiver in terms that

> the parties, by absorbing the consequences of damage to their property and employees without recourse against each other or other customers participating in STS Operations... jointly contribute to the common goal of meaningful exploration of outer space.[139]

Some writers have criticized the inter-party waiver, which is also utilized by Arianespace in its Launch Services Agreements, as placing launch customers at a disadvantage.[140] Furthermore, it has been observed that in view of the Challenger accident

> the presumption in favor of manned spacecraft reliability enjoyed by the shuttle is at least open to serious question. Risk transference clauses, therefore, should be negotiable.... Those providing the launch services and those making use of them ought to share in the risk of loss....[141]

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138. 'Agreement Between [NASA] and Fairchild Industries, Incorporated, for a Joint Endeavor Concerning the Research and Development of a Small Platform for Commercial Operations', 23 August, 1983, in Gorove _op. cit._, _supra_, note 134, Vol. II, 1 A.7(c).

139. _Ibid._, Article XXIV C3.

140. See T.J. Meyers of D.G. Hanes ' A New Approach to Launch Contracts', _Satellite Communications_, October 1986, 58.

141. _Ibid._ 60.

If the cogency of this argument when applied to comsats is clear, how much more so when applied to multiple user manned operations.

Regarding third party liability, which is that contemplated by the Liability Convention, the NAS Act[142] provided in section 308 that NASA is authorized to provide third party liability insurance to users of its launch vehicles on a reimbursable basis.[143] However, in practice, NASA requires the user to obtain third-party liability insurance in the JEAs or Launch Services Agreements.[144]

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142. Op. cit., supra, note 109.

143. Ibid., Section 308(a).

144. See 'Agreement Between [NASA] and McDonnell Douglas Astronautics Company for a Joint Endeavor in the Area of Materials Processing in Space', 25 January, 1980, reproduced in Gorove op.cit., supra, note 134, Vol. II, 1.A7(a), article XXII 2, which states that

> MDAC- St. Louis shall obtain, at no cost to NASA, insurance protecting MDAC-St. Louis, the United States Government and, to the extent the United States Government is liable to reimburse them for costs they incur for liability, the United States Government's contractors and subcontractors from any third party liability for damage arising out of the performance of this Agreement....

3. SPACE STATION PHASE B LIABILITY FORMULAE

(a) ESA - A Blanket Inter-Party Waiver

The NASA-ESA phase B MOU,[145] in contrast to the Spacelab Agreement discussed above, provided in article 12 for an inter-party waiver of liability by which

> NASA and ESA agree that, with respect to cooperative activities undertaken pursuant to this MOU, neither NASA nor ESA shall make any claim with respect to injury or death of its own or its contractors' or subcontractors' employees or damage to or loss of its own or its contractors' or subcontractors' property caused by ESA, NASA or the other Party's contractors or subcontractors whether such injury, death, damage or loss arises through negligence or otherwise.

It is further agreed between the parties to extend this inter-party waiver to their contractors or sub-contractors as third party beneficiaries, but this is not to apply to claims between ESA or NASA and its own contractors or sub-contractors.[146]

145. See supra, Chapter III A.

146. MOU Article 12.2

(b) STA - A Qualified Inter-Party Waiver

The terms of the inter-party waiver in the NASA-STA phase B MOU[147] are similar to that of its NASA-ESA counterpart regarding the relationship between NASA and NASDA, the executor of Japanese phase B activities. Thus, it is stated in article 12.1 of the MOU that

> NASA agrees, in accordance with the laws and regulations of the United States of America, that, with respect to cooperative activities undertaken pursuant to this MOU, NASA shall not make any claim with respect to injury or death of its own or its contractors' and subcontractors' employees for damage to or loss of its own or its contractors' and subcontractors' property caused by NASDA or contractors' and subcontractors' of NASDA, whether such injury, death, damage or loss arises through negligence or otherwise.

This is reciprocated by the STA on behalf of NASDA in similar terms.[148] This is once more extended to contract-

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147. See <u>op. cit.</u>, <u>supra</u>, note 145.

148. The MOU states that
> STA agrees that it will see to it, in accordance with the laws and regulations of Japan, that, with respect to cooperative activities undertaken pursuant to this MOU, NASDA will not make any claim with respect to injury or death of its own or is contractors' or subcontractors' employees or damage to or loss of its own or its contractors' or sub-contractors' property caused by NASA or contractors or subcontractors of NASA, whether such injury, death, damage or loss arises through negligence or otherwise.

ors and sub-contractors as third party beneficiaries.[149] However, the

> STA represents that, under the law of Japan, it is not authorized to waive its right to make an administrative claim against NASA for damage to or loss of its own or its contractors' or sub-contractors' property and, further, STA is not authorized to waive its right to make a legal or administrative claim against a NASA contractor or subcontractor for damage to or loss of its own or its contractors' and subcontractors' property.[150]

In order to avoid the breakdown of the waiver network, the STA agrees to involve neither its own property nor that of its contractors and sub-contractors in cooperative activities pursuant to the MOU. Furthermore, the STA represents that it is not permitted by the law of Japan to "waive its right to make a legal or administrative claim" against NASA or its contractors and sub-contractors "for the injury or death of an STA employee."[151] An agreement is made by the STA to "take appropriate measures protecting NASA" and its contractors and sub-contractors from such claims.[152] It is certainly questionable whether, if a claim had been lodged against NASA for the injury or death of an STA employee during phase B activities, this clause would have

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149. Ibid., MOU Article 12.2

150. Ibid., Article 12.3

151. Ibid., Article 12.4

152. Id.

forced the STA to indemnify NASA had the latter been negligent. It was perhaps a recognition of this problem that prompted the inclusion of article 12.6 in the MOU, which provided that " this approach does not prejudge the approach to liability for a follow-on arrangement covering the development, operation and utilization phases of the Space Station Program".

(c) MOSST - A Trust Concept

Like the two preceding MOUs, the NASA-MOSST one for phase B of the Station includes the establishment of the familiar inter-party waiver. However, following the agreement to extend this to subsequent contractual undertakings, a sweeping trust arrangement is provided for. Thus, it is stated in article 12.3 of the MOU that

> [a]s trustee for the benefit of NASA and NASA's Phase B contractors and subcontractors, MOSST shall irrevocably stipulate in any contract with a Phase B contractor that that Phase B contractor shall make no claim against NASA or NASA's Phase B contractors with respect to injury or death of an employee of MOSST's Phase B contractor, or damage to or loss of any property of MOSST's Phase B contractor which may have been caused by NASA or by NASA's Phase B contractors or subcontractors. A Canadian Phase B contractor shall be obliged to include the same provisions in contracts with subcontractors. It is understood that NASA and NASA's Phase B contractors shall be the beneficiaries of the trusts created pursuant to this MOU

and any Phase B contract and subcontract in Canada.

The only qualification to this clause is that it does not apply to claims between NASA or MOSST and their own contractors and sub-contractors. Nevertheless, it is submitted that this goes too far in pursuit of the "common goal of meaningful exploration of space" and can be construed as a licence to be negligent. If the purpose of having legal liability is a dual one of providing remedies to victims of wrongdoing and to ensure high contractor standards of production and operation, can this be served by such a wholesale abdication of responsibility? Furthermore, should this be extended to space station operations? These are public policy questions to be decided among the partners both independently and collectively. Some tempering of the inter-party waiver is evident, however, from the draft provisions for phase C/D/E.

4. THE PHASE C/D/E DRAFT FORMULATION

An inter-party waiver is also the desired goal of article 14 of the draft Agreement[153] both between the partners themselves and among them and their contractors and sub-contractors, their users and their contractors, etc.,

153. See *supra*, Chapter III C(a).

collectively termed "related entities". This applies to "Protected Space Operations" which is defined as meaning

> all launch vehicle, Space Station, and payload activities on Earth, in outer space, or in transit between Earth and outer space in implementation of this agreement. It includes but is not limited to research, design, development, test, manufacture, assembly, integration, or use of a launch vehicle, the Space Station, or a payload, as well as related support equipment and facilities and services. It also includes all activities related to ground support, test, training, simulation, or guidance and control equipment and related facilities or services. It excludes the development, manufacture, or use of products or processes on Earth developed as a result of activities in outer space.

However, this inter-party waiver is not as comprehensive as those for phase B sought to be. Thus, article 14.3 (c) provides that several categories of claims or suits are not prohibited, <u>viz</u> those

> (1) between a Party and its own contractors and subcontractors, or between a Party's own contractors and subcontractors to the extent the claim or suit arises from their contractual relationship;
>
> (2) made by a natural person, his/her estate or survivors for injury or death of such natural person;
>
> (3) for contribution or indemnity for injury or death of a natural person, or for damages incurred by third parties;
>
> (4) based on intellectual property rights.

This is perhaps an indication of the direction in which the ultimate policy response to govern liability will go. It may, however, be merely the result of the Challenger accident, since some of the survivors of the personnel who were lost filed claims in the USA against NASA for wrongful death under the Federal Tort Claims Act.[154] In addition, negligence suits were also filed against a NASA shuttle contractor, Morton Thiokol, the manufacturers of the Solid Rocket Boosters which malfunctioned causing the loss of the Challenger and her personnel.[155] The resulting out-of-court settlements were no doubt motivated by a desire to pre-empt the establishment of an adverse precedent, from NASA's and its contractor's perspectives, through the testing before the courts of the inter-party waiver used in

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154. 28 U.S.C. 2671-2680, see, 'Family of Challenger Pilot Files $15-billion Claim Against NASA', T.M. Foley, AW&ST, 21 July, 1986, 29. The FTCA provides at Section 2672 that

> [t]he head of each Federal agency [including the NASA Administrator]... may consider, ascertain, adjust, determine, compromise and settle any claim for money damages against the United States for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the agency while acting within the scope of his office or employment, under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred.

155. 'Astronaut's Widow Files Negligence Suit', AW&ST, 25 September, 1986, 81.

shuttle operations.

5. FUTURE CONCERNS

The difficulties which have resulted in product liability litigation with respect to general aviation manufacturers, for example,[156] certainly engenders some sympathy for the manufacturers of space objects and components thereof associated with the US/International Space Station. It may be that an inter-party waiver is the only viable way to proceed initially, especially in view of the attenuated liability insurance market. However, as the milieu matures, public policy may dictate that this practice be discontinued. Indeed, subsequent court decisions may achieve this anyway, by the waivers being struck down. Instead, it may be appropriate to consider the adoption of a limitation on liability, such as those established in the

156. See 'Congress Considers Efforts to Modify Product Liability Laws', D.M. North AW&ST, 28 October, 1985, 25; and 'Senators Plan Floor Vote for Product Liability Bill' AW&ST, 29 September, 1986, 39. In the space context, see N.M. Matte 'Product Liability of the Manufacturer of Space Objects II Ann. Air and Space L. 375 (1977).

Warsaw Convention[157] for international air carriers, and by the Price Anderson Act[158] in the USA for the promotion of nuclear energy.[159] Whatever course is decided upon, it is important that there be uniformity and equality of rights among the Partners and their "related entities", and adequate protection for the actual participants in space activities, the astronauts and payload specialists who will man the Space Station.

D. INTELLECTUAL PROPERTY LAW

1. THE IMPORTANCE OF THE ISSUE

This is likely to prove to be the single most important area of law applicable to activities aboard the US/International Space Station. One can anticipate that a host of articles and not a few books will be written on this

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157. 'Convention for the Unification of Certain Rules Relating to International Transportation by Air', the French text is the only authoritative one, the US translation appears in 49 Stat. 3000, T.S. 876.

158. 42 U.S.C. 2210 (1982).

159. See A. Ritholz, 'International and Domestic Regulation of Private Launching Ventures', 20 Stanford J. Int'l L 135, 157 (1984), where the author advocates the imposition of a limit on the liability of US Private launching ventures to encourage their development.

subject in the near future. Given the scope of this thesis, it will be impossible to deal with intellectual property law in the kind of detail that it merits. Nevertheless, an attempt will be made to address the major problems and perform a comparative review of the law and practice of the principal participants. In view of the space station rationale, explained in an earlier chapter of this thesis[160] that it is a means to promote domestic industrial activity in key technologies for the future, intellectual property law issues will be of paramount concern. Their importance has been succinctly stated by Lockheed Missiles & Space Company Counsel Roger Hoover, in terms that

> [t]he intellectual property of private industry is vital to its existence. The information and technology which make up the proprietary data and trade secrets of a private industry are the lifeblood of that industry. To the extent that the right to retain and protect such technology is diluted or lost, the industry will be weakened or destroyed. Thus a vital issue of security to private industry in its outer space activities is its ability to maintain its proprietary position.[161]

This then is the arena in which the difficulties inherent in the cooperative-competitive continuum mentioned

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160. See supra, Chapter I B passim.

161. R.K. Hoover, 'Law and Security in Outer Space From the Viewpoint of Private Industry', 11 J. Space L. 115,122 (1983).

in Chapter I of this thesis[162] will find their clearest expression. As a preface to a discussion of the various relevant international and national laws involved, several concepts must be differentiated.

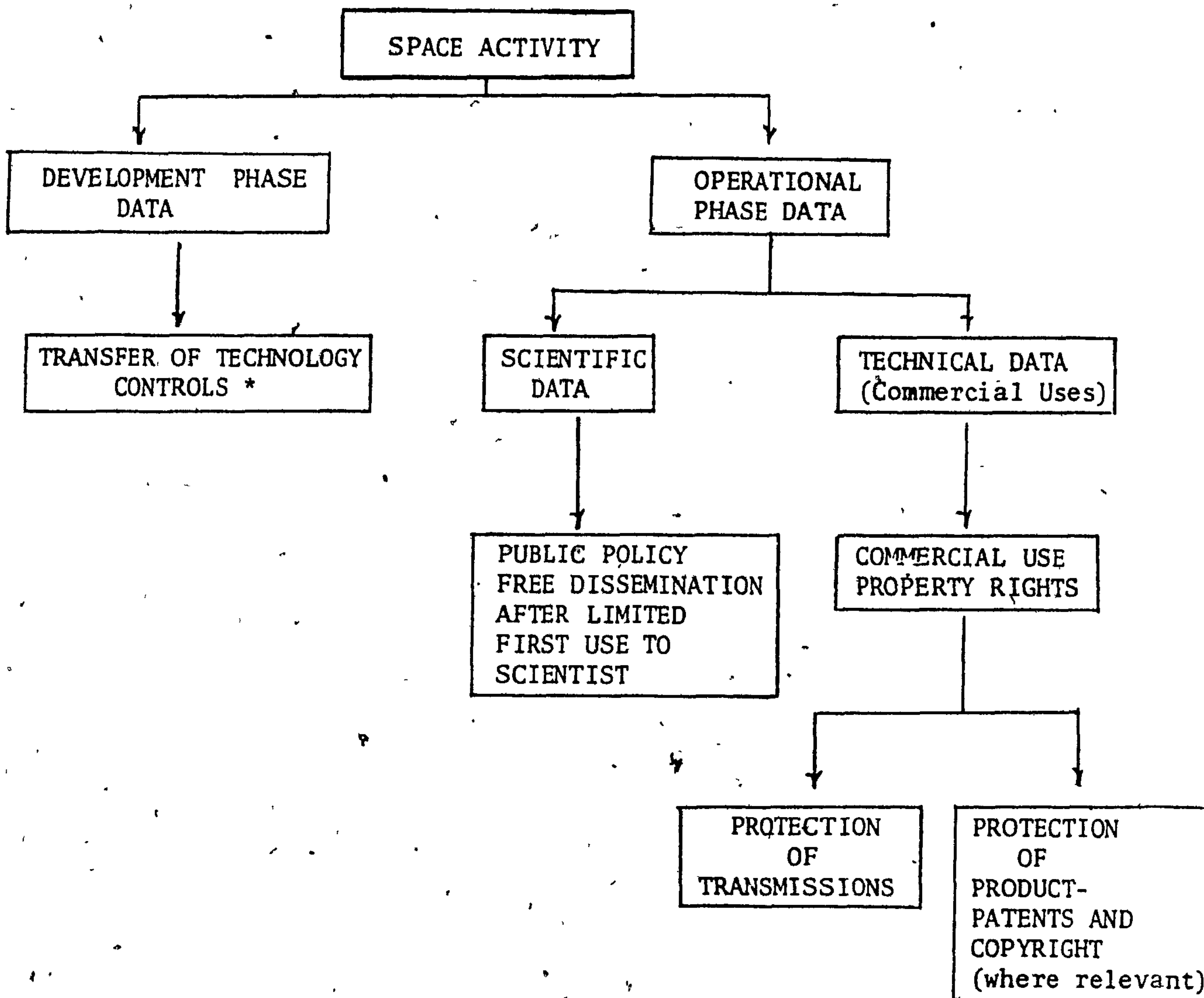
2. DATA AND PRODUCT DISTINGUISHED

Three tiers of distinction can be perceived in this rather complex area, as can be seen by reference to figure IV-2. In preparing to conduct a joint venture to perform a given activity in space, there are two main phases of activity. During the development phase there are apprehensions between participants (whether a single government and its domestic private sector concerns, or between governments, or their agencies or private sector concerns) regarding protection of the rights to data, and its resulting technology or product, which each may discover during R & D on the cooperative venture. This is the essence of the transfer of technology debate between industrialized nations, and will be discussed in the following section, part E of this chapter. This must be distinguished from the data produced during the operational phase of a cooperative

162. See *supra*, Chapter I B 5.

Figure IV-2

SOME INTELLECTUAL PROPERTY ASPECTS
OF SPACE ACTIVITY.



* See Figure IV-3 infra.

space activity[163] i.e. during the functioning of the resulting instrumentality in orbit. This is further subdivided into two broad categories, namely, scientific data and technical data.[164] This subdivision is premised on the nature of the activity, i.e. whether it is purely scientific or has commercial potential, in the case of space stations, both will be involved. However, there is usually little difficulty in permitting the unrestricted dissemination of scientific data, subject to initial utilization rights to the scientists directly involved with the experimentation. An example of this is provided by article 14 of the NASA-ESA MOU for Space Telescope (ST),[165] which states that

> [u]se of ST scientific data for scientific analysis will be reserved to investigators for a twelve month period, beginning with the receipt of data and any associated spacecraft data in a form suitable for analysis... Immediately after the period reserved to the investigator, reduced data will be deposited with the (US) National Space Science Data Centre... and in the Data Library of the European Space Operations Centre. Such records will then be available to the international scientific

163. G. Van Reeth and R. Oosterlinck (ESA) 'Exploitation of Data and Product - Experience of the European Space Agency', paper presented at the International Colloquium on the Space Station, Hamburg, West Germany, 4 October, 1984 pp. 1-2.

164. Ibid. 1.

165. See supra, Chapter III B 1(b)(ii).

community through the World Data Centre for Rockets and Satellites.

The procedure with respect to technical data, i.e. that which may be commercially useful, is much more restrictive. There are two main aspects of such technical data which require protection, namely, their transmission between an investigator on board the space station and his or her sponsoring private corporation or governmental agency on Earth, and the protection of rights in resulting products of such data, by means of patent, and/or copyright law where relevant. These latter two aspects are the ones discussed in the rest of this part of this chapter.

3. THE PROTECTION OF PRIVATE POINT-TO-POINT TRANSMISSIONS AND THE NEED FOR DATA ENCRYPTION

The fact situation envisaged herein is the transmission of technical data by an industrial investigator aboard the Space Station to representatives of his company at mission control via a data relay satellite. The Japanese have expressed particular concern over this issue and advocate the protection of proprietary information by encrypting such transmissions, or even avoiding transmission altogether by recording information and returning it unopened to Earth on "portable memory discs".[166] The fear is the unauthorized interception of such transmissions, a specific form of satellite piracy.

The specificity of this issue may be understood more clearly when it is differentiated from other forms of transmission. Point-to-point satellite transmissions are characteristically weak and low powered, requiring "highly sensitive, powerful, and very expensive ground stations for conversion and redistribution of signals".[167] This is in contrast to distribution satellites which reverse the power differential making the space segment dominant. Thus, smaller ground receivers are permitted such as the familiar commercial satellite dishes.[168] Distribution satellites are used for relaying television broadcasts, for example. Two further points are worthy of emphasis. The first is that copyright does not exist in data themselves, only

166 See 'Internationalizing NASA's Space Station', Editorial by D.E. Fink, AW&ST, 28 October, 1985, 13.

167 J.S. Weinstein, 'International Satellite Piracy: The Unauthorized Interception and Retransmission of United States Program-Carrying Satellite Signals in the Caribbean, and Legal Protection for United States Program Owners', 15 Georgia J. Int. and Comp. L, 1, 3 (1985).

168. Ibid., 4.

their form of expression.[169] The second relates to the private nature of a point-to-point transmission. Three ostensibly relevant international Conventions, the Berne Convention,[170] the Universal Copyright Convention[171] and the Brussels Satellite Convention,[172] all envisage

169. B. Luxenberg & G.J. Mossinghoff, 'Intellectual Property and Space Activities' 13 J. Space L. 8, 13 (1985).

170. 'The Berne Convention for the Protection of Literary and Artistic Works', OFS 9 September, 1886, 1886 Gr.Brit. T.S. No.(Cmnd 5167). Latest revision Paris 24 July, 1971, 25 UST 1341, TIAS 7868, 828 UNTS 221.

171. Universal Copyright Convention OFS 6 September, 1952, 6 UST 2731, TIAS 3324, 216 UNTS, 132, revised Paris 24 July, 1971, 25 UST 1341, TIAS 7868.

172. 'Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite' 13 Int'l Leg. Mat. 1449 (1974).

dissemination to the public or a section thereof.[173] Furthermore, neither the Berne Convention nor the Universal Copyright Convention were "drafted to take into account unauthorized interception of satellite transmission".[174] In addition, the Brussels Satellite Convention was designed to protect the "container" and not the "content", i.e. the signal and not what it carries,[175] such as sensitive

173. The Berne and Universal Copyright Conventions aim at protecting the economic interest of authors of "literary, dramatic, musical, or artistic work" by observing their exclusive right to "authorize reproduction by any means, public performance and broadcasting" (article IV(b)(i)(s) of The Universal Copyright Convention (emphasis added)) and of authorizing: (i) the broadcasting of their works or the communication thereof to the public by any other means of wireless diffusion of signs, sounds or images, [and] (ii) any communication to the public. (Berne Convention, article II(b)(i)(s) emphasis added). The Brussels Satellite Convention states in article 2(1) that

> [e]ach Contracting State undertakes to take adequate measures to prevent the distribution on or from its territory of any programme-carrying signal by any distributor for whom the signal emitted to or passing through the satellite is not intended (emphasis added).

"Distribution" is defined in article 1(viii) as "the operation by which a distributor transmits derived signals to the general public or any section thereof".

174. Luxenberg & Mossinghoff, op.cit. supra note 169, 11.

175. Ibid., and Weinstein op.cit. supra note 167, 15. See also Draft Report of the General Rapporteur, 13 Int'l Leg.Mat. 1449, (1974), at para 64, where the Convention's inapplicability to "transmissions of scientific and technical data, military intelligence, [and] private communications" is clearly pointed out.

technical data. In contrast, the International Telecommunications Convention[176] as amplified by its accompanying Radio Regulations is apparently useful in this context. Article 23 of the Radio Regulations states that

> administrations bind themselves to take the necessary measures to prohibit and prevent:
>
> a) the unauthorized interception of radiocommunications not intended for the general use of the public;
>
> b) the divulgence of the contents, simple disclosure of the existence, publication or any use whatever, without authorization, of information of any nature whatever obtained by the interception of the radiocommunications.

However, this is no more than a statement of intent, since there is no procedure for sanctioning such unauthorized interception.[177]

In the realm of municipal law, criminal sanctions have been applied to situations analogous to the instant case. Thus, the US Federal Communications Act of 1974[178] provides in section 605 that

> [n]o person not being authorized by the sender shall intercept any radio communi-

176. International Telecommunications Convention (Malaga-Torremolinos, 1973) (Nairobi - 1982) 28 UST 2495, TIAS 8572.

177. See Luxenberg & Mossinghoff, op.cit. supra note 169, pp. 10-16, and Weinstein, op.cit. supra note 167, 9.

178. 47 USC ss. 151-609 (1982).

> cation and divulge or publish the existence, contents, substance, purpose, effect, or meaning of such intercepted communication to any person. No person not being entitled thereto shall receive or assist in receiving any interstate or foreign communication by radio and use such communication (or any information therein contained) for his own benefit or for the benefit of another not entitled thereto....

Difficulties with the extension of this Act to satellite communications have centred on its limitation to point-to-point communications rather than broadcast communications, i.e. "those intended to be received by the public".[179] However, as we have seen, this is no impediment to the fact situation under discussion herein, though explicit legislative amendment may be necessitated to meaningfully extend the scope of this section. In addition, the sender being in outer space may prove problematic. Nevertheless, it is certainly arguable that a communication from LEO is a "foreign communication" for the purposes of the Act.

Regarding the viability of data encryption, Satellite Business Systems have developed such a system, which they are marketing to commercial customers under the rubric

179. J.C. Robinson, 'Private Reception of Satellite Transmissions by Earth Stations', 48 Albany L.Rev. 426 (1984), pp. 435-440.

Traffic Protected Service.[180] However, US federal regulations concerning reimbursable Shuttle services provided to non-US government users[181] require such users to "furnish NASA with sufficient information to verify peaceful purposes".[182] If data encryption were permitted general application to station activities, NASA may argue that it could not fulfil this mandate which will undoubtedly be extended to the Space Station in view of the new section 107 of the NAS Act, which states in part that the "civil space station may be used only for peaceful purposes."[183] Such an argument if mounted would assume a somewhat ironic character when compared to the latest US negotiating position for phase C/D/E of the Station. Prompted by the needs of the Strategic Defence Initiative,[184] the USA maintains that final determination of what constitutes

180. See 'Encrypted Transmissions', AW&ST, 25 November, 1985, 77.

181. Title 14 C.F.R. Subparts 1214.100-107.

182. Ibid. 1214.104.

183. Added by the 1985 National Aeronautics & Space Administration Authorization Act, P.L. 98-361 16 July, 1984.

184. See infra Chapter VB2(b).

peaceful purposes for the station would rest with it.[185] Furthermore, the USA would have the right to object to uses sponsored by the other partners on foreign policy or national security grounds.[186] It remains to be seen how this delicate political issue can be resolved to the satisfaction of all concerned.

4. PATENT LAW AND PRACTICE

(a) Distinctions in Priority - First Inventorship

A patent is defined as "the right conferred by letters patent of the exclusive use and benefit of a new invention."[187] This may be distinguished from a "trade secret" which is a non-statutory method of self-protection of an invention through keeping it secret.[188] The formula

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185. 'U.S. Proposal Would Restrict European, Japanese Station Use', T.M. Foley, AW&ST, 16 February, 1987, 23.

186. Ibid.

187. J. Burke, Osborn's Concise Law Dictionary (6th Ed.) (1976, Sweet & Maxwell) 248.

188. P.A. Kallenbach & R. Oosterlinck, 'ESA Inventions and Patents', ESA Bulletin No. 48, November, 1986, 29, 30.

for Coca-Cola is an example of a trade secret.[189] However, not being legally protected, a trade secret is vulnerable to industrial espionage[190] or reverse engineering and parallel development. A patent is a legal right to exclusivity lasting for between 15 and 20 years, depending upon the municipal law concerned and is intended to promote the dissemination of ideas in society.[191] In order to establish the priority of a patent claim, however, there is a basic legal distinction between the law applied in the USA and Canada on the one hand,[192] and that applied in Europe and Japan, indeed the rest of the world on the other.[193] Thus, the USA and Canada employ a first-to-invent system, whereby a patent is granted upon proof of first inventorship. According to Professor Donald Chisum, a US expert on patent law, "[p]riority of invention is determined by reference to certain key events - conception, reduction to

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189. Ibid.

190. Ibid.

191. R. Oosterlinck, 'Les inventions de l'Agence et leur protection', ESA Bulletin No. 27, August 1981, 22, 26.

192. The Philippines also apply similar methods to that in the USA and Canada. However, Bill C-22 currently before the Canadian Parliament would convert the Canadian system to a first-to-file one.

193. Luxenberg & Mossinghoff, op.cit. supra note 169, 20.

practice, and due diligence."[194] In establishing any of the latter aspects in US law, no account may be taken of activity in a foreign country, i.e. only actions on US territory are relevant.[195] This will assume crucial importance in the Space Station context as explained presently in this section.

In contrast, the vast majority of the world's nations employ a first to file system for patent priority. As explained by Gerald Mossinghoff, the former US Commissioner of Patents and Trademarks,

> [w]hoever gets to the patent office first with an application is presumed conclusively to be the first inventor and is entitled to the patent. . . In all those countries, whether something is invented in space and can be so proved is really not relevant. The only relevant data is the data a person files in a country's patent office.[196]

This in turn may be affected by the security of data transmission discussed in the previous section, since a patentable process or invention discovered on board the

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194. Patents in Space, Hearing before the Sub-Committee on Courts, Civil Liberties, and the Administration of Justice of the Committee on the Judiciary, US House of Representatives, 98th Congress, 1st sess., 13 June, 1985, serial No. 16, testimony of Prof. Chisum 14, 17.

195. Ibid.

196. G.J. Mossinghoff, 'Intellectual Property Rights in Space Ventures', 10 J.Space L. 107, 110 (1982).

Space Station may need to be relayed to earth to ensure prompt filing.

(b) US Law and Practice Concerning Patents in Space

Section 305(a) of the NAS Act provides that

> [w]henever any invention is made in the performance of any work under any contract of the Administration (i.e. NASA)... such invention shall be the exclusive property of the United States, and if such invention is patentable a patent therefore shall be issued to the United States upon application made by the [NASA] Administrator, unless the Administrator waives all or any part of the rights of the United States to such invention.

Any such waiver is subject to the reservation of an

> irrevocable, non-exclusive, non-transferable, royalty-free licence for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States.[197]

With the advent of the STS, federal regulations were promulgated which included provisions governing the apportionment of patent rights. Two types of mission were distinguished, the straightforward reimbursable variety whereby users paid for STS services, and special arrangements for the ESA nations and Canada who were contributors to STS development. Regarding reimbursable services, it is provided that

> NASA will not acquire rights to inven-

197. NAS Act, ~~op.cit. supra note 109~~, s.305(f).

> tions, patents or proprietary data privately funded by a user, or arising out of activities from which a user has reimbursed NASA.[198]

However, this is subject to two important provisos, for NASA "may obtain assurances" from a user that

> activities which have a significant impact on the public health, safety or welfare... will be made available to the public on terms and conditions reasonable under the circumstances.[199]

In addition, a user is required to furnish information to "verify peaceful purposes",[200] and to ensure the safety of the shuttle and the continued compliance by NASA and the US Government with the law.[201] The position is entirely different with regard to a specific form of usage by the STS collaborators - ESA and Canada. Thus, in return for their contribution to the STS,

> when conducting experimental science or experimental applications missions with no near-term commercial implications...[202] NASA will obtain for US Governmental purposes rights to inventions, patents and data resulting from such mission, subject to the user's retention of the rights to first publication of the data for a speci-

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198. Title 14 C F R. Chapter V. s.1214.104(a) Patent & Data Rights.

199. Ibid.

200. See supra footnote 183 and accompanying text.

201. Op.cit. supra note 198, s.1214.104(b).

202. Ibid. s.1214.201(b) emphasis added.

fied period of time.[203] (emphasis added)

There is a similar requirement for information relating to peaceful purposes, shuttle safety, etc...[204] The rationale for this provision is that since there are no immediate commercial implications, public policy requires that NASA retain such rights.[205] This is reminiscent of the Symphonie launch agreement, and does appear somewhat one-sided.[206]

Desiring to promote US private sector utilization of the STS, NASA developed the Joint Endeavour Agreement (JEA) as the most extensive of a suite of three cooperative formats for NASA - private sector joint activity.[207] A JEA basically permits a company which provides hardware and scientific expertise, to have a flight aboard the shuttle

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203. Ibid. s.1214.204(a).

204. Ibid. s.1214.204(b).

205. See Mossinghoff, op.cit. supra note 196, 109.

206. See supra Chapter III B2(b)(i).

207. The other two are Technical Exchange Agreements, which are limited to ground-based facilities only, and Industrial Guest Investigatorships, whereby NASA permits a company scientist to work at its facilities under the company's sponsorship. See J.A. Fountain, 'Opportunities for Commercial Materials Processing in Space', paper presented to Space Station: Gateway to Space Manufacturing Conference, Orlando, Fla., 7-8 November, 1985, pp. 16-17.

with no exchange of funds.[208] As a further inducement, NASA construed the JEA as not being a contract, and so outside the purview of section 305 of the NAS Act.[209] As an example of this, the JEA between NASA and McDonnell Douglas Astronautics Company (MDAC),[210] provides in Article XI that

> MDAC-St. Louis and any party in privity therewith shall retain all right, title and interest to any invention conceived or first actually reduced to practice in carrying out its responsibilities under this Agreement.

This is subject to a contingent royalty-free licence in the US Government "to practice or have practiced <u>in a space environment only</u>, such inventions by or on behalf of the Government."[211] However, this licence is only activated if MDAC does not take "effective steps" to utilize the invention commercially, or "in response to a national emergency involving a serious threat to the public

208. <u>Ibid</u>. 3.

209. See P.G. Dembling, 'A Lawyer's Space', <u>Astronautics and Aeronautics</u>, April 1982, 18, and Mossinghoff, <u>op.cit</u>. <u>supra</u> note 196, 122.

210. <u>Op.cit</u>. <u>supra</u> note 144.

211. <u>Ibid</u>. article XB1, emphasis added.

health",[212] or following a unilateral termination of the Agreement by MDAC.[213] This procedure was reinforced in the 1984 Draft NASA 'Guidelines for United States Commercial Enterprises for Space Stations Development and Operations'.[214] It is therein stated that "NASA will protect proprietary rights, and will ask for privately owned data only when necessary to carry out its responsibilities".[215] As a further refinement, a recently concluded Agreement between NASA and the 3M Corporation[216] extends the period for disclosure of flight data to two years, since 3M considered one year was not enough to permit them to analyse the data and file

212. Ibid., the latter is further limited by the need to show, presumably by NASA, that (a) no competitive alternative is reasonably available and (b) that MDAC is not supplying the invention in sufficient quantity to meet the needs of the market.

213. Ibid. article XB1(iii).

214. 'NASA drafts commercial guidelines', Space Business News, 4 November, 1985, 1.

215. Ibid., see also Space Policy May 1985, 222, 223.

216. Minnesota Mining and Manufacturing Co., St. Paul, Minn.

patents.[217]

As we shall see presently, there are recent changes affecting US patent law which may be vital to the Space Stations' Era.

(c) ESA Patent Law and Practice

As European activity in space has evolved, so too have its laws and practices with respect to proprietary information.[218] On the purely scientific side, the European Space Research Organization (ESRO) embodied the commitment, in article III of its founding Convention[219], that

> [t]he scientific results of experiments carried out with the assistance of the Organization shall be published or otherwise made generally available. After prior use by the scientists responsible for the experiments, the reduced data resulting from such experiments shall be

217. See 'NASA Agreement with 3M Sets Precedent For Large Commercial Space Commitments', T.M. Foley, AW&ST, 12 January, 1987, 102, 103.

218. See R. Oosterlinck, 'The Evolution of the Agency's Patent Policy', ESA Bulletin No. 44, November, 1985, 80.

219. 'Convention for the Establishment of a European Space Research Organisation', OFS 14 June, 1962, EIF 20 March, 1964, Basic Texts of the European Space Agency, Vol. I, Conventions and Rules, part A1/1.

the property of the Organization.

Paragraph 2 of this article provided that ESRO would normally publish such technical results "subject to patent rights." However, by 1967, some measures were taken to limit the availability of such results, when the ESRO Council established as standard practice that intellectual property rights remained with a contractor, subject to

> ensuring that technical results generated in the performance of the contract should be available for use, free of charge, by the Organisation and its Member States, solely within the field of space research and space technology...[220]

Parallel developments with respect to the European Launcher Development Organisation (ELDO) were more industrially conscious, since it concerned a space application, namely, the development of an expendable launch vehicle (ELV) as a space transportation system. Thus, article 8 of the ELDO Convention[221] provided that all technical information made available to ELDO, including that covered by "patents or other forms of legal protection",[222] could be used by ELDO "for the carrying out of its programmes without

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220. Oosterlinck, op.cit. supra 218, emphasis added.

221. 'Convention for the Establishment of a European Organisation for the Development and Construction of Space Vehicle Launchers', OFS 29 March, 1962, EIF 29 February, 1964, reproduced in N.M. Matte, Aerospace Law (1969, Sweet & Maxwell and The Carswell Co.) Annex X, pp. 391-405.

222. Ibid. article 8(1)(c), emphasis added.

payment".[223] In addition, Member States of the Organisation were permitted to "use such information for any purposes of their own without payment" and could make it available to individuals and concerns under their jurisdiction, subject to use within the field of space technology and contractual limitations to retain the information within the territories of the Member States.[224] By a subsequent Protocol,

> any individual, company or organisation under the jurisdiction of and resident in the territory of a Member State had the right to use inventions for purposes outside the field of space technology on commercially reasonable, non discriminatory terms.[225]

Thus, individuals and concerns had a royalty-free licence for space usage and the Member States had an unlimited royalty-free licence.[226]

Article III 3 of the <u>ESA Convention</u>[227] provides that

> [w]hen placing contracts or entering into agreements, the Agency shall, with regard to the resulting inventions and technical data, secure such rights as may be appropriate for the protection of its interests, of those of the Member States

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223. <u>Ibid</u>. article 8(1)(d).

224. <u>Ibid</u>. article 8(1)(e)(i) & (ii).

225. Oosterlinck, <u>op.cit</u>. <u>supra</u> note 218, 81.

226. <u>Ibid</u>.

227. <u>Op.cit</u>. <u>supra</u> note 92.

> participating in the relevant programme, and of those of persons and bodies under their jurisdiction. These rights shall include in particular the rights of access, of disclosure, and of use. Such inventions and technical data shall be communicated to the participating States.

This results in a system much like that which obtained with ELDO.[228] Thus, ESA and concerns in participating Member States have royalty-free licensing rights for space applications in Europe.[229] The rationale for this "free transfer of intellectual property"[230] is emblematic of the maturing European capability in space, and is "intended to stimulate European industrial cooperation in advanced-technology areas related to space, and thereby to improve the overall competitiveness of European industry."[231]

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228. See Kallenbach & Oosterlinck, _op.cit._ _supra_ note 188, 34.

229. _Ibid._

230. _Ibid._

231. _Ibid._ The authors also explain that

> [p]resent-day patent laws allow first filing of a patent application in one country, thereby establishing a 'priority' date, and further filing in other countries within a year following this priority date, these secondary applications then having the benefit of being based on the same priority date

at 31. Furthermore, the possible availability of a 'European Patent' is adverted to, whereby a filing in three relevant European nations would result in widespread recognition of a "European Patent" _inter partes_, 34.

(d) Application to the Utilization Phase of the Space Station

Recent legislative activity in the USA has sought to unambiguously extend the ambit of US patent law to activities occurring in outer space. Thus, Section 305 of the NASAct would be amended to include a provision that

> any invention made or used in outer space or an aeronautical and space vehicle... under the jurisdiction or control of the United States shall be considered made or used within the United States for purposes of this Act.[232]

This has important implications if applied to the US/International Space Station. It will be recalled that the current negotiating text for phase C/D/E provides that each participant will register its own module.[233] The "legal regime" suggested for Space Station activities further amplifies this concept relating to patent jurisdiction and rights, to the effect that

> for the purpose of applying patent law to inventions made or used in activities on board the Space Station, such activities shall be deemed to have occurred within... the State registering... the element on

232. Bill H.R. 2725, 99th Congress 1st sess., 11 June, 1985, Rep. Kastenmeier (D-Wisc.) et al., see also Patents in Space Hearings, op.cit. supra note 194, pp. 1-25.

233. Supra this chapter part B2(c).

which the invention is made or used...[234]

Recalling that in US law activity in foreign countries does not count towards obtaining priority in a patent interference,[235] extending this concept to the station leads to the situation where the actions of US companies and investigators aboard non-US modules would not be permissible as evidence of conception or reduction to practice in US territory. This is an application of the floating territorial principle of state jurisdiction. According to Professor Chisum,

> [t]he original rationale for the bar on proof of foreign activity in support of a date of invention was that it was too difficult to obtain reliable evidence on activity in foreign countries. This concern is obsolete in view of modern methods of communication and transportation and the development of suitable means of obtaining discovery of evidence.[236]

This applies a fortiori to the Space Station modules which would be linked together to form the core station. René Oosterlinck, the Head of the ESA Intellectual Property Service, would reject the law of the flag concept as evidenced by registration, in the context of intellectual property, as being an

> inappropriate... connecting factor. The

234. Op.cit. supra note 128.

235. Supra this chapter part D4(a).

236. In Patents in Space hearing, op.cit. supra note 194, 17.

> fact is that use of the law of the flag was introduced into private international law to replace, in certain specific cases such as ships and aircraft, the principle of "lex rae sitae" generally accepted with respect to moveable property. This was done because such property would, in normal use, regularly cross frontiers and consequently the applicable law would change each time a frontier was crossed. This is not the case where space applications are concerned since once the objects have been launched they will - accidents apart - remain in a specific place or orbit. This means that one could apply the principle of "lex rae sitae", i.e. apply an appropriate space law.[237]

He further advocates a "Convention on the space law of intellectual property", promulgated under the auspices of the World Intellectual Property Organization (WIPO).[238]

Whilst the latter may represent an ultimate goal, given the lateness of the hour with respect to the Space Station Project materializing at all, there may not be time to develop such a Convention. It is submitted that an alternative method of proceeding would be to expand the State of residence rubric used for civil and tax jurisdiction in the legal regime for the Space Station to apply to intellectual property. Apart from the consistency that this would bring to the regime, the location of the invention would be irrelevant for the USA and Canada, as it already is

237. R. Oosterlinck, 'Intellectual Property and Space Activities', 26th Colloq, Budapest, 1983, 161, 164.

238. Ibid.

for European Nations and Japan. This would allow US companies to use non-US modules and still have their activity count towards patent priority. By fastening on the inventor, wherever he or she goes in the Station, the inventor's own law would be applicable without prejudice to inventors from other States applying their respective laws. Continuous laboratory records can be kept which can be collated in the event of an interference to a patent application in the USA to establish priority. In addition, this would permit the original goal of mutual access to be revived by removing one of the major legal barriers to this most crucial aspect of the whole Space Station rationale. Furthermore, this would leave undisturbed the provision in a number of State's laws whereby their nationals are not permitted to file for a first patent abroad, but must file it in their own nation. This is to protect the interests of that nation in the creativity of its nationals.[239]

This issue is by no means resolved as yet, and at the time of writing another Bill has been placed before the US Congress.[240] It reiterates the provisions of HR2725 which did not become law, but inventions developed in a research facility provided for under international

239. Ibid., 163.

240. HR-4316.

agreement would be exempt.[241] Thus, the Space Shuttle would be considered US territory for the purposes of US patent law, but the Station would not. It is impossible to predict which method will ultimately be favoured, but the intellectual property experts at ESA consider that

> the commercialisation of space goes hand in hand with legal protection of the data and products gathered or produced during space missions and in the coming decade one can expect to witness the birth of an international private space law.[242]

I. DATA RIGHTS AND TECHNOLOGY TRANSFER IMPEDIMENTS

1. DATA RIGHTS IN THE DEVELOPMENT PHASE

(a) Intra USA

Section 203(a)(3) of the NAS Act requires NASA to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the

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241. Space Commerce Bulletin, 26 September, 1986, 9. There has even been a call from the American Bar Association for the US Congress to enact legislation which would make any patent developed in space, regardless of who invents it, under US jurisdiction, see Space Commerce Bulletin, 27 February, 1987, 9. This suggestion may, however, be dismissed as nothing more than a self-serving proposal to make work for its members.

242. Van Reeth & Oosterlinck, op.cit. supra note 163, 13.

results thereof." Furthermore, the Freedom of Information Act[243] enables requestors to obtain access to the records of government agencies, including NASA, unless one of nine exemptions is applicable.[244] The relevant one here is (b)(4) whereby trade secrets and confidential business information are protected.[245] According to Gerald Mossinghoff, writing in the context of reimbursable STS activities,

> [i]f NASA does get such data, and someone were to demand it under the Freedom of Information Act, NASA would resist as heartily as it could any attempt to acquire the data. That would put the matter squarely in a district court. NASA's policy will be not to get the data internally so that such data does not become subject to requests under the Freedom of Information Act.[246]

Thus, with respect to both Launch Services Agreements for reimbursable services and JEAs, where it is necessary to

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243. 5 USC s.552 *et seq*.

244. B. Luxenberg, 'Exploitation of Data and Products - Aspects of Law and Practice in the United States', paper presented to the International Colloquium on Space Station, Hamburg, W.Germany, 4 October, 1984, 8.

245. *Ibid*.

246. *Op.cit. supra* note 196, pp. 110-111.

submit technical data to NASA,[247] the purchaser of launch services and the collaborator respectively may mark the data with a notice stating that it is a trade secret.[248] This

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247. Reasons include insuring safety of flight operations, peaceful purposes of an activity, or necessary knowledge to enable NASA payload specialists to operate an experiment in space.

248. The following is an example of such a notice, in article III of the Standard NASA Launch Services Agreement, <u>op.cit. supra</u> note 134.

> <u>NOTICE</u>: This data is a trade secret of _____ and is submitted in confidence to NASA under Launch Agreement No.______ on __________. It shall not, without permission of the User, be duplicated or used for any purpose other than as necessary to carry out NASA's obligations under this Agreement nor disclosed outside the United States Government, except as needed for use by contractors in support of the Launch and Associated Services to be provided under this Agreement and only after such contractors have agreed in writing to protect the data from unauthorized use, duplication and disclosure. This notice shall be marked on any reproduction of this data, in whole or in part.

The terms are similar for a JEA, such as that between NASA and MDAC, <u>op.cit.</u> <u>supra</u> note 144, which contains the followng notice in article VIII:

> This data is a trade secret of ________and is submitted in confidence to NASA under Joint Endeavor No.______________, on ______________. It may be used, reproduced and disclosed by NASA for the purpose of carrying out its responsibilities thereunder, with the express limitation that it will not, without permission of the originator, be disclosed outside the Government; except that, subject to reasonable notice to the originator and agreement by recipient to protect this data from unauthorized use and disclosure, it may be disclosed outside the Government as needed for use by NASA contractors in carrying out NASA's responsibilities under this Agreement. This Notice shall be marked on any reproduction of this data, in whole or in part.

also exists within the context of the Stevenson-Wydler Technology Innovation Act of 1980[249] which states in section 11 that

> [i]t is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nations's Federal investment in research and development. To this end the Federal Government shall strive where appropriate to transfer federally owned or originated technology to State and local governments and to the private sector.

This transfer is administered by the Centre for the Utilization of Federal Technology within the Department of Commerce, which serves as a clearing house for information on federally owned technologies and facilities.[250]

(b) Practice in Co-operative Projects

The rationale governing NASA cooperation with foreign participants has been succinctly stated by its former Director of International Affairs, Kenneth Pedersen in the following terms:

> In projects where there is foreign involvement, that involvement is structured so as to avoid technology transfer. Generally, foreign participants undertake to provide a discrete piece of the overall project and are then responsible for

249. 15 U.S.C. 3701, P.L. 96-480, 21 October, 1980, 94 Stat., 2311.

250. Ibid., section 11(d).

> developing the resulting technology and hardware. Only the minimum amount of technical information necessary to ensure effective interface among the various elements of a project is exchanged.[251]

Probably the most representative expression of this policy is that with respect to Spacelab. The NASA-ESRO Spacelab MOU[252] contains provisions in its article XIII whereby each of the parties retains all rights to patents and/or proprietary information both antedating and postdating the MOU. Furthermore,

> [w]here it is initially determined that patentable or proprietary information should be transferred in the interest of successfully implementing this cooperative programme, this may be done under arrangements which fully recognise and protect the rights involved.[253]

This is amplified in the Spacelab Inter-Governmental Agreement[254] which provides that the European Partners and the USA will have reciprocal access to each others technology, "including know-how" which is "needed in order to accomplish successfully their tasks under the cooperative programme."[255] Further provisions restrict the European

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251. K.S. Pedersen, 'International Cooperation and Competition in Space: A Current Perspective', 11 J.Space L. 21, 23 (1983).

252. See supra Chapter III B2(a).

253. Ibid.

254. Ibid. Agreement article 6A.

255. Ibid. article 6C.

Partners, their nationals and ESRO from making such technology available "beyond" them (presumably meaning their borders) without express approval by the USA.[256] In addition, such access to technology "will be effected in such a way as not to infringe any existing proprietary rights of any person or body in the United States or Europe."[257]

This procedure was largely repeated in the Memoranda of Understanding for phase B of the US/International Space Station.[258] All three contained virtually identical provisions concerning data exchange and rights, which appeared as article 9 in each of the Memoranda. It is therein established that the intent of the Parties is to exchange technical information, data and goods "necessary for the purpose of carrying out the objectives and activities of this cooperative programme".[259] However, where the originating party or its contractor considers that such a transfer involves proprietary information, "the Parties agree to consult promptly and provide in a timely manner for appropriate protective conditions for its exchange and use

256. Id. article 6F.

257. Id.

258. Supra Chapter IIIA.

259. Ibid., article 9.1 of each MOU.

within this cooperative programme".[260] Apart from the desire to protect such information for commercial reasons, it is also stated that such measures would be to "protect against dissemination of dual use technology from the Space Station System".[261] This procedure is policed by "any applicable national laws and regulations",[262] which will be discussed in the following part of this section.

The two procedures discussed so far in this section have been combined in the draft for phase C/D/E. Thus, there is a stated policy of efficient exchange of technical data and goods among the partners which are needed to fulfil their respective responsibilities.[263] This is subject to two caveats, applicable national laws and regulations, and the provision for protection by marking data and goods for proprietary or export control purposes.[264]

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260. Ibid. article 9.2.

261. Ibid.

262. Ibid. article 9.3.

263. Article 16.1 of ~~the~~ C/D/E draft, for further discussion of this draft, see supra Chapter III C(a).

264. Ibid.

2. TRANSFER OF TECHNOLOGY IMPEDIMENTS AND THEIR NECESSITY FOR SPACE STATION ACTIVITIES

(a) US Law on Technology Transfer - The Driving Force

According to US attorney Dennis Burnett, who specializes in navigating exporters through the maze of US technology transfer laws and regulations, in discussing this issue in the Space Station context,

> [w]e start from the premise that US technology restrictions, however aggravating or ill-applied in individual cases, are a fact of commercial life that will be with us at least in the foreseeable future. The United States has and will continue to have a valid security interest in the end use of US-origin equipment and technology.[265]

US law is of course not the only relevant source impinging upon this issue, since each of the participants in the Space Station project (including all the Member States of ESA) have their own national regulations governing technology transfer. However, it can be said without fear of con-

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265. D.J. Burnett, 'The U.S. Legal Regime Governing Technology Transfers', reproduced in Commercial Use of Space Stations - The Legal Framework of Transatlantic Cooperation, Proceedings of an International Colloquium, Hanover Fairgrounds, 12-13 June, 1986 (hereinafter Hanover Colloq.) (1986, DGLR publication under the scientific management of Prof. Dr. K-H. Böckstiegel) 141, 142.

tradiction that US law is by far the most restrictive, extensive, and generally relevant given the importance of the USA as the linchpin of the Space Station project (indeed the entire chassis).

There are three main avenues whereby the USA controls the export and ultimate destination of technology and hardware. Periodic reference to figure IV-3, which attempts to summarize the relevant provisions, may be useful as the following necessarily brief explanation unfolds.

(i) The Arms Export Control Act[266] - This Act authorises the President to control the export and import of defence articles and defence services "in furtherance of world peace and the security and foreign policy of the United States".[267] This authority was delegated to the Secretary of State and is executed by the Director of the Office of Munitions Control (OMC) of the Bureau of Politico-Military Affairs within the Department of State.[268] The OMC administers the US Munitions List, which catalogues a

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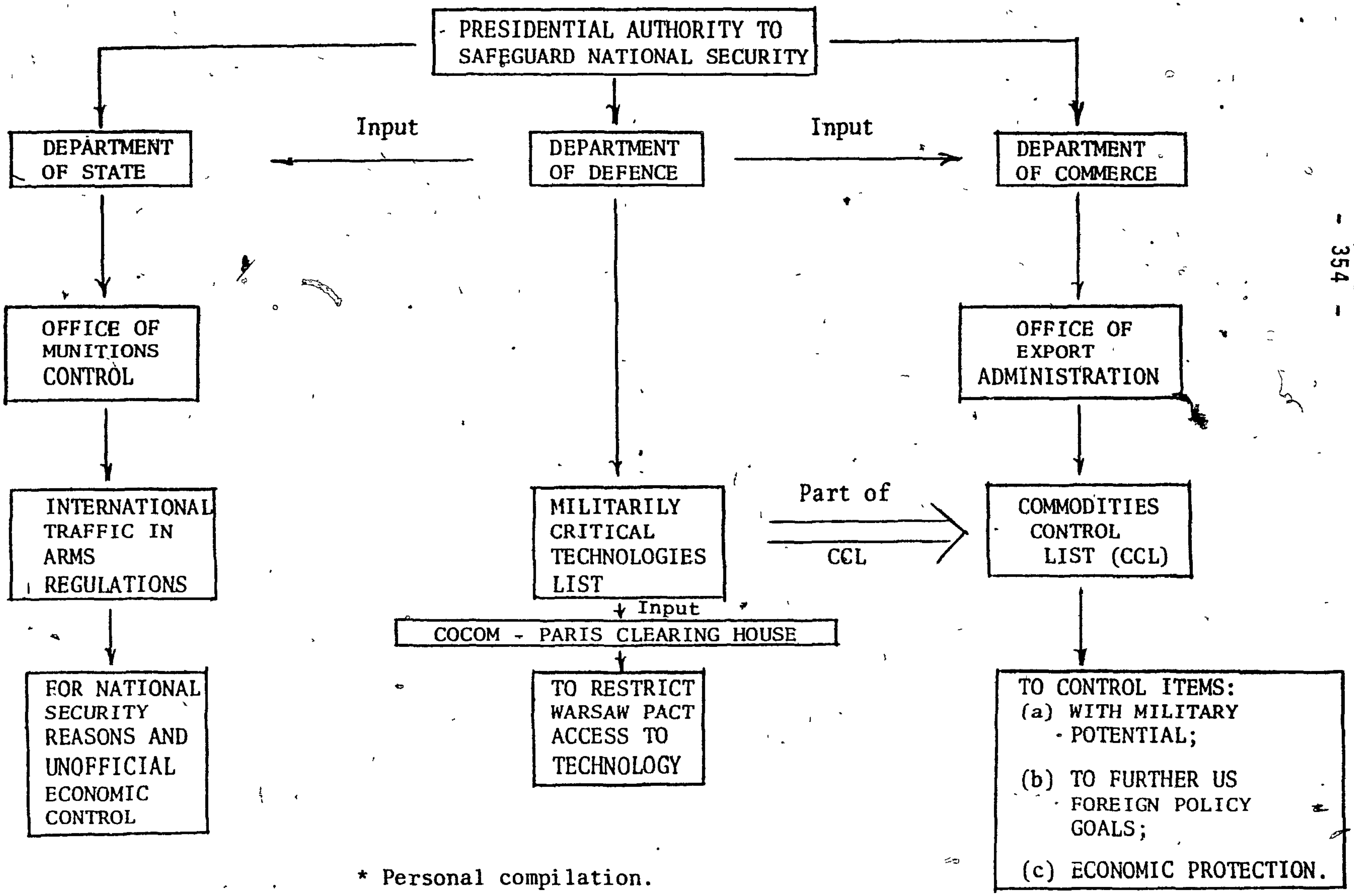
266. 22 U.S.C. s. 2778 et seq., P.L. 96-72, 93 Stat. 503.

267. Ibid. 22 USC s. 2778(a)(1).

268. Title 22 CFR Ch.1, section 120.1. There is also consultation with the Departments of Defence and Commerce, pursuant to Executive Order No. 11,958, 3 CFR 79 (1977) as amended.

Figure IV-3

SUMMARY OF EXPORT CONTROL REGULATIONS RELEVANT TO THE US/INTERNATIONAL SPACE STATION.



* Personal compilation.

number of sensitive "articles, services and related technical data",[269] pursuant to the International Traffic in Arms Regulations (ITAR).[270] There are 21 categories of "defense articles", categories IV, VIII, and XI being especially relevant in this context. Whilst category IV includes rockets and other launch vehicles, and Category XI military and space electronics,[271] category VIII would appear to be the most significant. Part (b)(1) of the latter lists "spacecraft, including manned and unmanned, ~~active~~ and passive satellites" as defence articles subject to export control. This control is exercised through the requirement of export licences.[272] In applying for an export license, the country of ultimate destination must be stated, together with the specific "end-user" and "end-use" of the defence article.[273] When such an export is

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269. Ibid.

270. Ibid. Title 22 CFR Subchapter M, parts 120-129 (1986). The Munitions List is contained in part 121.

271. Category XI(b)(1) includes "eletronic equipment specifically designed or modified for spacecraft and spaceflight".

272. Op.cit. supra note 270, s. 121.1(a). As they are also designated as "significant military equipment" additional controls are applied over and above the normal licensing procedures, s.120.19.

273. Ibid. s.123.9(a).

approved, the OMC requires the exporter to incorporate the following statement in the shippers' export declaration, the bill of lading and the invoice:

> These commodities are authorized by the US Government for export only to (country of ultimate destination). They may not be resold, diverted, transferred, transshipped, or otherwise be disposed of in any other country, either in their original form or after being incorporated through an intermediate process into other end-items, without the prior written approval of the US Department of State.[274]

As we shall see later in this part, this has caused difficulties in Europe.[275] There is an exception in the case of exports of unclassified defence articles or data to Canada, where no licence is required provided end-use is in Canada or is intended for return to the USA.[276] Finaly, in this context, it should be mentioned that the ITAR also apply to imports of defence articles to the USA and that the export licensing process takes up to six months or more.[277]

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274. Ibid. s.123.9(b).

275. See infra part E2(a)(iii).

276. Op.cit. supra note 270, s.126.5. However, this is subject to certain clauses being inserted in the agreements between US and Canadian concerns for such export pursuant to manufacturing, licensing and technical assistance agreements.

277. Burnett, op.cit. supra note 265, pp. 146-147.

(ii) <u>The Export Administration Act - As Amended</u>[278] - The Office of Export Administration (OEA) within the Department of Commerce administers the Commodity Control List.[279] The latter is divided into 10 commodity groups 0-9, which comprises one part of an equation also including country groups Q, S, T, V, W, Y and Z.[280] The latter are classified according to <u>inter alia</u> their degree of strategic commonality with the USA, although they are not graded alphabetically.[281] Thus, Western European

278. P.L. 96-72, 29 September, 1979, 93 <u>Stat.</u> 503, as amended by the Export Administration Authorization Act of 1985, P.L. 99-64, 95 <u>Stat.</u> 1727.

279. Title 15 CFR Part 399.

280. Burnett, <u>op.cit.</u> <u>supra</u> note 265, 144.

281. 50 USCS Appx s.2404 states in part that
[i]n determining whether a country is added to or removed from the list of controlled countries, the President shall take into account-
(A) the extent to which the country's policies are adverse to the national security interests of the United States;
(B) the country's Communist or non-Communist status;
(C) the present and potential relationship of the country with the United States;
(D) the present and potential relationships of the country with countries friendly or hostile to the United States;
(E) the country's nuclear weapons capability and the country's compliance record with respect to multilateral nuclear weapons agreements to which the United States is a party; and
(F) such other factors as the President considers appropriate.

nations and Japan are in group V, while the USSR is in group Y.[282] Canada is excepted from this system and more relaxed measures are applied to it. Basically, when an exporter wishes to export a commodity, reference must be made to the commodity group for initial classification. This is then cross-referred to the country group to verify if such a commodity is restricted for the desired country.[283] If so, one of a range of applicable licences may be issued depending upon the circumstances of the particular case.[284]

The rationale for the Commodities Control List is stated to be

> (A) to restrict the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the <u>national security</u> of the United States;
> (B) to restrict the export of goods and technology where necessary to further significantly the <u>foreign policy</u> of the United States or to fulfill its declared international obligations; and
> (C) to restrict the export of goods where necessary to protect the <u>domestic economy</u>

282. *Op.cit. supra* note 280.

283. *Op.cit. supra* note 279.

284. 50 USCS Appx s.2403(a) lists four types of licenses:- validated; qualified general; general; other licenses as required. Validated licenses are further sub-divided into distribution, comprehensive operations, project and service supply licenses.

> from the excessive drain of scarce materials and to reduce the serious inflationary impact of foreign demand.[285]

Relevant examples of controlled commodities are robots,[286] including end effectors such as those used with Canadarm and to be used with the Mobile Servicing Centre.[287] All country groups are restricted, and a validated licence is required, the most onerous of the suite of licences.[288] Another example is lasers, to which similar conditions apply as those with respect to robots.[289] Both of these commodities are stated to be controlled for national security reasons.

An additional restriction with respect to ESA nations in the Space Station context may be illustrated by the following fact situation. In the event a commodity is required to be exported to a company, in e.g. West Germany, to enable it to successfully construct the ESA module, the West German firm must obtain the permission of the US Government prior to exporting such a commodity to another

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285. Ibid. s.2402(2), emphasis added.

286. 15 CFR s.399.1, Supp. 1, Group 3, General Industrial Equipment, item 1391A.

287. See *supra* Chapter IB4(b).

288. *Op.cit.* *supra* note 286.

289. *Ibid.*, item 1521A.

ESA Member State - a re-export authorization.[290] According to ESA Legal Advisor Gabriel Lafferanderie,

> legitimate control over the final destination of technical information or product, should not, by prohibiting re-export of the transferred technology, be transformed into a barrier against cooperation or block the transfer of technology.[291]

An additional point worth noting herein, is the Militarily Critical Technologies List, which is a sub-part of the Commodities Control List, maintained under the primary responsibility of the Secretary of Defence.[292]

(iii) COCOM Procedures - This is the final element to be adverted to herein, and concerns the Coordinating Committee on Multilateral Export Controls (COCOM). This body was set up on an informal basis in 1949 to control export of sensitive technologies to the Eastern bloc, now the Warsaw Pact nations. Representatives from the COCOM countries[293] meet in Paris where a consultative group and

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290. 15 CFR part 374.

291. G. Lafferanderie, 'The Legal Regime for the Transfer of Technology', Hanover Colloq. op.cit. supra note 265, 156, 165, (emphasis in original).

292. 50 USCS Appx s.2404(d).

293. Belgium, Denmark, France, West Germany, Greece, Italy, Japan, Luxembourg, The Netherlands, Norway, Portugal, Turkey and the United Kingdom.

two subordinate Committees administer three COCOM lists: a munitions list; an atomic energy list; and an industrial/ commercial list.[294] These are in addition to national lists maintained by each COCOM country, including those just outlined for the USA which are the most restrictive.[295] US provisions which exceed those agreed to by COCOM countries have been criticized by the European Parliament in the form of a Resolution on 21 February, 1986 in which it is stated that there is "a common view in Europe that [they] ... are, in part, motivated by general national commercial considerations".[296] It is further averred that there should be "no limits on technology transfer among nations that have accepted COCOM."[297] The requirement in US regulations for an end-user certificate, as mentioned above, with its attendant restriction to one European nation has come into conflict with the objective of the Rome Treaty on

294. V. Leister, Space Technology: From National Development to International Cooperation, (unpublished D.C.L. thesis, Institute of Air and Space Law, McGill University, 1982) pp. 147-148.

295. Ibid. 149.

296. 'European Parliament Threatens Legal Action To Resolve Technology Transfer Stalemate', AW&ST, 17 March, 1986, 66, 68.

297. Ibid.

the European Economic Community[298] to ensure freedom of movement of goods and the abolition of export controls among member nations.[299] This matter has been brought before the European Commission and may end up requiring European Court of Justice resolution.[300] This sensitive situation may well have a significant impact upon Space Station activities. Indeed, this concern has been paralleled in the USA, by a call from the National Academy of Sciences for a realignment of the US bureaucracy for export control under the auspices of the Department of Commerce, operating within a strengthened and harmonized COCOM system.[301]

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298. See supra Chapter I B2(a).

299. Op.cit. supra note 296, 66.

300. Lafferanderie, op.cit. supra note 291, 165.

301. 'Science Panel Urges Lead Export Role For Commerce', P. Mann, AW&ST, 19 January, 1987, 20. See also 'Administration Cites Security Threat in Bill that Reduces Export Controls', AW&ST, 16 June, 1986, 80, in which a House of Representatives approved Bill to ease re-exportation restrictions in COCOM countries by cutting the Commodities Control List by 40 per cent, was criticised by President Reagan and his chief advisors as "risking decontrol of critical items regardless of national security".

(b) A Question of Policy

This is a highly politicized area comprising the two principal elements of a nation's power, namely its security and its economy. The three aspects to this political question in the Space Station context will now be briefly presented.

(i) West-East Controls - We have seen that the restriction of sensitive technologies is maintained by a formidable array of procedures. Given the state of geo-politics today, the necessity for such restrictions as a general rule cannot be seriously questioned. However, in the specific context of Space Stations' technology, the Soviet Union has displayed preeminence. Indeed, as noted in a previous chapter of this thesis,[302] NASA is compiling a classified report on Soviet Station activities to aid it in formulating its own plans for the US/International Station. Given this position, the necessity for excessive controls on the ESA nations, Japan or Canada for the conduct of phase C/D/E of the project is highly questionable. Furthermore, in the closest cooperative project between the USA and the Soviet Union to date in space, the Apollo-Soyuz Test

302. See supra Chapter I B1(b)(v).

Project, little technology transfer occurred. According to James Oberg, a noted expert on the Soviet space programme,

> [t]he alleged technology transfer from the United States to the Soviet Union during ASTP has probably been exaggerated. Most of what the Soviets could have learned about American space techniques was already available to them through the open literature.[303]

(ii) Controls Among Western Industrialized Nations - As explained in chapter I of this thesis, the relative inequality which used to obtain between the USA and its prospective Station partners has been eroded to a significant degree. There is firm belief among the partners that they are at least as advanced in some areas of space activities as the USA. In view of this relative equality, Dr. Gabriel Lafferanderie has averred that during the currency of the Space Station project

> transfers of technology should prove to be limited. They should be the exception, concern only specific fields, and arise only for reasons of commonality (safety, interface) or because of time scheduling or financial constraints. In these fields and circumstances, transfers will be, so to speak, "obligatory".[304]

The necessity for restrictions other than those absolutely necessary for COCOM purposes would appear to be overstated.

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303. J.E. Oberg, Red Star in Orbit (1981, Random House, 143.

304. Op.cit. supra note 291, 161 emphasis in original.

(iii) The North-South Perspective - One cannot leave this topic without adverting to this aspect. This is in anticipation of the treatment which will be given, in the final section of this chapter and Part Three of this thesis, to the Macrocosm within which the US/International Space Station exists and by which it must be influenced. The debate has been summarized by the US Congressional Office of Technology Assessment in terms that

> [t]he desire for economic growth and technological independence has prompted the less developed nations to apply pressure on the industrialized states to provide space services and hardware on a fully equitable basis and to institutionalize the means of transfer of this technology within the U.N. system.[305]

This is a powerful current in international affairs and cannot be entirely ignored by the participants in the US/International Space Station. Finally, they must be mindful of article XI of the Outer Space Treaty, by which they agree to inform the UN Secretary General "as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results" of activities in outer space.

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305. UNISPACE 82 - A Context For International Cooperation and Competition - A Technical Memorandum, Congress of the United States, Office of Technology Assessment, March 1983, 15.

Naturally, it is left up to the States concerned to interpret the ambit of this provision and the practice with respect to the Registration Convention does not augur well.[306]

F. A PROGRESSIVE ALTERNATIVE - THE FLEXIBILITY CONCEPT

It will have become apparent from a perusal of this chapter that there are numerous issues requiring successful resolution for the US/International Space Station project to proceed. If it is attempted to solve them all in advance, the project will never materialize and the partners will go their separate ways. Believing that cooperation is desirable, it is submitted that inbuilt flexibility should be incorporated in the phase C/D/E text. What is envisaged is an inter-agency legal liaison which would operate with the mandate to coordinate necessary legislation under the direction of the Multilateral Coordination Board as modified in the previous chapter.[307] Concerns that this may be an "agreement to agree" and thus lack enforceability, might be eased by extending the enforcement procedure advocated in the draft phase C/D/E negotiating text. The latter contains

306. See infra Chapter VII.

307. See supra Chapter IIIC.

a provision whereby a partner cannot have access to the Station if it has not enacted the legal annex into its national law. Furthermore, in the event of non-payment of operating expenses, the MCB may declare an offending partner's share of Station utilization resources forfeit. This sanction could be tempered by the inclusion of a transitional period, such as that used within the European Economic Community for the alignment of the national legislation of an acceding member State.

Such a strong legal liaison would allow problems to be solved on a case-by-case basis as the project unfolds and knowledge and experience increase. The premature nature of space industry demands the avoidance of unnecessary over-regulation which could stifle it, there are formidable enough impediments there already. The approach advocated herein could largely avoid this with a minimum addition to the existing bureaucracy since current agency legal staffs and the respective Directors can report to their governments to have legislation drafted and tabled as necessary. Of course, this is less applicable to the development phase of the Station. Thus, the policy with respect to transfer of technology restrictions and data transfers will need to be clarified on an _a priori_ basis. Certainly one of the earliest issues requiring legal coordination will be intellectual property law. However, this is unlikely to become crucial until the Station is operational. In the meantime, it could receive the extensive discussion it merits with informed decisions being taken in due course safe in the knowledge that the project is proceeding. Furthermore, this flexibility would allow liability provisions to evolve as requirements and experience dictate. This should result in a high degree of legal certainty which will in turn encourage commercial activities in the Space Stations' Era.

G. CONCLUSION - UNDERSTANDING THE 'PROVINCE OF ALL MANKIND' CONCEPT - TOWARDS THE MACROCOSM

Article 38 of the Statute of the International Court of Justice is generally recognized to enumerate the sources of international law as being

> (a) international conventions, whether general or particular, establishing rules expressly recognized by contesting States; (b) international custom, as evidence of a general practice accepted as law; (c) the general principles of law recognized by civilized nations; [and] (d) ... judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.[308]

In the halcyon days of 1958 after the news of Sputnik had reverberated around the world, the United Nations resolved to create a Committee on the Peaceful Uses of Outer Space

308. Emphasis added.

(COPUOS).[309] Contained in that inchoative resolution was the phrase, destined to become a veritable incantation in relation to outer space, "the common interest of mankind". This principle articulates the apogee beyond which the policy makers in the governments of the space powers may not go. "While in itself so general as to lack any clearly defined content, it is important precisely because it is so general."[310] Strongly reminiscent of principles of equity and fairness tempering the Common Law, especially in its illimitability, the common interest principle was amplified in the well known 1963 UNGA Resolution, the "Declaration of Legal Principles".[311] The quaternity to which it gave rise was enumerated in the first four articles of the latter Declaration, and reappeared with almost identical syntax in the Outer Space Treaty[312] in articles I to III. The key phrases in the present context are con-

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309. UNGA Res. 1348(XII), 'Question of the Peaceful Use of Outer Space', 13 December, 1958, created COPUOS ad hoc. UNGA Res. 1472(XIV) 'International Co-operation in the Peaceful Uses of Outer Space', 12 December, 1959, established COPUOS as a fully fledged wing of the U.N.

310. C. Wilfred Jenks, Space Law, (1965, Stevens & Sons), 193.

311. Op. cit., supra note 67.

312. Op. cit., supra note 73.

tained in article I paragraph (1), wherein the exploration and use of outer space must not only be carried out "for the benefit and in the interests of all countries" but also is declared to be the "province of all mankind". There are widely differing views among international jurists as to the correct interpretation of this paragraph. Since it defines the scope of the Outer Space Treaty and thus the legal regime applicable to all activities in outer space including commercial, a detailed consideration at this juncture is apposite.

There is widespread agreement that the "province of all mankind" at its narrowest construction denotes an area which is res extra commercium; indeed Professor Bin Cheng states quite forcefully that

> [u]nder the treaty, both outer space and celestial bodies are declared res extra commercium, thus forestalling any possible recurrence of colonialism in extra-terrestrial space."[313]

Territorium extra commercium, meaning territory which cannot be subjected to the sovereignty of any State, such as the High Seas,[314] is contrasted with Territory sub judice[315] in the sense of full untrammeled

313. "The 1967 Space Treaty", 95 J. Droit Int. 532, 564 (1968).

314. See Brownlie, op. cit., supra note 97, 181.

315. Ibid., 179.

sovereignty, and Terra Nullius,[316] such as Antarctica, which is not under the sovereignty of any State but may be in the future, subject to proof of claim by any of the accepted modalities.[317] Another term which Professors Lay and Taubenfeld note is used "inter-changeably" with res extra commercium, is res communis omnium.[318] Dr. Andrew Haley, in pre-Outer Space Treaty days was of the opinion that "outer space is, morally speaking, the common property of all mankind."[319] Thus, the property in or ownership of outer space would be vested in mankind.[320] Since International law deals primarily with States as its subjects, it is surely inappropriate to incorporate private law notions of ownership into a branch of law which would attribute this, as one of its many facets, to the generic concept of sovereignty, which is to be excluded in relation

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316. Ibid., 180.

317. Ibid., Part III Territorial Sovereignty, pp. 109-174 passim.

318. S. Lay and H. Taubenfeld, The Law Relating to Activities of Man in Space, 1970, (University of Chicago Press), 54.

319. A.G. Haley, Space Law and Government, (1963, Appleton Century Crofts), 11.

320. G. Gal, Space Law, (1969, Sijthoff Leyden, Oceana Publications Inc.), 123.

to outer space. In support of the latter point, Arbitrator Huber in the 1928 Island of Palmas Arbitration[321] before the Permanent Court of Arbitration, stated that sovereignty meant the "principle of exclusive competence of the State in regard to its own territory".[322] Furthermore, he stated that "territorial sovereignty belongs to one, or in exceptional circumstances to several States, to the exclusion of all others".[323] Thus, it would seem that the "province of all mankind" is meaningless unless read with article II of the Outer Space Treaty proclaiming the illegality of national appropriation of outer space "by claim of sovereignty". It has been observed in the policy context that the "province of all mankind" concept was

> accepted by the space powers on the general assumption that it will not really burden their programs and, in any case, that they themselves will determine unilaterally how it is to be implemented.[324]

321 22 Am. J. Int'l L. 867 (1928).

322. Ibid.

323. Ibid.

324. S. Brown, W. Cornell, L. Fabian, and E. Weiss, Regimes for the Ocean, Outer Space and Weather, (1977, The Brookings Institute), 130.

In 1979 the UN adopted the Moon Treaty[325] by a majority Resolution of the General Assembly. The renowned principle of the "Common Heritage of Mankind"(CHM) was contained therein in article 11. The CHM reiterates article II of the Outer Space Treaty, but augments this by advocating a commitment to the future creation of an "international regime" to govern exploitation.[326] This is in the context of a "rational management" of resources,[327] founded upon an "equitable sharing" of the benefits derived from such managed exploitation.[328]

To gain a fuller understanding of the concept it is necessary to return to its proponent, Arvid Pardo's definition of the CHM. On 1 November, 1967, the latter introduced the CHM to the world at the UN where he stated inter alia that the concept implied

> the equitable distribution of benefits from exploitation of the heritage. It is possible to go further... the notion of property that cannot be divided without the consent of all and which should be administered in the interest and for the benefit of all is a logical extension of

325. 'Agreement Governing the Activities of States on the Moon and Other Celestial Bodies', UNGA Resolution 34/68 5 December, 1979, U.N. Doc. A/RES/34/68 5 December, 1979, OFS 14, December, 1979, EIF 11, July 1984.

326. Ibid., article 11(5).

327. Ibid., article 11(7)(b).

328. Ibid., article 11(7)(d).

the common heritage concept.[329]

Further definition occurred in 1970 whereupon Arvid Pardo rejected the allusion to property, and suggested that the three characteristics of the CHM were: "the absence of property", in the sense of permitting use, not ownership; the "management" of the heritage, including intangible "values"; and the sharing of the benefits of the heritage.[330] Such a concept, were it to apply to orbits around the Earth would have far-reaching consequences for participants in activities therein.

The Moon Treaty, and therefore the CHM principle is stated in article 1 to apply to the Moon, "other celestial bodies within the solar system other than the Earth" and "orbits around or other trajectories to or around" the moon. Thus, it would appear not to apply to orbits around the Earth. This was formally admitted in COPUOS in its final review of the draft Treaty before its adoption in December 1979,[331] when it was stated that

> the trajectories and orbits mentioned in Article 1 paragraph 2 do not include trajectories and orbits of space objects in Earth orbit or trajectories of space

329. Anthony J. Dolman, Resources, Regimes, World Order, (1981, Pergamon Press), 227.

330. Ibid., 228.

331. See C.Q. Christol, The Modern International Law of Outer Space, (1982, Pergamon Press), 285 et seq.

> objects between the Earth and such orbits.[332]

This is highly significant since all commercial activities for the foreseeable future will take place in Earth orbits.[333]

Although the Moon Treaty is officially in force, it has a mere six ratifications, none of which are space powers.[334] Furthermore, the Vienna Convention on the Law of Treaties[335] provides in article 26 that "[e]very Treaty in force is binding upon the parties to it" and in article 34 that "[a] Treaty does not create either obligations or rights for a third State without its consent."

In a valiant attempt to circumvent this process, Dr. Nicolas Matte has analysed article 1(1) of the Outer Space Treaty as expanding the "common interest clause" which is said to establish the "principle of the 'Common Heritage of Mankind' or the 'province of all mankind'". This

> common interest clause or the 'common heritage of mankind' principle is of far-reaching importance. Departing from the pattern of individual and independent

332. Ibid., 304.

333. See supra, Chapter I passim, and this Chapter Part A.

334. The six Signatories are the Netherlands, the Philippines, Chile, Uruguay, Austria and Pakistan.

335. Reproduced in 63 Am. J. Int'l L., 875 (1969), OFS 23 May, 1969, EIF 27 January, 1980.

> States, it adopts a global view point by providing that the interests of all countries, regardless of their degree of economic or scientific development are to be taken into account. Benefits should be equitably distributed according to an acceptable method.[336]

However, this altruistic interpretation of the "province of all mankind" as being synonymous with the CHM would seem to rather overstate the case. The Moon Treaty itself in article 4(1) repeats the concept of "province of all mankind" with identical syntax to that used in article I(1) of the Outer Space Treaty. Yet, in article 11 the CHM is developed without reference to the "province of all mankind", suggesting a totally different concept. Professor Gorove has stated that the common interests clause in article I(1) of the Outer Space Treaty

> is not self-executing, but rather a kind of imperfect legislation in that it expresses an aspiration couched in very general terms which could not be specifically implemented without further elaboration and guidelines particularly those relating to the determination of the degree and nature of the sharing and the kinds of benefits that are to accrue.[337]

Professor Bin Cheng in his analysis of the cosmographical scope of International law distinguished between the

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336. N.M. Matte, Aerospace Law - Telecommunications Satellites, (1982, Butterworths), 77.

337. S. Gorove, "Implications of International Space Law for Private Enterprise", VII Ann. Air and Space L. 319, 322 (1982).

territorium extra commercium and the CHM or *territorium commune humanitatis* in the following terms:

> In the former, in time of peace...general international law allows [a State] to use the area or even to abuse it more or less as it wishes, including the appropriation of its natural resources, ...the emergent concept of the common heritage of mankind, on the other hand, while it still lacks precise definition, wishes basically to convey the idea that the management, exploitation and distribution of the natural resources of the area in question are matters for the international community and are not to be left to the initiative and discretion of individual States or their nationals.[338]

Thus, the common interests concept must be regarded, as it was by C. Wilfred Jenks, as a "point of departure"[339] necessitating further definition and conceptualization before making the transition from executory to executed International law. At least two more stages must be reached before the CHM would impinge upon commercial activities in Earth orbits. Firstly, it would need to be extended by further International Agreement to include Earth-orbital space. Secondly, a regime for effecting the international management of the resources of the "heritage" such as that established for the resources of the Deep Sea

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338. B. Cheng, "The Legal Regime of Airspace and Outer Space: The Boundary Problem, Functionalism versus Spatialism: The Major Premises", V *Ann. Air and Space L.*, 333, 337 (1980).

339. *Op.cit.*, *supra*, note 310.

Bed in the 1982 Law of the Sea Convention[340] would have to be internationally agreed upon not only for that area but for the area already within the scope of the Moon Treaty.

In evaluating whether the CHM provision may be becoming Customary International law, the North Sea Continental Shelf Cases[341] may be taken to authoritatively state the necessary indicia. The International Court of Justice therein articulated the principle that

> [a]lthough the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law on the basis of what was originally a purely conventional rule, an indispensable requirement would be that within the period in question.... State practice including that of the States whose interests are specially affected, should have been both extensive and virtually uniform...and show a general recognition that a rule of law or legal obligation is involved...i.e. opinio juris...[342]

It is certainly the official policy of the USA that the CHM

340. UN Doc. A/Conf. 62/122 7 October, 1982, 21 Int'l Leg. Materials, 1293 (1982), articles 136-189 inclusive.

341. Federal Republic of Germany (FRG) v. Denmark and FRG v. The Netherlands 8 Int.l Leg. Materials 340 (1969).

342. Ibid. paras 74 and 77.

concept does not bind them in any way.[343] Furthermore, Soviet scholars Zhukov and Kolosov interpret it in terms that

> the "common heritage" concept, as applied to celestial bodies and their resources, is confined to the aims and subject to this particular agreement. There are no grounds for arguing that as a result of its inclusion in an international agreement, a precedent has been established for the legal regulation of other space activities of States...[344]

This political position is clearly reflected in the range of national activities which are being conducted for profit in space. Telecommunication, remote sensing, space transportation and the nascent materials processing industry together exhibit clear and uniform State practice by all the space powers of the exact ambit of the "province of all mankind" provision. It

> means, in practice, that the results of space research serve the interests of all nations, of every person, and the general progress of civilization. It does not, however, imply an internationalization of space activities. Every State conducts such activities in accordance with its own space program or jointly with other States in line with agreements it has

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343. See Policy and Legal Issues Involved in the Commercialization of Space, 98th Congress, 1st sess., Ctte. Print S. PRT 98-102, 23 September, 1983, 32, and the statement of S. Neil Hosenball op. cit. supra, note 79.

344. Op. cit., supra note 81, 186.

concluded.[345]

Naturally, with this great freedom comes a commensurate responsibility, and that is the theme addressed in Part Three of this thesis.

345. *Ibid.* 184.

PART THREE

THE MACROCOSM

"In spite of the great importance we attach to the triumphs of knowledge and achievement, it is nevertheless obvious that only a humanity which is striving after ethical ends can in full measure share in the blessings brought by material progress and become master of the dangers which accompany it."

Albert Schweitzer(1)

(1) Out of My Life and Thought, (1963, Mentor), 119.

V. MILITARY SPACE STATION UTILIZATION - REALPOLITIK VERSUS IDEALISM

> *Despite the hopeful attitude of statesmen and jurists, and others who have attempted to mould what they think the political and economic structure of space industrialization ought to be, I think the chances are great that we are entering another era of imperialism, with all the trappings of imperialistic warfare.*
>
> Dr. George S. Robinson[1]

A. INITIAL ORIENTATION

Until recently, a discussion of military activities in space involved a return to the position which existed at the beginning of the Space Age, since such activity was generally confined to the super-powers. While this remains so in absolute terms, just as has occurred with every other space endeavour, we may be witnessing a broadening of the base of involvement, leading to a proliferation of such capabilities. This can be interpreted in at least two ways, either as being indicative of a maturation of the milieu, or

1. Statement at 1979 Annual meeting of the American Bar Association, Dallas, Texas, entitled 'Space Commerce and the Space Shuttle, its Development: Legal, Scientific and Practical Implications', Jurimetrics J., Fall 1980, 73, 96.

as an unnecessary repetition and extension of that which has occurred on Earth. In this chapter there will be a discussion of the military side of dual-use space station technology, its legality, and an alternative solution proposed to pre-empt the apparently inevitable military escalation.

A preliminary point of orientation, is the distinction between the terms "militarization" and "weaponization". Unfortunately, in the arms control context, when one first delves into the world of definitions there is a rapid realization that virtually nothing admits of a precise and uniformly agreed meaning. Indeed, as a paradigm of life wherein the greater the knowledge the greater is the appreciation of the immensity of that which is to be known, it seems the more assiduous the search for precision in arms control terminology the more uncertainties arise. Nevertheless, for conceptual purposes only, militarization as used herein refers to the ranges of stabilizing/passive/non-intrusive/supportive military activities conducted in space, such as communication, early warning surveillance, navigation, geodesy, meteorology, and reconnaissance.[2] In contrast, the term weaponization denotes military activities which are active/potentially intrusive/independent/ and thus

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2. See I.A. Vlasic, 'Disarmament Decade, Outer Space and International Law', 26 McGill L.J. 135, 149-150 (1981).

destabilizing, such as anti-satellites (ASATs) and space-based ballistic missile "defences".[3] This is already judgemental to a certain extent, for it is exceedingly difficult to tread a path of absolute neutrality when discussing such a visceral issue. Despite any inherent bias, the principle of audi alteram partem will be observed.

B. MILITARY UTILIZATION OF THE US/INTERNATIONAL SPACE STATION

> [T]here are no currently identifiable DOD mission requirements that could be uniquely satisfied by a manned space station. Further, no current DOD requirements were found where a manned space station would appear to provide a significant improvement to DOD over alternative methods of performing the given task. Over time, however, this situation may change. Therefore, we are devoting considerable attention to developing a better understanding of the potential future uses for the military role of man in space.[4]

3. See R. Bowman, 'The Militarization of Space? The Real Issue is the Weaponization of Space', Paper submitted to the International Progress Organization, 24 September, 1984, 2.

4. R.D. DeLauer (US DOD) 'Military Space Activities and a Space Station', in M. Gerard & P.W. Edwards Eds. AIAA/NASA Symposium on the Space Station (1983, AIAA Publication) 40.

1. THE MANNED ORBITING LABORATORY (MOL)

Announced by President Lyndon B. Johnson on 25 August, 1965, the MOL was to be launched by a Titan III C ELV and attached to a Gemini capsule.[5] The Gemini was to be a logistics vehicle, similar to the Soyuz used by the Soviet Union, to transport US Air Force astronauts to and from the MOL "in a program designed to determine man's military usefulness in space."[6] According to Brigadier General (Retired) Charles E. Yeager in his recent autobiography

> [t]he Air Force wasn't interested in going to the moon. We had had plans on the boards since 1947 for orbiting military space stations manned with our own astronauts. We knew damned well the Russians had similar plans, and we aimed to beat them to it.[7]

Furthermore, the US Air Force established a Manned Orbital Laboratory Command "to test experimental weapons and military hardware from permanently orbiting labs in space".[8] Although this programme was cancelled in the post-Apollo

5. 'Manned Orbiting Laboratory', 7 Spaceflight 116 (1965).

6. Ibid.

7. C.E. Yeager, Yeager (1985, Bantham) 265.

8. Ibid., 285.

climate of budget austerity, it is probable that early predictions of shuttle capability indicating it would be a much more militarily versatile vehicle affected the decision. Despite this, its inclusion herein is of the utmost importance for a proper appreciation of current plans. The contemporaneous legal defence of this programme by the late Professor John Cobb Cooper[9] is as applicable today as when it was written over twenty years ago, clear proof of the old adage that "there is nothing new under the sun". There are four elements to this argument whose importance demands reiteration, amplification and updating herein.

(a) The National Aeronautics and Space Act (NAS Act) 1958[10]

Section 102 of this Act declares the policy and purpose of the USA to be that "activities in space should be devoted to peaceful purposes for the benefit of all man-

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9. 'The Manned Orbiting Laboratory: A Major Legal & Political Decision', in I.A. Vlasic (Ed.) Exploration in Aerospace Law - Selected Essays by John Cobb Cooper 1946-1966. (1968, McGill University Press) 423.

10. P.L. 85-568, 85th Congress, H.R. 12575, 29 July, 1958, 72 Stat. 426.

kind."[11] Furthermore,

> activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense.[12]

Also, in carrying out its civilian mandate, NASA is instructed to make available "discoveries that have military value or significance" to national defence agencies.[13] The legislative history of the NAS Act contains a clear declaration that

> [i]t is the intent of the Congress that the necessary freedom to carry on research, development, and exploration be afforded both a civilian agency and the Defense Establishment to insure the full development of these peaceful and defense uses without unnecessary delay.[14]

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11. *Ibid.*, 102(a)

12. *Ibid.*, 102(b)

13. *Ibid.*, 102(c)(6)

14. Cooper, *op. cit.*, *supra*, note 9, 425.

(b) The United Nations Charter[15]

The implicit national security override with respect to US activities in space contained in the NAS Act goes directly to the essence of sovereignty itself, as manifested in articles 2(4) and 51 of the UN Charter. Thus, States respectively agree to "refrain... from the threat or use of force against the territorial integrity or political independence of any State" and that nothing in the Charter "shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations." Regardless of whether this actually permits preemptive or merely reactive self-defence, US policy has been clear since at least 1962 that there is no "ban on military nonaggressive use" of outer space.[16] Although the Soviet position has been _de facto_ the same over the years, official admission of this did not occur until

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15. 16 UST 1134, Signed 26 June, 1945, EIF 24 October, 1945.

16. Cooper, _op. cit._, _supra_, note 9, 426.

1985.[17]

(c) UN Resolutions

Only two resolutions of the UN General Assembly made prior to the 1967 Outer Space Treaty[18] addressed the issue of military space utilization. Thus, UNGA Resolution 1148(XII)[19] called for a disarmament agreement containing provisions which would eliminate nuclear weapons and reduce armed forces across the board, safeguarded by an open inspection system including elements "designed to ensure that the sending of objects through outer space shall be exclusively for peaceful and scientific purposes." However,

17. See 'Soviet Defense Chief Admits to Peaceful Military Research in Space', R. Owen, The Times 6 May, 1985, where it is reported that Marshal Sergei Sokolov, the Soviet Defense Minister, acknowledged "that the Soviet Union was conducting military research in space, but insisted that it was for peaceful purposes only."

18. 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies', OFS 27 January, 1967, EIF 20 October, 1967 610 UNTS 206, 18 UST 2410 TIAS 6047.

19. 'Regulation, limitation and balanced reduction of all armed forces and all armaments; conclusion of an international convention (treaty) on the reduction of armaments and the prohibition of atomic, hydrogen and other weapons of mass destruction', 14 November, 1957.

by 1963, this goal had been reduced to the more modest resolution to

> refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, installing such weapons on celestial bodies, or stationing such weapons in outer space in any other manner.[20]

This of course was later to become Article IV of the Outer Space Treaty, which has been rather superfluously reenacted as an amendment to the NAS Act to be discussed in more detail later in this chapter.[21] Multilaterally, that was and remains the extent of control upon military activities in outer space.

(d) The High Seas Analogy

The zenith of Professor Cooper's reasoning is the drawing of an analogy between activities in outer space and those on the high seas. Thus, he states that by approving the MOL programme

> [w]e (the USA) have now asserted in substance that outer space, like the high seas, may be used for defence purposes. Ships of the armed services of any nation may, in time of peace, navigate the high seas unmolested, making observations,

20. UNGA Res. 1884 (XVIII) 'Question of General and Complete Disarmament', 17 October, 1963.

21. See infra part C1.

> perfecting weapons and otherwise preparing the defenses of their country.[22]

As we shall see, according to the letter of the law and State practice interpreting its spirit, this argument is difficult to refute on other than moral or ethical grounds of limited probative value.

2. THE RATIONALE FOR THE DOD VOLTE-FACE

Although consistently denying any interest in or use for a space station,[23] both before and after President Reagan's official launch of the project in his January 1984 State of the Union address, some informed

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22. Cooper, op. cit., supra, note 9, 429.

23. See 'Station Decision Overrode Strong Opposition', AW&ST 30 January, 1984, 16, where it is observed that "opposition in the Defense Dept. was primarily from Defense Secretary Caspar W. Weinberger and his staff. The Air Force and Navy said they have no current station requirement, but they do not specifically oppose the development." See also 'Europe Pushes Space Station Role', M. Feazel, AW&ST 18 June, 1984, 16, where NASA officials are reported as saying "they have formal assurances from the Defense Dept. that there is 'no requirement for military use of the Space Station."

observers predicted that a military use would emerge.[24] In December 1986 the DOD announced its decision to formulate detailed plans for "use of the US/International Space Station for military research."[25] In executing this apparent volte-face, four principal reasons have been

24. See the comments of David Velupillai in Flight International 21 January, 1984, 163, 165 where he states the following:

> How does NASA respond to the US Department of Defense's (DOD's) relatively cool attitude to Space Stations? 'History shows that requirements follow a demonstration of capability', answers the agency. In other words, 'the DOD will find uses for a Space Station once it comes into existence'.

Furthermore, former US Assistant Secretary of State for Political Affairs, Lawrence S. Eagleburger, stated that

> Tout comme la navette, la station spatiale sera utilisée à des fins très diverses. Quand elle le sera à des fins de défense nationale, chaque cas sera étudié séparément. En ce qui concerne d'autres utilisations de type national ou international, il faudra que les utlisations à des fins de défense nationale soient compatibles avec la politique du pays et les impératifs internationaux.

in 'De l'Atlantique au Pacifique: L'Occident s'est élargi', Géopolitique Spring/Summer 1984, 26, 28.

25. 'Defense Decision to Use Space Station Will Delay International Negotiations', C. Covault and T.M. Foley AW&ST 22 December, 1986, 23.

given.[26] Their importance to the unfolding of the Space Stations' Era demands a somewhat detailed presentation.

(a) The Availability of Transportation

There are two basic interrelated elements to this argument. The first concerns the post-Challenger dearth of available space transportation. Apart from the crucial shuttle loss itself which reduced the fleet to three, the launch hiatus during which the STS is overhauled has pushed back the entire US space programme, both civilian and military. To compound these difficulties a series of ELV failures have occurred since the Challenger loss. Thus, a Titan 34D carrying a reconnaissance satellite[27] exploded during its 18 April, 1986 launch from Vandenberg Air Force Base in California.[28] The expressions of concern this precipitated were exacerbated by the destruction by launch safety officers of a malfunctioning Delta ELV carrying

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26. Ibid.

27. The reconnaissance satellite was either a KH-11 Big bird or a new version with independently returnable film pods to be retrieved by aircraft after their reentry, see 'Rocket Payload that Exploded Is Under Debate', New York Times, 26 April, 1986, A9.

28. 'Blow to Security Seen in the Loss of Titan Missile' W.J. Broad New York Times, 20 April, 1986, A1.

GOES-7,[29] launched from Cape Canaveral on 3 May, 1986.[30] There followed two successes, with the launch of the Delta 180, to be discussed presently,[31] and a revived 25 year old Atlas-E which carried the NOAA-G weather and rescue satellite into orbit.[32] However, the final member of the US space transportation stable, the Atlas-Centaur, has also recently been unsuccessful. Launched on 26 March, 1987 and carrying a defence communications satellite (FLTSATCOM-6), the penultimate NASA-owned Atlas-Centaur had to be destroyed by range safety personnel following a malfunction.[33] Therefore, over a period of fourteen months, all of the available US space transportation systems have failed. This development is all the more extraordinary when one considers that they are each managed independently of

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29. Geostationary Operational Environmental Satellite.

30. See 'Third US Rocket Fails, Disrupting Program in Space', W.E. Schmidt New York Times, 4 May, 1986, A1; 'Delta Rocket Explosion Clouding Celebration of US Manned Flight', J. Nordheimer, New York Times, 5 May, 1986, A-16; 'NASA Says Rocket's Failure Cripples Launching Capacity', D.E. Sanger, New York Times, 5 May, 1986, A1; 'Power Surge Cited in Failure of Rocket', J. Nordheimer, New York Times, 6 May 1986, C3.

31. See *infra* section 2(b)

32. *Space Commerce Bulletin* 26 September, 1986, 7.

33. 'Ex-NASA Officials Asking Why Rocket was Launched in Storm', *The Gazette*, Montreal, 28 March, 1987, H-18.

one another. This is a salutary lesson in the imperfection of the art. It is also a double-edged sword wielded by the defence community, which on the one hand lobbies for increased appropriations for "Complementary Expendable Launch Vehicles" (CELVs),[34] while on the other cites that up to 5000 shuttle (or equivalent) flights will be required

34. The CELV contract has been awarded to Martin Marrietta Aerospace in Denver, Colorado, for 10 Titan 34D7 rockets, the first to be delivered in 1988, see 'Newest Titan Groomed as Rival For Shuttle' W.J. Broad, New York Times 20 May, 1986, C1. In addition USAF is contracting for a new Medium Launch Vehicle (MLV) as part of a suite of defence ELVs required for its activities into the 21st century, see 'Air Force Selects MLV Contractors' AW&ST 18 August, 1986, 22; 'NASA, Air Force Seek Funds for New Orbiter, Expendables', P. Mann, AW&ST 3 March, 1986, 14; 'Aldridge Reveals Launch Lag Impact', Military Space 3 March, 1986, 1; 'Air force Speeds Plan for Rockets', J.H. Cushman Jr., New York Times, 13 May, 1986, A-15; 'Air Force Plans Mid-Sized Rocket for Space Fleet', D.E. Sanger, New York Times, 24 June, 1986, A1.

to deploy a ballistic missile defence (BMD) system.[35]

(b) The Strategic Defence Initiative[36]

(i) A Political Commitment - Space-based BMD is by no means a new concept. It was being openly discussed at the beginning of this decade in the USA as some of the initial results of research and development activities were released into the public domain.[37] In addition, there was widespread belief that the Soviet Union was actively

35. See "Reverberations of the Space Crisis: A Troubled Future for 'Star Wars'", W.J. Broad, New York Times, 15 June, 1986, A1 and 12, where it is observed that "[b]y official "Star Wars" estimates, deploying what the Government calls a medium-sized defensive system in space could take up to 58 years and cost from $87 billion to $174 billion if the task was undertaken with existing rockets and space shuttles." Furthermore, "[i]f in the mid-1990s, the Government decides to go ahead and build an anti-missile system, the Pentagon will need something other than the shuttles to lift thousands of space sensors and weapons into orbit. "Star Wars" officials drew this conclusion when they made their estimate that up to 5000 shuttle flights would be needed to deploy an anti-missile system in space."

36. See also supra Chapter I B 1(b)(vii) and infra. Chapter VI B 2(c).

37. See 'Technical Survey - Pentagon Studying Laser Battle Stations in Space', AW&ST, 28 July, 1980, 57; and 'Space-Based Laser Battle Stations Seen', C.A. Robinson Jr. AW&ST, 8 December, 1980, 36.

pursuing such a BMD capability.[38] With this background, it came as no surprise (at least to the defence community) that President Reagan included in his 23 March, 1983 statement on defence policy a commitment in the following terms to what became known as the Strategic Defence Initiative (SDI):

> What if free people could live secure in the knowledge that their security did not rest upon the threat of instant US retaliation to deter a Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?... Tonight, consistent with our obligations of the ABM Treaty[39] and recognizing the need for close consultation with our allies, I'm taking an important first step. I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles.[40]

This resulted in a veritable deluge of discussion whose essence will be caught and presented herein beneath an umbrella of relevance. Despite and perhaps because of informed criticism of the SDI programme, President Reagan

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38. *Ibid.*

39. See *infra* this chapter part C2 for a discussion of the legality of the SDI programme in the *ABM Treaty* context.

40. 'Text of Reagan Address on Defense Policy', *Congressional Quarterly Weekly Rpt*, Vol. 41, no. 12, 629, 26 March, 1983, pp. 632-633.

has used the annual State of the Union address to reiterate and reinforce the commitment of his administration. Thus, in the 1986 address, his prosaic support for "going forward to build a Space Station" is contrasted with the more poetic oratory of a belief in the

> technology transforming our lives [which] can solve the greatest problem of the 20th century. A security shield can one day render nuclear weapons obsolete and free mankind from the prison of nuclear terror. America met one historic challenge and went to the moon. Now, Americans must meet another - to make our strategic defense real for all the citizens of Planet Earth.[41]

This resolve was tested and not found wanting at the Reagan-Gorbachev Summit in Iceland on 11 and 12 October, 1986. Though agreement was almost reached on reduction of intermediate-range nuclear forces (INF), the Soviet Union at that time demanded controls on SDI research as part of the package. In his 27 January, 1987 State of the Union Address, President Reagan averred that

> in Iceland last October we had one moment of opportunity that the Soviets dashed because they sought to cripple our Strategic Defence Initiative - SDI. I wouldn't let them do it then I won't let them do it now or in the future. This is the most positive and promising defense program we have undertaken its the path for both sides to a safer future, a system that defends human life instead of threatening

41. 'State of the Union: Reagan Reports to the Nation', New York Times, 5 February, 1986, A-20.

it. SDI will go forward.[42]

As President Reagan's political mandate draws towards its conclusion, there is good reason to believe that the administration is attempting to irreversibly entrench SDI to bind any future less enthusiastic administration, be it Democratic or Republican.[43]

(ii) Basic SDI Technological Architecture - The administrative infrastructure for the SDI programme appears in Figure V-1 hereto. The SDI Organization has diligently researched, tested and evaluated technologies over the last few years. This effort has been fuelled by considerable federal funding, rising from $2.75 billion in fiscal year (FY) 1986,[44] to a requested $5.2 billion for FY 1988 and

42. Personal video transcript.

43. See 'Les manoeuvres autour du traité ABM et de la station spatiale - Ottawa manifeste son impatience', J. Coulon, Le Devoir, 16 February, 1987, 6, where it is averred that "Face au scandale de l'Irangate, aux vélléités du Congrès en matière de contrôle des armements et au peu de temps qu'il reste à l'administration Reagan, les durs ont décidé de passer à l'action pour rendre irréversible leurs programmes militaires."

44. 'Star Wars Planners are Digging Themselves in', C. Mohr New York Times, 20 April, 1986, A4.

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

as of January 1987

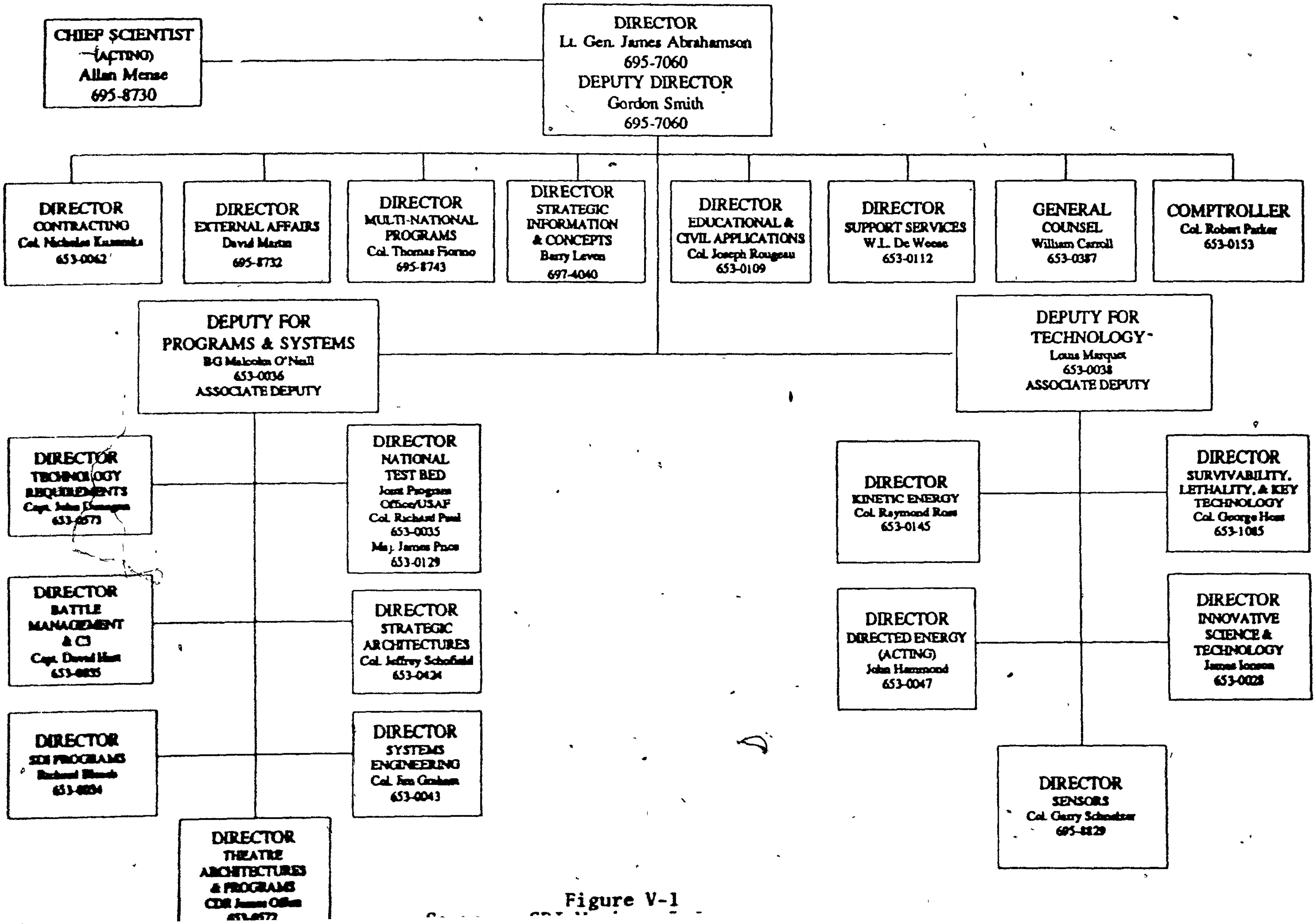

Figure V-1

$6.3 billion for FY 1989.[45] The SDI Organization has established five principal areas of development

- Surveillance, acquisition, tracking and kill assessment (SATKA);
- Directed Energy Weapons;
- Kinetic Energy Weapons;
- Systems analysis and battle management;
- and Survivability, Lethality and Key technologies[46].

These five elements have combined to produce a basic scenario composed of a three-layered system of strategic defence. This largely reflects the mission profile of an ICBM whose phases have been divided into: boost; post-boost; mid-

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45. 'Reagan's $303.3 Billion Defense Request Sets Real Growth at 3%', J.D. Morrocco, AW&ST, 12 January, 1987, 18, 20.

46. See M.L. Stojak, Legally Permissible Scope of Current Military Activities in Space and Prospects for their Future Control, (1985, Unpublished DCL Thesis Institute of Air & Space Law, McGill University), pp. 55-66.

course; and terminal.[47]

During the boost and post-boost phases a space-based component is considered essential, since timing is of the essence in order to eliminate the ICBMs before they have a chance to deploy their MIRVed warheads. Thus, the space-based kinetic kill vehicle (SBKKV) has emerged. This concept was tested during the Delta 180 launch on 5 September, 1986. Among the many interesting features of this mission, were the following:

- the mission was subject to an initial delay due to a possibility of collision with the Soviet Union's Salyut 7 space station during interceptor testing;[48]
- the Delta third stage equipped with a missile radar tracker manoeuvred to intercept and destroy the Delta second stage in low earth orbit above the Kwajalein

47. In the boost phase the ICBM is launched and accelerates through the upper atmosphere. At the high point of its trajectory its bus or post-boost vehicle proceeds to deploy multiple independently targetable re-entry vehicles (MIRVs) containing the nuclear warheads. The MIRVs travel through space for a time during the so called mid-course phase, accompanied by a number of decoys and associated debris. During the terminal phase the MIRVed warheads re-enter the Earth's atmosphere and descend to their terrestrial targets. Ibid., pp.51-53.

48. 'Next SDI Launch to Carry Multiple Research Payload', C. Covault, AW&ST, 17 November, 1986, 20.

Missile Range;[49]

- the rocket plumes of the two Delta stages were recorded and analysed for tracking and target acquisition purposes;[50]
- and existing tracking technology was tested in space to monitor a simulated Soviet ICBM launch during the boost phase.[51]

As a result of the data acquired during the Delta 180 mission, the SDI Organization has predicted that a system of SBKKVs could be "clustered in low-flying satellites that the SDIO calls garages".[52] Each garage would house between 6 and 24 SBKKVs up to a total of approximately 450 garages,

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49. A graphic depiction of this event can be seen on the cover of the 12 January, 1987 issue of AW&ST.

50. Op. cit., supra, note 48.

51. Ibid., a Space Vector Aries/Minuteman second stage was launched from the White Sands Missile Range to simulate a Soviet ICBM.

52. 'SDIO on verge of Producing Kinetic Kill Vehicle', AW&ST, 9 February, 1987, 24.

which translates into up to 11,000 SBKKVs.[53] Each SBKKV would effectively be an intelligent missile weighing between 250 and 500 pounds (120-240 kg).[54] SDI Organization enthusiasm for this variation on a theme of kinetic or ballistic technology has led it to advocate kinetic systems for other phases, since directed energy weapons are unlikely to be available for short term deployment.[55]

In order to eliminate MIRVs in the mid-course phase, the Exoatmosphere Reentry Vehicle Interception System (ERIS) is under study.[56] This would involve some 10,000 interceptors, which may be space and/or ground based and supported by three to five Airborne Optical Systems aircraft to assist in target discrimination.[57] The last line of

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53. See 'Near Term Deployment is Cost Effective', SDI Monitor, 2 March, 1987, 57. See also 'Deployment 'Straw Man' draws critics', Military Space, 30 March, 1987, 1, where it is reported that the latest SDI Organization scenario is for a "first stage phased deployment" using 3000 SBKKVs or "about 300 satellites," costing some $40-$60 billion.

54. Op. cit., supra, note 52.

55. 'SDI Obfuscation', D.E. Fink, editorial in AW&ST, 16 February, 1987, 9.

56. 'SDI Deployment Could Start in 1992, Study says', SDI Monitor, 5 January, 1987, 8.

57. Ibid., i.e. discriminating between a live warhead and a decoy.

defence for the terminal phase, would involve 3,000 ground and submarine based High Endoatmospheric Defence Interceptors (HEDI) to "protect large metropolitan areas or military sites".[58] Regarding the cost, estimates of an initial operational system feasible by 1994 are $54 billion, rising to $121 billion with a fully operational system a few years after that.[59] This assumes its proper significance when it is recalled that there has been considerable cavilling concerning the $8-12 billion estimated for the contemporaneous space station.[60]

Defence Secretary Caspar W. Weinberger has called for an early phased deployment of SDI technologies beginning with those which are near maturation, such as kinetic kill vehicles.[61] Meanwhile, research continues on "third generation" weapons such as X-ray lasers, hyper-velocity

58. Ibid., five HEDI tests using Spartan first stages and the first and second stages of Sprint missiles are to commence in 1989 to evaluate upper atmospheric MIRV interception, 'HEDI Program Plans Missile Interception Test', AW&ST, 24 March, 1986, 28.

59. Op. cit., supra, note 53.

60. See supra, Chapter I B 1(b)(iii).

61. 'Weinberger Endorses Phased Deployment of SDI', AW&ST, 19 January, 1987, 22.

pellets, microwaves, particle beams and optical lasers.[62] This requires considerable underground nuclear testing, which is permissible by the Limited Test Ban Treaty of 1963,[63] hence the resistance by the Reagan administration to a comprehensive nuclear test ban, as this "would block all SDI weapons development (and not just the nuclear-driven X-ray laser), since even non-nuclear systems must be designed to operate in a nuclear environment."[64]

(iii) Strategic Doctrine - According to former US Defence Secretary Harold Brown who has served under five

62. 'US Researchers Foresee a Big Rise in Nuclear Tests', W.J. Broad, New York Times, 21 April, 1986, A1.

63. 'Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water', 480 UNTS 43, OFS 5 August, 1963, EIF 10 October, 1963. Article I(1) provides that "[e]ach of the Parties to this Treaty undertakes to prohibit, to prevent and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control: (a) in the atmosphere; beyond its limits, including outer space; or under water, including territorial waters or high seas...."

64. 'Who Says West Wants no Nukes?', G. Dyer, The Gazette, Montreal, 8 March, 1986, B3, the author is here citing the observations of George Miller of the US Lawrence Livermore National Laboratory in California which is conducting research on third generation weapons in concert with the Los Alamos National Laboratory, also in California.

presidents,

> [s]ince the advent of nuclear weapons, presidents and other American political leaders have sought an alternative to the strategy of deterrence based on the threat of massive retaliation and to a situation where the American people were vulnerable to catastrophic destruction. President Reagan is no exception. Each president beginning with President Eisenhower, has considered the possibility of substituting defence and rejected it.[65]

With the failure of negotiations in the early 1960s for general and complete disarmament, there was a transition from a concept of disarmament to that of arms control as a more realistic objective.[66] The operative strategic doctrine has been and continues to be deterrence of attack by the threat of mutual assured destruction (MAD). The MAD doctrine holds that an aggressor will be deterred from commencing a nuclear attack due to the fear of a retaliatory strike by the victim resulting in the destruction of both nations. In order to foster this position, the super-powers agreed in the 1972 ABM Treaty[67] to severely restrict BMD

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65. H. Brown, 'The Strategic Defense Initiative: Defensive Systems and the Strategic Debate', Survival, Vol. XXVII, No. 2, March/April 1985, 55.

66. P.H. Nitze, 'The Objectives of Arms Control', Survival, Vol. XXVII, No. 3, May/June, 1985, 98, 100-101.

67. 'Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems', 23 UST 3435, signed 20 May, 1972, EIF 3 October, 1972. This treaty is discussed in more detail, infra, this chapter, Part C2.

capabilities in order to leave themselves vulnerable. SDI is an attempt to reverse this by a shift from the vulnerability of MAD to that of an active defence resulting in "mutual assured security".[68] The US Strategic concept has been summarized by Ambassador Paul H. Nitze in the following terms:

> During the next ten years, the US objective is a radical reduction in the power of existing and planned offensive nuclear arms, as well as the stabilization of the relationship between offensive and defensive nuclear arms whether on earth or in space. We are even now looking forward to a period of transition to a more stable world, with greatly reduced levels of nuclear arms and an enhanced ability to deter war based upon an increasing contribution of non-nuclear defences against offensive nuclear arms. This period of transition could lead to the eventual elimination of all nuclear arms, both offensive and defensive. A world free of nuclear arms is an ultimate objective to which we, the Soviet Union, and all other nations can agree.[69]

This unimpeachable objective unfortunately seems to contain

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68. See Nitze op. cit., supra, note 66, pp. 106-107 where he states that "deterrence would be based on the ability of the defence to deny success to a potential aggressor's attacks whether nuclear or conventional. The strategic relationship could then be characterized as one of mutual assured security.... Our hope and intent is to shift the deterrent balance from one which is based primarily on the punitive threat of devastating nuclear retaliation to one in which nuclear arms are greatly reduced on both sides and non-nuclear defences play a greater and greater role."

69. Ibid., 104., emphasis added.

more of idealism than it does of realism. Thus, a number of informed observers in the USA have criticised SDI as being: extremely vulnerable to pre-emptive and counter attack, particularly upon fragile space-based components;[70] technologically unable to defeat less expensive counter measures such as decoys;[71] outrageously expensive; and destabilizing by sending the wrong signals to the Soviet Union for "[w]e must assure the Russians that we are probing new concepts in science, not fielding a weapon against them."[72] Such critics remain convinced that research should continue in the hope of developing technology capable of permitting the transition from MAD to a universal defensive system. However,

> [t]hose who push hardest for early deployment are under the illusion that there is a unilateral, technological fix that can protect us from Soviet nuclear weapons. They are wrong. And not only are they the enemies of arms control, they are the Strategic Defense Initiative's worst enemies as well.[73]

In the meantime strenuous efforts toward strategic arms

70. See Brown, op. cit., supra, note 65, 57.

71. Ibid., 58.

72. ''Star Wars' May Destroy Strategic Defenses', W.E. Colby and R.D. English, New York Times, 15 February, 1987, A21.

73. Ibid.

control and an improvement in the relationship between the USA and the Soviet Union are advocated.[74] There is no doubt whatsoever that these objectives, in contrast to the likelihood of either side fielding an entirely successful BMD system, are feasible given the political will to achieve them. Furthermore, they are considerably less expensive and undoubtedly stabilizing. Despite the logic of this, the SDI Organization continues assiduously to pursue its presidential mandate to examine the feasibility of a BMD system such as that outlined in the previous section. The original "Nitze Criterion" of cost-effectiveness at the margin[75] may be replaced by one proposed by Lt. General James Abrahamson, that the system be merely "simply affordable".[76] The debate continues.

(iv) The Space Station Association - Orbiting in a

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74. See Brown, op. cit., supra., note 65, 59.

75. Cost-effectiveness at the margin means that "it must be cheaper to add additional defensive capability than it is for the other side to add the offensive capability necessary to overcome the defense.", Nitze op. cit., supra, note 66, 105.

76. See Broad op. cit., supra, note 35 A12. A panel composed of SDIO consultants recently assessed that the SBKKV and HEDI layers of defense would be cost effective but that ERIS still favours the offense, see 'Near Term Deployment' op. cit., supra, note 53.

<u>Putative Battlefield</u> - According to SDI Organization Director Abrahamson, the strategy for SDI deployment is an evolutionary one. Four phases are foreseen:[77]

- a Research Phase which will end in the early 1990s whereupon a decision will be taken on development;
- a Systems Development Phase during which prototypes will be "designed, built, and tested";
- a Transition Phase for incremental deployments of SDI systems, it is their

> intention that each added increment, in conjunction with effective and survivable offensive systems, would increase deterrence and reduce the risk of nuclear war. During this period, as the US and Soviet Union deploy defenses against ballistic missiles that progressively reduce the value of such missiles, significant reductions in nuclear ballistic missiles would be negotiated and implemented;[78]

- and a Final Phase which will witness the deployment of "highly effective multi-phased defensive systems... [as]... ballistic missile force levels reach their negotiated nadir."[79]

As we have seen, initial deployment is believed to be

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77. 'Documentation - the SDI: program and rationale', Lt. Gen. Abrahamson-Statement to Congress, 9 May, 1984, in <u>Survival</u>, Vol. XXVII, No. 2, March/April, 1985, 75.

78. <u>Ibid.</u>

79. <u>Ibid.</u>

feasible by 1994 or sooner i.e. the optimistic end of the space station construction timeframe. Furthermore, the orbit in which SBKKVs would operate is between 300 and 500 miles.[80] The lower of these figures is approximately the altitude at which the US/International Space Station would orbit and at which the Salyut 7 and MIR stations currently do so. Those SBKKVs above 300 miles would, if activated (either accidently or deliberately) shoot downward at ICBMs (actual or supposed) in the boost or post-boost phases i.e., past or through the area of civilian space operations, conceivably hitting manned facilities with deadly results. It will be recalled that some 300 SBKKV garages are currently envisaged by the SDI Organization.[81] In addition to such kinetic kill vehicles, the US Defence Department has announced that it requires flexibility to use the "civilian" space station for SDI experimentation, probably on directed energy weapons technology.[82]

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80. See 'SDI Deployment' op. cit., supra, note 56.

81. See 'Deployment Straw Man' op. cit., supra, note 53.

82. See 'Washington May Reverse Policy, Use Space Station for Star Wars', The Gazette, Montreal, 20 December, 1986, G9; and 'Space Station to be Used for Military Testing', The Ottawa Citizen, 26 January, 1987, A7. This is discussed in greater detail infra, this chapter parts B2(d) and B3.

(c) Soviet Military Space Station Activities

Soviet military utilization of their space stations was long suspected by Western observers to be a key part of their range of military space activities.[83] This was finally admitted by Dr. Roald Sagdeyev, the Director of the Soviet Institute for Space Research of the USSR Academy of Sciences in October 1986.[84] This admission went much further than the revelation 18 months previously by Defence Minister Marshal Sergei Sokolov that military research was being conducted in space.[85] Thus, Dr. Sagdeyev declared that there is a specific linkage between Soviet space stations ("orbital laboratories") and their research on

83. See for example N. Johnson The Soviet Year in Space: 1983 (1984, Teledyne Brown Engineering) pp. 10-39; N. Johnson The Soviet Year in Space: 1984 (1985, Teledyne Brown Engineering), pp. 11-38; N. Johnson The Soviet Year in Space: 1985 (1986, Teledyne Brown Engineering) pp. 10-51; G.L. Borrowman 'Soviet Military Activities in Space', 35 J. Brit. Interplanetary Soc. 86 (1982); Soviet Military Power (2nd Ed.) (1983, US Department of Defense Publication) pp. 65-69; Soviet Military Power, (4th Ed.) (1984, US DOD Publication), pp. 54-59.

84. "Shultz et Chevardnadze reprennent les négociations", Le Devoir, 30 October, 1986, 6.

85. See 'Soviet Defense Chief', op. cit., supra, note 17.

strategic defence technologies.[86] According to the 1986 edition (fifth) of the annual US Defence Department publication Soviet Military Power, expanded orbital space stations

> will provide the Soviets with a manned space-based military capability for missions such as reconnaissance, command and control, ASAT, and ballistic missile defence support operations as well as satellite maintenance and repair. Such space stations will probably be serviced and supported by the Soviet shuttle and space plane.[87]

In addition, it has been alleged that not only do Soviet cosmonauts support military exercises on Earth,[88] but they could soon be manning kinetic BMD systems to protect their stations from attack.[89] Thus, the Soviet Union would appear to be contributing its fair share towards both the militarization and the weaponization of outer space.

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86. See op. cit., supra, note 84, where it is reported that Dr. Sagdeyev "a admis hier à l'ONU que les 'laboratoires orbitaux' pouvaient faire partie intégrante de la recherche dans le domaine de la défènse stratégique, à condition toutefois que des limites très strictes soient appliquées sur les expériences ainsi conduites dans l'espace.".

87. Soviet Military Power (5th ed.) (1986, US DOD Publication) 53.

88. Ibid., see also 'Salyut Cosmonauts Support Military Exercises' AW&ST, 28 January, 1985, 22.

89. Ibid., Soviet Military Power, 47, and 'Soviet Space Station Will Carry Own Defense", AW&ST, 11 June, 1984, 18.

This certainly undermines General Secretary Mikhail Gorbachev's remark in the wake of the Iceland Summit that "the militarization of outer space is a step to war",[90] for this "step" is part of a minuet which both super-powers are already dancing, the Soviet Union apparently doing the leading.

(d) Evolving US Defence Space Policy

Explicitly in response to "impressive Soviet manned military demonstrations" the DOD is in the process of finalizing a new "Defense Space Policy".[91] Thus, General Robert Herres, the chief of the US Air Force's (USAF's) Space Command, has stated recently that

> [w]e are taking a hard look at the role of military man in space and how to make his utilization compatible with new launch vehicles, on-orbit servicing and the repair of space systems and programs such as the space station.... We do have the problem of finding and using a platform to explore the utility of man in space for military missions. There may be a need to

90. 'Iceland can give peace a chance: Gorbachev', The Gazette, Montreal, 14 October, 1986, A-6.

91. 'New Defense Space Policy Supports Manned Flight Role', C. Covault, AW&ST, 8 December, 1986, 18.

do that on the space station.[92]

In addition, General Herres is advocating an "armed space navy of antisatellite (ASAT) weapons to act against hostile space systems of a potential adversary."[93] Furthermore, the USAF-sponsored Project Forecast II, a six month intensive study to evaluate 21st century USAF capabilities, outlined a number of key technologies.[94] Among the latter were a horizontal take off and landing (HOTOL) trans-atmospheric vehicle called the National Aerospace Plane, and a "Swarm Concept", whereby "a large number of small, relatively simple and inexpensive satellites" would be orbited and cluster together to form phased arrays for radar, navigation or communications tasks.[95] According to General Lawrence Skantze, the commander of Air Force Systems Command which launched the project, there is "little doubt that our next generation Air Force will be built around the technology and

92. 'Space Station to be used for Military Testing', op. cit., supra, note 82.

93. "Herres pushes 'space power' doctrine", Military Space, 12 May, 1986, 3.

94. 'Project Forecast II: Study opens window on 21st century Air Force', Maj. C. Scheer & J.W. Jones, Space Trace, Vol. 4, No. 5, 2 May, 1987, pp. 4-5.

95. Ibid. This has now been termed Lightsat.

systems highlighted in today's Project Forecast II."[96]

Finally, in this context, an American Institute for Aeronautics and Astronautics (AIAA) group comprised of representatives from all of the major US aerospace corporations[97] has advocated utilization of the "civilian" space station by incorporating "[s]eparate Defence Dept. experiments modules, depots for electronic packages and fuel "farms" for spy satellite servicing."[98] Such activity is envisaged as paving the way to a $3.5 billion DOD space station on orbit by 2010.[99] This would profit from the technology and experience gained by the NASA station and could be armed with "shoot-back self-defense techniques."[100]

96. Ibid., 5.

97. The corporations included: McDonnell Douglas Astronautics Corporation; Martin Marietta; Grumman Aerospace; Rockwell International; Lockheed; and The Aerospace Corporation, see "Contractors tout potential of DOD station", Military Space, 30 March, 1987, 1, 8.

98. Ibid., 1.

99. Ibid., 7.

100. Ibid., 8.

3. INTERNATIONAL REACTION AND THE PEACEFUL PURPOSES DEBATE

(a) The US/International Space Station Partners

There are two main elements to the question of reaction by the partners. The first concerns the invitation by US Defence Secretary Casper Weinberger to North Atlantic Treaty Organization (NATO) allies (including most Member States of ESA, and Canada) together with Japan, Israel and Australia, to participate in the SDI programme. In a letter of 26 March, 1985 sent to each invited nation, Secretary Weinberger stated that

> [t]he United States will, consistent with our existing international obligations, including the ABM Treaty, proceed with cooperative research with the Allies in areas of technology that could contribute to the SDI research program. Pursuant to this policy, the United States is permitted - and is prepared - to undertake such cooperative programs or data and technology short of ABM component level as may be mutually agreed with Allied countries.[101]

A sixty day time limit was originally fixed, within which interested governments were to reply giving their areas of "research excellence", but this was subsequently

101. The letter is reproduced in Survival Vol. XXVII, No. 3 May/June 1985, 128.

withdrawn.[102] Only three governments have so far signed memoranda of understanding with the USA, the United Kingdom in December 1985;[103] the Federal Republic of Germany in

102. Ibid.

103. "Britain Signs MOU to Participate in SDI", AW&ST 16 December, 1985, 12. The first contract awarded thereunder was jointly to Ferranti Computer Systems of Bracknell, England and Heriot-Watt University of Edinburgh, Scotland for $285,000. An SDI participation office has been set up whose Director General is Stanley Orman. The latter has expressed considerable frustration with the Pentagon bureaucracy, particularly in relation to transfer of technology restrictions, see "Battle of Britain 2: DOD Red Tape", Military Space, 26 May, 1986, 1. In the impending British General Election, should the Labour Party win, SDI involvement would probably be terminated, SDI Monitor, 5 January, 1987, 16.

March 1986;[104] and Israel in May 1986.[105] Although all the agreements are classified[106] they basically stipulate the conditions under which their private companies and research groups may tender for and participate in SDI research contracts. The rationale for allied participation has been articulated by former U.K. Defence Minister Michael Heseltine as resting upon four points:

- The aim of the NATO nations is not gain superiority but rather to maintain a military balance taking account of Soviet developments;

104. "'Star Wars' Pact Disclosure Upsets Bonn", J.M. Markham, New York Times 20 April, 1986, A-3. The decision to participate was based on the belief that the Soviet Union was already pursuing such research, and thus it was necessary to ensure Western Security and NATO's deterrent capability. See 'Comments by the Government of the Federal Republic of Germany on President Reagan's Strategic Defense Initiative (SDI)', 1985, Space Policy, August 1986, 273, and 'German Minister Discusses NATO's Defense Options', AW&ST, 17 November, 1986, 77. The first West German SDI contract was awarded to Messerschmitt-Boelkow-Blohm (MBB), for $4 million, and is for a study of space-based infrared sensors. A $40 million contract is anticipated by MBB for development, 'German SDI Contract', AW&ST, 21 July, 1986, 31.

105. 'Israeli Defense Chief Links Syria to Abortive Bombing of EL AL Jet', R. Halloran, New York Times, 8 May, 1986, A-1, where it is reported that Israeli Defense Minister Yitzhak Rabin and Casper Weinberger signed a secret MOU.

106. The West German MOU was leaked to the Express in Cologne, much to the chagrin of Chancellor Helmut Kohl, see "Star Wars Pact Disclosure", op. cit., supra, note 104.

- Any deployment of SDI-related equipment would have to be a subject for further negotiations;
- The aim of the SDI program is to enhance, rather than undermine, deterrence;
- East-West negotiations should aim to achieve security by reducing the levels of offensive weapons on both sides.[107]

The two other principal member States of ESA, particularly from the perspective of their level of participation in the Columbus programme,[108] are France and Italy. The French Government has been critical of the SDI invitation to the extent that President François Mitterand proposed an alternative EUREKA programme.[109] The latter involves 18

107. See "Britain Signs MOU", op. cit., supra, note 103.

108. See supra Chapter I B 2(b) for further information on the Columbus Programme.

109. Ibid., part B 2(a).

countries throughout Western Europe,[110] indicative of widespread support for this "unlabelled" programme i.e. it is categorized as neither civilian nor military, but is given a neutral designation as a "high technology development" programme.[111] Ensuring the success of this programme certainly impacts upon French criticism of SDI, which is also qualified by the statement of Defence Minister André Giraud that he "really can see no reason to prevent the people at Ariane (sic) from launching satellites which could be of interest to the SDI program."[112] Regarding Italy, negotiations are under way towards a MOU with the USA, and in the meantime seven Italian companies have formed

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110. The participating States are: Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. See "European Minister's Approve Eureka High-Technology Projects", AW&ST, 1 September, 1986, 134, which synopsizes the 29 technological projects being funded, both by how much and by which nations in each project. There are five basic rubrics categorizing EUREKA activities: EUROMATIQUE - computer technologies; EUROBOT - robotics and lasers; EUROCOM - advanced telecommunications; EUROBIO - biotechnology; and EUROMAT - advanced industrial turbines, see S.F. Wells Jr., 'The United States and European Defence Co-operation', Survival, Vol. XXVII, No. 4, July/August 1985, 158, 164.

111. Ibid., 163.

112. SDI Monitor, 5 January, 1987, 17.

a consortium to compete for SDI contracts.[113]

Most other invited nations, including Canada and Japan, have been more equivocal concerning SDI involvement. A Japanese 55 member joint government and industry study group favoured SDI participation to enhance technological capability, in a report submitted to the Diet in April 1986.[114] However, there was considerable opposition from those who cited Japan's existing strength in many technologies and the anti-nuclear sentiment prevalent in Japanese society.[115] This has resulted in a September, 1986 statement by Chief Cabinet Secretary Masaharu Gotoda whereby both Japanese private firms and public institutions will participate in SDI research.[116]

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113. The consortium is entitled "Consorzio Italiano per la Tecnologie Strategiche", see "Allied Star Wars Support Remains Spotty", P. Langereux, Aerospace America, February, 1986, 10, 62. The consortium includes Agusta, Oto Melara, Breda Meccanica Bresciana, Officine Galileo, SMA, Elletronica, and Marconi Italiana, AW&ST, 8 September, 1986, 40.

114. "Tokyo Panel Backs 'Star Wars'", C. Haberman, New York Times, 24 April, 1986, A-4.

115. "Japan Study Group Endorses SDI", Military Space, 26 May, 1986, 6.

116. "Japan's SDI Participation", AW&ST, 15 September, 1986, 20. No formal agreement has yet been agreed but this is expected according to the US DOD.

Canadian policy on this matter was articulated by Prime Minister Brian Mulroney, who stated on 7 September, 1985 that

> after careful and detailed consideration the Government of Canada has concluded that Canada's own policies and priorities do not warrant a government-to-government effort in support of SDI research [although] private companies and institutions interested in participating in the programme will continue to be free to do so.[117]

Thus, none of the prospective Space Station partners have officially rejected participation in SDI research, approval being merely a question of degree. It is either wholehearted as in the case of the UK and West Germany, supportive with token reluctance exhibited by Italy and Japan, _de facto_ as with France, or, in Canada's case, implicit by abdication of official responsibility. Clearly, in our present day world realpolitik still governs.

Regarding the second element, reaction to the SDI association with the US/International Space Station, this centres around the interpretation of the phrase 'peaceful purposes' which will be discussed presently.[118]

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117. "Prime Minister's Statement Regarding the Strategic Defence Initiative", reproduced in _The Disarmament Bulletin_, Autumn 1985, 7.

118. See _infra_ this Chapter part B 3(c).

(b) The Soviet Union

Soviet reaction has been characterized in part by a reasoned critique of the US space-based anti-missile system (SBAMS) by a "Committee of Soviet Scientists for Peace, Against Nuclear Threat", headed by Dr. Roald Sagdayev.[119] Concluding an analysis based almost exclusively on Western sources, it is stated that

> [e]ven if Soviet–American relations improve in the forseeable future so much that the American side will be politically prepared to conclude mutually acceptable and equitable agreements on the limitation and reduction of strategic weapons, the existence of the tested and deployed components of SBAMS even on a limited scale may substantially complicate the progress of the talks and reduce the chances for a timely Soviet-American understanding.[120]

As this report was published in 1984, before the Soviet Union had publicly admitted it was carrying on military activities in space, the analysis only hints at Soviet space-based BMD activities in its prediction of arms control difficulties. Thus, the report states that if, following upon the experience with

> strategic offensive arms, the development

119. See "Space-Based Defences: A Soviet Study", which is an excerpted reproduction of the Soviet report, and appears in Survival, Vol. XXVII, No. 2, March/April 1985, 83.

120. Ibid., 90.

> of SBAMS in both nuclear powers is to go along different lines, [this] will increase even more the asymmetry of their strategic forces and make them even more difficult to compare. Asymmetry may prove even more considerable if we take into account potential anti-SBAMS systems and counter-anti-SBAMS systems being deployed....[121]

Less cogent reaction has come from the Soviet media, as exemplified by the following comment by Enver Mamedov of the Novosti press agency, who avers that

> [i]f rhetoric about a space "dome" that will allegedly save the American population from the nuclear hail is cast aside, it is clear that SDI amounts to an attempt to move the arms race to space, create a new weapon of enormous destructive power, and gain military supremacy over the Soviet Union.[122]

In view of admitted Soviet space-based strategic defence activities, this can be discounted as mere propaganda.

(c) Defining 'Peaceful Purposes'

This issue is proving to be as intractable in the space context as it has been in terrestrial milieux. There has been a ceaseless tide of doctrine on the subject which can be divided into two broad categories. Thus, on the one

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121. Ibid.

122. "Why Isn't Canada more active in search for peace?", E. Mamedov, The Gazette, Montreal, 10 February, 1987, B3.

hand it is argued that peaceful means non-military activities,[123] while on the other it is equated with non-

123. See for example M. Markoff, "The Juridical Meaning of the Term 'Peaceful' in the 1967 Space Treaty", 8 Diritto Aero 28 (1969) who argues that article 1(1) of the Outer Space Treaty (see supra Chapter IV G) "shuts out automatically from the fields of...lawful space activities all kinds of military action without exception. That is because no military activity can nowadays be envisaged as being carried out in the interest of all countries of the world. Clear enough, all military action in present international conditions may serve only the interest of one particular state, or a group of States"; see also M. Lachs, The Law of Outer Space (1972, Sijthoff) pp. 105-106 where it is argued in a discussion of Article IV of the Outer Space Treaty (see infra part C 1) that since the UN Charter forbids the threat or use of force against other nations (article 2(4), see supra this chapter part B 1(b))

> not only when directed against the territorial integrity or political independence of any State', but also when used or brandished 'in any other manner inconsistent with the purposes of the United Nations'.... Thus an attack or any other constraint against a ship, aircraft or any other vehicle moving in other dimensions, such as outer space, constitutes a violation of the law.... Had only this prohibition been contemplated, the additional words "for peaceful purposes" would have been redundant.

Other agreements cited in support of the non-military interpretation are the 1959 Antarctic Treaty (402 UNTS 71 OFS 1 December, 1959, ETF 13 June, 1961) which provides in article I(1) that "Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military manoeuvres, as well as the testing of any type of weapons". Furthermore, the Statute of the International Atomic Energy Agency (IAEA) (276 UNTS 3, 26 October, 1956, as amended to 1 June, 1973, TIAS 7668) authorizes the IAEA to "encourage and assist research on, and development and practical application of, aggressive actions.[124] Although consensus on what constitutes military activity is relatively easy to reach,

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atomic energy for peaceful uses throughout the world" (Article III A 1) and "[t]o establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose" (Article III A.5). This has been interpreted as equating peaceful with non-military, see M. Niciu, 'What is the Meaning of the Use of Cosmos Exclusively for Peaceful Purposes', in Proc's of the 17th Colloq. on the L. of Outer Space (hereinafter Colloq.), (1974, AIAA Publication) 224.

124. See A. Meyer, 'Interpretation of the Term 'Peaceful' in the Light of the Space Treaty', 18 Z.L.W. 28 (1969) where he argues that

> 'Peaceful' in the sense of the Charter of the United Nations and in classical international law is used in contradiction to 'aggressive'. Thus, any use of space which does not itself constitute an attack upon, or stress against, the territorial integrity and independence of another State, would be permissible. Therefore, according to this interpretation of the term 'peaceful' military manoeuvres in peace time, the use of reconnaissance satellites, the testing of weapons, the establishment of MOLS, etc... would be permissible in Outer Space, these activities being the so-called 'peaceful military activities'.

Support for this proposition comes from the American Bar Association who stated at the dawn of the Space Age that

> 'peaceful' in the sense of the Charter, and in international law generally is employed in contradistinction to 'aggressive'. Thus any use of space which did not itself contribute an attack upon, or threat against, the territorial integrity and independence of another state would be permissible. .... It is the opinion of the Committee that the only uses of space that are prohibited are those that fall within the prohibitions of the Charter,

there is considerable division regarding which activities are aggressive and which are non-aggressive.[125] US policy has been clear since the early days of the Space Age and has been summarized by Professor John Cobb Cooper in the following terms which remain unchanged:

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> and that until such time as a disarmament agreement dealing with space activities can be arrived at, the U.S. is fully justified in using space for non-aggressive military uses consistent with the terms of the Charter.

(Report of the Committee on Law of Outer Space - Recommendations 1959 ABA Symposium 1961, 571). For a comprehensive treatment of this issue see S.H. Lay and H. Taubenfeld, The Law Relating to Activities of Man in Space (1970, University of Chicago Press), pp. 97-102.

125. ASATs are generally interpreted as constituting an aggressive military use of space, see: E. Ulsamer, 'Space Command Setting the Course for the Future', Air Force Magazine Vol. 65 No. 8, August, 1982, 48; C.Q. Christol, 'Article IV of the 1967 Principles Treaty', 21st Colloq. (1978), 192, and E. Galloway, 'Space Law and Astronautics for Peace and Human Progress', ibid., 21st Colloq., 175. In addition the US MOL, military stations used as command posts for conducting strategic reconnaissance, satellite interception and bombing from space are all characterized as aggressive, see W.F. and H.F. Scott, 'Space: Are the Soviets Ahead?', Air Force Magazine Vol. 64 No. 3, March 1981, 84 et seq. Furthermore, fractional orbital bombardment systems are considered aggressive in their partial use of the outer space medium, see E. Ulsamer, 'Space - The Fourth Dimension', Air Force Magazine Vol. 65 No. 11, November, 1982, 102. The activities mentioned at the beginning of this chapter as constituting a definition of militarization are generally considered to be non-aggressive, see for example Christol, ibid., I. Brownlie, 'The Maintenance of International Peace and Security in Outer Space', 40 Brit. Yrbk of Int'l L. 1 (1964) and Meyer, ibid.

> While it may be true the term "peaceful use of outer space" in some earlier public statements might have led to the erroneous conclusion that the United States was committed to a policy which banned all military use, it is quite certain that no such policy ever existed.[126]

For many years, the Soviet Union denounced US military activity in outer space as being non-peaceful while denying that it was also conducting such activities.[127] However, as we have seen this policy has been revised recently, whether in response to the Glasnost (openness) methodology, or in final realization that its position was no longer either tenable or believed.

The latest manifestation of this issue has occurred with respect to the US/International Space Station. All of the Phase B Memoranda of Understanding[128] contain language to the effect that the Space Station will be used for

126. Op.cit. supra note 9, 424.

127. See Lay and Taubenfeld, op.cit. supra note 124.

128. See supra Chapter IIIA.

"peaceful purposes".[129] In the wake of the US Defence Department volte-face on military utilization of the Space Station as outlined above, there have been forceful assertions by the other partners regarding their policies on peaceful uses. Thus, Japanese officials have been reported as stating that it was their understanding that the "space station could be used only for peaceful purposes."[130] This is supported by the legal opinion of Professor Tadao Kuribayashi who has articulated Japan's position on the matter in the following manner:

> As early as 1969, a resolution was adopted at the National Diet, to the effect that the use of space objects and launching of

129. The NASA-ESA MOU states in article 1.2 that "[t]he ultimate objective of the activities described [therein] is to define the nature and content of the potential cooperation between the Parties in the development, operation and utilization of the Space Station System for <u>peaceful purposes</u> which will maximize the mutual benefits to be derived from such cooperation". The NASA-STA MOU contains a statement in its preamble that it envisages "a cooperative effort in manned space activities for peaceful purposes", which is amplified in article 2 where the Space Station is defined as "a multi-purpose, permanent facility for <u>peaceful purposes</u> in low-Earth orbit". The NASA-MOSST MOU provides in its preamble that

"[i]t is the intent of NASA and MOSST that this MOU will, if successful, lead to cooperation in the development, operation and utilization of the Space Station for <u>peaceful purposes consistent with international treaty obligations</u>". Emphasis added.

130. 'DOD worries halt station talks', <u>Space Business News</u>, 12 January, 1987, 6.

> rockets into outer space should be carried out exclusively for "peaceful purposes". This phrase has also been inserted in the Act regarding the National Space Development Agency of Japan. It is expected, therefore, that the future regime concerning space station activities should duly partake of the object and purpose of "peaceful use".[131] (Emphasis added)

Japanese objections to the SDI association with the space station[132] have been echoed by Canadian Secretary of State for External Affairs Joe Clark, who believes that this changes the entire complexion of the station project and may force a reconsideration of Canadian participation therein.[133]

The European response is complicated by the nature

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131. T. Kuribayashi, 'A Legal Framework for Space Station Activities', in Commercial Use of Space Stations - The Legal Framework of Transatlantic Cooperation (1986, DGLR publication) 63, 70, emphasis added. At the 81st Meeting of the American Society of International Law - Kaname Ikeda of the Japanese Embassy averred during discussion, in the Panel on the US/International Space Station - Aspects of Technology and Law, that it was Japan's position that peaceful means non-military. See the account by the present writer of this Panel in Proc's of the 81st Meeting Am. Soc. Int'l L. (1987) in press.

132. See 'Defense Decision to Use Space Station', op.cit. supra note 25, 24.

133. See 'Les manoeuvres autour du traité ABM', op.cit. supra note 43 where it is reported that "le ministre Clark a déclaré, vendredi, que s'il devait y avoir des changements sensibles dans l'utilisation de la station spatiale, le Canada devrait reconsidérer sa décision de participer à cette initiative".

of ESA, as an international organization.[134] The <u>ESA Convention</u>[135] provides in article II that the prime

> purpose of Agency shall be to provide for and promote, for <u>exclusively peaceful purposes</u>, cooperation among European States in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space applications systems....

ESA would unequivocally hold that its interpretation of "exclusively peaceful purposes" is directly proportional to their entirely civilian programme. However, ESA is founded upon a measure of technological and economic cooperation, which does not extend to uniform political integration. Thus, the national policies of its member States govern their participation in ESA-focused activities. It is submitted that, in view of the level of participation in the SDI programme by all major European nations interested in space activities, it would be erroneous reasoning to set up the ESA structure as an impediment. This applies equally to Japan and Canada. Whilst diplomatically unpalatable, past practice is not opposable to US plans unless accompanied by a complete withdrawal of participation in the SDI programme. It is too casuistical to pretend that governmental actions

134. See <u>supra</u> Chapter II B 4.

135. See <u>ibid.</u> and Chapter III B 3 for further information on this Convention.

can be divorced from those of its electorate, whether individual or corporate, for to do so is surely to countenance an ultra vires delegation of executive functions. Nevertheless, this does not excuse the current US position adopted in the phase C/D/E negotiations for the US/ International Space Station, whereby it is resisting the future involvement of the other partners in case-by-case decisions regarding what constitutes "peaceful uses" of the station during its operation.[136] If the USA trusts its allies enough to invite them to participate in the SDI programme, is not there a much lower level of trust required for a process whereby consensus decisions can be taken *in camera* by all the partners regarding mere "research" activities? However, the USA is simply following previous practice, which has proved acceptable to European nations, as exemplified by the *Spacelab Agreement*.[137] The latter provides in article 7D that

> [i]n order to assure the integrity of operation and management by the Government of the United States of America of the Space Shuttle system, this Government shall have full control over the first SL unit, after its delivery...*including the*

136. See 'U.S. Proposal Would Restrict European, Japanese Station Use', T.M. Foley, *AW&ST*, 16 February, 1987, 23, 24.

137. See *supra* Chapter III B 2(a) for further information on the Spacelab project.

> right to make final determination as to its use for peaceful purposes.

Although times have changed since this procurement project, they may not have changed enough to make the USA more flexible on this issue.

C. RELEVANT LEGAL CONTROLS ON MILITARY SPACE STATION ACTIVITIES

> Most official interpretations and negotiations relating to military activities in space are constrained by complicated policies of governments seeking to serve innumerable economic, ideological, political and military positions.[138]

1. ARTICLE IV OF THE OUTER SPACE TREATY

Estimating the scope of this article has provoked a considerable outpouring of doctrine since the Outer Space Treaty was promulgated in 1967.[139] There have been valiant juristic efforts to perfect the text of article

138. G. S. Robinson, 'Militarization and the Outer Space Treaty - Time for a Restatement of "Space Law"', Astronautics and Aeronautics, February 1978, 26, 29.

139. See Dr. M.L. Stojak, op.cit. supra note 46, pp. 184-198 for a definitive treatment of this issue through an exhaustive review of doctrine.

IV[140] by employing a treaty "intent and purpose" override derived from the preamble to the Outer Space Treaty[141] or

140. Article IV states as follows:-

> 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.
> The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

141. The preamble provides in part that States Parties to the Treaty

> Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes,
> Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,
> Desiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes ... [h]ave agreed on the following [treaty]. (emphasis added).

See A.A. Cocca, 'Discussion Paper on the Legal Aspects of the Present and Projected Military Uses of Outer Space', Space Law Committee, Int'l Law Assoc., in Report of the Sixty-First Conference, Paris, 1984, 356, 359, where it is stated that "[m]any of us who participated in the elaboration of the Space Treaty of 1967 expressed our deep disagreement on the text of Article IV, which was considered the most vulnerable part of the Treaty. In our view, the concept of partial demilitarization was not in accordance with article I thereof.[142] However, it can be stated with as much certainty as anything in space law that article IV has been authoritatively interpreted as establishing a regime of demilitarization and denuclearization of celestial bodies, but merely one of denuclearization of the outer space

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the inner spirit and inspiration of Space Law. On the other hand, it was not in harmony with the context of the Treaty. Just the contrary, it was opposed to the Preamble - the expression of [the] intents of the instrument - and also to specific provisions of other articles". See also Vlasic, op.cit. supra note 2, 174, where he states that "the cumulative effect of the directives contained in the preamble and in the operative part of the Treaty, more than any single specific stipulation in it, suggests convincingly that the present level of "defence" activities in space is contrary to the letter and the spirit of the document".

142. See M. Markoff, "Disarmament and 'Peaceful Purposes' Provisions in the 1967 Outer Space Treaty", 4 J.Space L. 3,17 (1976) who is of the opinion that "[i]t is Article I(1) and not Article IV, that fixes and determines the fundamental criterion of reference relating to the legal use of outer space. This criterion mandates the exploration and use of outer space in the interest of all states.... The 'soft law' of Article I(1) has been reinforced by the prohibitive rules of Article IV, which constitute a 'hard law' of duly specified and self-executing treaty obligations".

medium.[143] This was crafted deliberately during the drafting process and, according to Professor Bin Cheng,

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143. See B. Jasani & M. Lunderius, 'Peaceful Uses of Outer Space - Legal Fiction and Military Reality', 11 Bull. of Peace Proposals 57 (1980). This interpretation is further reinforced by three proposals in recent years to amend Article IV (see also infra Chapter VII C(b)). The first was made by Italy at the UN in March 1979 and advocates a protocol to amend the Outer Space Treaty, embodying an enumerative definition of "peaceful purposes" for activities in outer space. The protocol would prohibit inter alia "the launching into earth orbit or beyond of objects carrying weapons of mass destruction or any other types of devices designed for offensive purposes, the conduct of military manoeuvres, as well as the testing of any type of weapons" (ibid.). This was followed by a 1981 Soviet 'Draft Treaty on the prohibition of the stationing of weapons of any kind in outer space'. (UN Doc. A/36/192 Annex, 1, 11 November, 1981) which provided in article I(1) that

> States Parties undertake not to place in orbit around the earth objects carrying weapons of any kind, install such weapons on celestial bodies, or station such weapons in outer space in any other manner, including on reusable manned space vehicles of an existing type or of other types which States Parties may develop in the future.

This was replaced by a 1983 Soviet 'Draft Treaty on the Prohibition of the Use of Force in Outer Space and From Space Against the Earth' (UN Doc. A/38/194, 22 August, 1983) which includes on undertaking in article 2

> 1. Not to test or deploy by placing in orbit around the Earth or stationing on celestial bodies or in any other manner any space-based weapons for the destruction of objects on the Earth, in the atmosphere or in outer space...
> 3. Not to destroy, damage, disturb the normal functioning or change the flight trajectory of space objects of other States.
> 4. Not to test or create new anti-satellite systems and to destroy any anti-satellite systems that they may already have.
> 5. Not to test or use manned spacecraft for mili-

Writing shortly after the Outer Space Treaty was agreed upon,

> [t]he present position, therefore, is that outer space as such is militarily too important already to be demilitarized except as part of a general programme of disarmament. Both super-powers made it clear that any attempts within the context of the space treaty to demilitarize outer space would simply make the treaty as a whole unacceptable to them.[144]

(continued from previous page)
tary, including anti-satellite purposes. None of these would be necessitated had not Article IV been drafted with the clear lacuna in relation to the outer space medium. Furthermore, they were echoed in a 1983 Joint Resolution of the US House of Representatives (H.J. Res. 120, 2 February, 1983, 98th Congress, 1st sess.) which provides in its preamble that "an international agreement to prohibit the introduction of weapons of any kind into space is needed in order to avoid the financial, social, and human costs that could result from such an arms race". Section 1 of the Resolution instructed the President to resume bilateral talks with the Soviet Union to negotiate a "comprehensive treaty prohibiting"-

(1) The testing, production, deployment, or use of any space-based, air-based, or ground-based weapons system which is designed to damage, destroy, or interfere with the functioning of any spacecraft of any nation; and

(2) The stationing in orbit around the Earth, or any celestial body, or at any other location in outer space of any weapon which has been designed to inflict injury or cause any other form of damage on the Earth, in the atmosphere, or on objects placed in space.

Section 2 of the resolution clearly recognized that this is in order to extend the scope of Article IV of the Outer Space Treaty to include all space-based weapons.

144. B. Cheng, 'The 1967 Space Treaty', 95 J.Droit Int. 532, 604 (1968).

This applies more forcefully with every launch for military purposes and there have been hundreds since this comment was made in 1968.

Thus, whilst not quite a carte blanche, article IV, in the words of Professor Nicolas Matte, "practically represents a franchise, if not an invitation to use outer space for military purposes".[145] This renders a recent amendment to the NAS Act somewhat poignant. Thus, Section 107 of this Act states that

> [n]o civil space station...may be used to carry or place in orbit any nuclear weapon or any other weapon of mass destruction, to install any such weapon on any celestial body, or to station any such weapon in space in any manner. This civil space station may be used only for peaceful purposes.[146]

Not only is this superfluous in view of the fact that US-ratified treaties are the supreme law of its land[147] (and it has ratified the Outer Space Treaty) but also it adds nothing to the peaceful purposes debate.

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145. N.M. Matte, Aerospace Law (1969, The Carswell Co.) 299.

146. NASA Authorization Act P.L. 98-361, 16 July, 1984, 98 Stat. 426.

147. See supra Chapter II B(a).

2. THE ABM TREATY[148]

In view of the limited scope of article IV of the Outer Space Treaty, a consideration of the ABM Treaty in the space weaponization context is mandated. This is not only due to its being the only other ratified treaty which impinges upon this area (see Table V-1), but also because it is in danger of being interpreted into obsolescence or abrogated altogether.

(a) Relevant Treaty Provisions

The ABM Treaty was one of the most significant achievements of the first round of bilateral (US-Soviet) Strategic Arms Limitation Talks (SALT I). Its rationale was to severely curtail the ABM capability of both nations to ensure their mutual vulnerability (i.e. MAD). This was intended, as stated in the Preamble to the Treaty, to

> contribute to the creation of more favourable conditions for further negotiations on limiting strategic arms,...to achieve at the earliest possible date the cessation of the nuclear arms race and to take effective measures towards reductions in strategic arms, nuclear disarmament, and general and complete disarmament.

Article I contained the undertaking to "limit anti-ballistic

148. Op.cit. supra note 67.

TABLE V-1 TREATIES RESTRICTING SPACE ACTIVITIES

TREATY	BANS NUCLEAR DETONATION IN SPACE	BANS NUCLEAR WEAPONS AND WEAPONS OF MASS DESTRUCTION FROM EARTH ORBIT	BANS INTERFERENCE WITH NATIONAL TECHNICAL MEANS	BANS SPACE-BASED ABM SYSTEMS	BANS FRACTIONAL ORBIT BOMBARDMENT SYSTEM	BANS ALL WEAPONS FROM EARTH ORBIT	BANS INTERFERENCE WITH ALL SPACE OBJECTS OF OTHER PARTIES	BANS ASAT WEAPONS OF ALL TYPES	BANS USE OF MANNED SPACECRAFT FOR MILITARY PURPOSES
LIMITED TEST BAN (1963)	ART I								
OUTER SPACE TREATY (1967)		ART IV							
SALT I (1972)			ART V						
ABM (1972)			ART XII	ART V					
SALT II (1979)		ART IX	ART XV		ART VII&IX				
SOVIET DRAFT TREATY (1981)		ART I	ART IV			ART I	ART III		
SOVIET DRAFT TREATY (1983)		ART II	ART IV	ART II	ART II	ART II	ART II	ART II	ART II

(Shaded) CURRENTLY IN FORCE

Source : Nicholas L. Johnson The Soviet Year in Space - 1984 (1985, Teledyne Brown Engineering) 38.

missile systems" by restricting them to two specific areas in each party's territory as outlined in article III thereof.[149] An ABM system "to counter strategic missiles or their elements in flight trajectory" was defined in article II as "currently consisting of" ABM interceptor missiles, launchers and radars "constructed and deployed for an ABM role, or of a type tested in an ABM mode." The latter phrase has given rise to considerable difficulties and will be discussed in more detail presently.[150] The crux of the Treaty in this context is the undertaking in article V "not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land based."[151] In order to ensure compliance with the provisions of the Treaty, each party is permitted

149. Article III establishes the two areas as: a 150 mile ABM system deployment area with a radius centered on each party's capital; and within 150 miles radius of an ICBM silo. The Soviet Union deployed a system called Galosh around Moscow, but the USA decided that it would be politically unacceptable to only defend Washington while leaving the rest of the nation exposed. See Ballistic Missile Defense Technologies, U.S. Congress, Office of Technology Assessment, (OTA-SC-254, Washington, D.C.; US Government Printing Office, September 1985) pp. 45-64 for an overview of the history of BMD developments before and after SALT I.

150. See infra this chapter section C2(c).

151. Emphasis added. Thus, fixed land-based ABM systems are permitted though restricted by Article III.

to use "national technical means (NTMs) of verification", which include reconnaissance satellites. In addition, the latter are protected by a mutual undertaking "not to interfere with" NTMs.[152] In addition a Standing Consultative Commission is provided for in article XIII, to discuss and clarify disputes as they arise.[153] Although the Treaty is expressed to be of unlimited duration, article XV accords each party

> in exercising its national sovereignty... the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this

152. A detailed consideration of the legality of reconnaissance satellites is beyond the scope of this thesis; see however, for example, A.J. Young, Space Transportation Systems (1984, unpublished LL.M. Thesis, Institute of Air and Space Law, McGill University), pp. 187-213. This is then counterpointed by a legal analysis of the legality of ASATs, ibid. pp. 213-225. In the space station context, a reconnaissance function has been denied by former NASA Administrator James M. Beggs, who points out that though such a potential exists, "the first station planned will have an orbit of low inclination (28°) and will not pass over the Soviet Union", 'Britain Cold-Shoulders NASA's Salesman', New Scientist, 8 March, 1984, 5. Nevertheless, the station could still function in a crisis monitoring role in relation to terrestrial incidents which occur within its orbital purview.

153. See infra Chapter VI D2(d) where the SCC is applied to NPS safety regulation. The SCC meets semi-annually and has produced two classified Protocols to the ABM Treaty in 1974 and 1976 and a confidential Agreed Statement concerning "tested in an ABM mode" in 1978, see J.B. Rhinelander, 'US and Soviet Ballistic Missile Defence Programmes Implications for the 1972 ABM Treaty', Space Policy, May 1986, 138, 139.

> Treaty have jeopardized its supreme interests.

A six month notice period is provided for.

A number of Agreed Statements were initialled by both parties during the negotiations and are collateral to the Treaty. The most contentious in the present context, is Agreed Statement D, which states that the

> Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty.[154]

(b) The Traditional Interpretation Versus the Sofaer Restatement

The entire scope of the ABM Treaty has been called into question in the analysis thereof by the Legal Advisor to the US Department of State, Abraham D. Sofaer.[155] The

154. Article XIV merely provides that each Party "may propose amendments" to the Treaty. There is no requirement to agree upon them.

155. See his written Statement presented to the Subcommittee on Arms Control, International Security, and Science of the House Foreign Affairs Committee, 22 October, 1985, reproduced in Appendix A to A.B. Sherr 'Sound Legal Reasoning or Policy Expedient? The "New Interpretation" of the ABM Treaty', 11 Int'l Security 71, pp. 86-91 (1986-87).

latter was commissioned by the Reagan Administration to evaluate the consistency of SDI with the Treaty. After a review of the fragmented and classified negotiating record, Judge Sofaer concluded that the traditional interpretation of the Treaty was incorrect and that both the Senate which passed the Treaty and the negotiators thereof had been mistaken.[156] The three key provisions are articles II(1) and V(1) and Agreed Statement D, as outlined above. The traditional or "narrow" interpretation of these provisions rests on construing article II as a "functional definition" of an ABM system, whereby "anything ever conceived that could serve the function of countering strategic missiles in flight falls within the definition."[157] Thus, article V would forbid "development, testing or deployment of any future ABM systems and components other than those that are

156. Ibid., pp. 90 and 91, where he states that he "reached the firm conclusion that although the U.S. delegates continually sought to ban development and testing of non-land based systems or components based on future technology, the Soviets refused to go along, and no such agreement was reached". See, in contrast, 'Arms Control Protests Force Delay in Next Stage of SDI Research', P. Mann, AW&ST, 16 February, 1987, 17, 18, where Senator Sam Nunn (D-Ga), Chairman of the Senate Armed Services Committee is quoted as saying that he was "concerned that absent due consultation, a unilateral executive branch decision to disregard the interpretation of the treaty which the Senate believed it has approved when the accord was ratified in 1972 would provoke a constitutional confrontation of profound dimensions".

157. Ibid. Sofaer, 88.

fixed and land-based."[158] Furthermore, Agreed Statement D is interpreted as being "relevant only to fixed land-based systems and components".[159] Although the latter would permit the research and development of such land-based systems and components based on "other physical principles", they may not be deployed without agreement between the parties on specific limitations.[160] However, the Sofaer restatement challenges these assumptions by citing the existence of Agreed Statement D, which would be "superfluous" if the narrow interpretation were correct, and reads the Treaty as establishing

> a coherent, non-redundant scheme that prohibits: - the deployment of all fixed land-based systems and components derived from current technological principles, except as specifically permitted (Article III); - the development, testing, and deployment of all mobile systems and components derived from current technological principles (Article V(1)); and - the <u>deployment</u> of all forms of systems and components derived from "other" physical principles, until after agreement on specific limitations (Agreed Statement D).[161]

Thus, research is permitted, since both sides agreed that it

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158. *Ibid*. 87.

159. *Ibid*.

160. *Ibid*.

161. *Ibid*. 89.

could not be controlled by NTMs,[162] as would be development or testing of ABM Systems or components (including in space) based on future technology. The only prohibition would be that against the deployment of such systems.

Nevertheless, the Reagan Administration has decided to uphold the "narrow" interpretation, but considers that current and short term SDI testing does not contravene this, the debate shifting *inter alia* to what exactly comprises an "ABM system or component".[163] In particular, envisaged SBKKV testing in the upcoming Delta 181 mission, scheduled to occur before the 1988 US Presidential election,[164] has been seriously questioned in Congress as being a violation of the prohibition in the *ABM Treaty* against space-based

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162. See Rhinelander, *op.cit. supra* note 153 at 140 where he states that the *ABM Treaty* "does not place a limit on 'research' because the USA and USSR agreed at SALT I that prohibitions on research could not be verified by national technical means. The Treaty does not even refer to research, and there is no agreed interpretation distinguishing permitted research from prohibited types of deployment and testing".

163. See 'Exotic Tests Ahead for SDI', *Military Space*, 31 March, 1986, 1, and 'Budget Cuts Threaten Target Date for SDI Development Decision', B.M. Greeley Jr., *AW&ST*, 14 July, 1986, 115.

164. 'Mission Control', *Military Space*, 30 March, 1987, 1.

testing.[165]

(c) Compliance Diplomacy

The latest topics to emerge in the never-ending super-power dialogue on Treaty compliance, are the Soviet phased-array radar at Krasnoyarsk and the US Delta 180 mission. The USA alleges that since the Krasnoyarsk radar is located deep within the Soviet Union it violates article

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165. See 'Nunn Affirms 1972 ABM Pact, Finding Kinetic Tests Illegal', P. Mann, AW&ST, 16 March, 1987, 21. Senator Samuel Nunn (D. Ga) in a three part presentation to the US Senate [Congressional Record - Senate 11 (S. 2967 et seq.) 12 (S. 3090 et seq.) and 13 March, 1987 (S. 3171 et seq.)] countered the Sofaer Restatement, with a detailed review of the Senate debate in 1972 on the text of the ABM Treaty and his conclusions after a review of the classified negotiating record. Senator Nunn, the Chairman of the Senate Armed Services Committee, was of the opinion that:

> the treaty prohibits the development and testing of mobile/space-based ABMs using exotics. I also concluded that the Senate clearly understood this to be the case at the time it gave its advice and consent to the treaty, and that the evidence is compelling beyond reasonable doubt.... Based on the information provided to the Senate to date by the State Department, I found no evidence which contradicted the Senate's original understanding of the meaning of the treaty. On the contrary, I noted that successive administrations, including the Reagan administration, had prior to 1985 consistently indicated that the treaty banned the development and testing of mobile/space-based ABMs using exotics.

Ibid. Congressional Record - Senate, 13 March, 1987, S. 3171.

VI(b) of the ABM Treaty which contains the undertaking "not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward" (emphasis added).[166] This is countered by the Soviet Union which considers the US PAVE PAWS radars to be similar violations.[167] Furthermore, the USSR has registered complaints with the Standing Consultative Commission

166. See 'The President's Report to the Congress on Soviet Non Compliance With Arms Control Agreements: Fact Sheet', 23 January, 1984, reproduced in Survival Vol. XXVI No. 3, May/June, 1984, 127, 128; see also 'The President's Unclassified Report to the Congress on Soviet Noncompliance with Arms Control Agreements', 1 February, 1985, The White House, Office of the Press Secretary, 11, where it is stated that

> the U.S. Government judges, on the basis of evidence which continued to be available through 1984, that the new large phased array radar under construction at Krasnoyarsk constitutes a violation of legal obligations under the [ABM Treaty] in that in its associated siting, orientation, and capability, it is prohibited by this Treaty. Continuing construction, and the absence of credible alternative explanations, have reinforced our assessment of its purpose. Despite U.S. requests, no corrective action has been taken.

This is repeated in the 1986 edition of Soviet Military Power, op.cit., supra note 87, 45.

167. See 'Soviet Aide-Memoire to USA', 29 January, 1984, in Survival, ibid., 129, 131.

regarding the Delta 180 test, discussed above.[168] In particular, they allege that the manoeuvring of the Delta third stage to intercept the second stage was space-based testing "in an ABM mode" of ABM systems or components.[169] This would be contrary to article VI of the ABM Treaty whereby the parties undertook

> not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode.

This may be supported by a unilateral statement of the US delegation on 7 April, 1972, to the effect that it

> would consider a launcher, missile or radar to be "tested in an ABM mode" if, for example, any of the following events occur: (1) a launcher is used to launch an ABM interceptor missile, (2) an interceptor missile is flight tested against a target vehicle which has a flight trajectory with characteristics of a strategic ballistic missile flight trajectory, or is flight tested in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range, or is flight tested to an altitude inconsistent with interception of targets against which air defenses are deployed.[170]

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168. 'Administration Denies Soviet SDI Complaints', SDI Monitor, 2 March, 1987, 59, 60.

169. Ibid.

170. A series of unilateral statements are printed in the West together with a number of 'Common Understandings' as collateral to the ABM Treaty.

However, the position is by no means clear, and the Soviet interpretation is denied by the US Arms Control and Disarmament Agency.[171]

There are clearly more than enough ambiguities to prevent either party being unduly fettered by the ABM Treaty. Thus, according to arms control analyst John B. Rhinelander,

> [c]olourable legal justifications can be made by each side for its programmes, but there are reasons for concern over the activities of both sides. Each tends to interpret the ABM Treaty strictly with respect to the other's programmes, but permissibly for its own. Present actions of each, coupled with a failure to enhance the ABM Treaty, will serve to undermine the Treaty.[172]

(d) Some Proposed Amendments to the Treaty and Future Negotiating Strategies

In order to clarify the applicability and utility of the ABM Treaty in the Space Stations' Era, a number of amendments have been suggested. The aforementioned Mr. Rhinelander advocates four amendments[173] which would:

- "prohibit the development, testing and

171. Op.cit. supra note 168.

172. Op.cit. supra note 153, 148.

173. Ibid., pp. 139 and 149.

deployment of fixed, land-based exo-atmospheric ABM systems and components" together with a collateral treaty prohibiting ASAT weapons;

- "prohibit the development of anti-tactical ballistic missile (ATBM) systems;"

- "prohibit the deployment of any additional LPARs" (Large phased-array radars); and

- "provide for a five-year notice of withdrawal" to replace the existing six-month notice period.

In contrast, Zbigniew Brzezinski, President Carter's national security advisor, recommends the abandonment of the ABM Treaty and the deployment of a limited space-based and land-based ABM defence, while holding the number of US offensive ICBMs below that required to hit all Soviet targets in a first strike.[174] This strategy is at variance with that of former Defence Secretary Harold Brown who favours the retention of the ABM Treaty while SDI research continues.[175] However, he suggests that US goals during ongoing arms control negotiations should be "to reduce the level of strategic offensive forces and promote the survivability of the force postures on both sides" while seeking "to ban weapons in space [and] reaffirming the leg-

174. 'Brzezinski, in a Book, is Offering New U.S. Strategy Toward Soviet', D.K. Shipler, New York Times, 17 June, 1986, A6.

175. Op.cit. supra note 65, pp. 62-63.

itimacy of non-weapon space-based systems, such as satellites for early warning, surveillance and communications."[176]

The latest Presidential National Security Decision Directive instructs US arms negotiators at Geneva "not to negotiate or even discuss limits on defensive systems that would be more restrictive" than the Sofaer restatement.[177] The debate continues.

D. ALTERNATIVES TO THE INEVITABLE - POLICING THE HIGH GROUND

> Over the beneficial effects of the opening up of outer space, the extension to it of the armaments race hangs like an ominous shadow.[178]

In order to perfect the existing unsatisfactory situation, a number of international legislative steps, in addition to those outlined in the previous section, have been advocated. Thus, Professor Hamilton DeSaussure suggests that the regime established in the 1959 Antarctic

176. Ibid. 64.

177. 'Reagan Reported to Limit Debate at Geneva Talks', M.G. Gordon, New York Times, 22 February, 1987, A1.

178. Lachs, op.cit. supra note 123, 105.

Treaty[179] should be applied to manned space stations.[180] This would accord Contracting Parties to a future multilateral agreement on space stations the "right to designate observers to carry out inspections...[of]...all stations, installations and equipment."[181] This would be an extension to the outer space medium of article XII of the Outer Space Treaty which provides that

> [a]ll stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.[182]

However, such "on-site inspection" has been strongly resist-

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179. Ibid. note 123.

180. H. DeSaussure, 'The Impact of Manned Space Stations On the Law of Outer Space', 21 San Diego L.Rev. 985, 1007 (1984).

181. Antartic Treaty article VII.

182. Emphasis added.

ed in the past in terrestrial milieux[183] and in view of both existing transfer of technology restrictions and the dictates of military secrecy, this will undoubtedly prove unpalatable to the super-powers.

It is submitted that, in view of the dismal record of space arms control, the treaty approach is highly suspect. There can be no doubt that there are myriad military concepts in progress and planned by both super-powers to add to their existing instrumentalities. If this continues and they are realized, they will cumulatively result in a plethora of military space-based systems far outnumbering civilian ones. The Space Stations' Era will therefore be dominated by militarization and weaponization as has every other era of man's development. This is inevitable, unless the military industrial complex in the

183. See however, 'New Yorkers Sign Soviet Test Pact', P. Taubman, New York Times, 29 May, 1986, A3, where it is reported that the Soviet Union suggested that it would be prepared to permit "American non-governmental scientists to staff stations in the Soviet Union to monitor underground nuclear tests". See also 'Inspect New Satellites for hidden arms, Soviets Say', The Gazette, Montreal, 18 March, 1987, H7, where Soviet arms control negotiator Yuri Nazarkin proposed to the Geneva Conference on Disarmament that a new international agency be established "to make on-the-spot inspections of satellites before launch to ensure that no country deploys weapons in outer space.... It would be given access to the launching sites of all objects designed to be launched and stationed in outer space". In view of past conduct, this is undoubtedly a propaganda ploy to counterpoint US SDI developments.

USA and the vested interests of the defence elite in the USSR can be overriden. As we have seen, language employed in arms control treaties variously: restricts the weapons neither super-power wishes to use or desires to develop (the Limited Test Ban Treaty);[184] is interpreted in such a manner as to render its restrictions impotent (the ABM Treaty); or is deliberately drafted to constitute the absolute minimum impediment to military activities (the Outer Space Treaty). Arms control should not be approached like a business deal, where the maximum benefits (security) are sought for the minimum expenditure (dismantling or limiting existing systems or agreeing not to develop new systems) and the currency is military hardware. Keen bargaining is of course necessary, but this will never be successful unless and until the negotiators have a mandate which is not dictated to a large extent by self-serving jingoistic beliefs in each other's imperialistic ends, fostered by those who stand to gain the most, i.e. the defence industry in the USA and those involved in maintaining the momentum of the Soviet war machine. However, this is so fundamental a departure from present practice that it may well be impossible, certainly if it is left to the super-powers themselves. It is this writer's belief that

184. Op.cit. supra note 63.

only through a democratization of the space milieu through expanded civilian participation by ever more nations can a powerful enough voice of sanity make itself heard demanding a surcease. Thus, the international community of nations will police each other's conduct through their representatives in space, ensuring that weapons are controlled and, hopefully, eliminated from the space milieu.[185] Until this materializes, the status quo will obtain with all the considerable tenacity inherent in realpolitik. Strong defence is of course mandatory in the world of today as in any other age but, if we are ever to progress as a species and channel our human aggression towards worthwhile ends, a start must be made with the, as yet, relatively unsullied outer space milieu. If this is not done, we will have simply ignored the lessons of history and in so doing repeat it. Despite all the superficial indicia of progress, this cyclical truth is the real measure of mankind, and it indicates stasis. In the meantime, research (at least) continues toward space weaponization. This is a race markedly different from any other yet run in the competitive space milieu. Let us hope that space democratization will outmatch space weaponization, for international legislation must be considered a non-starter.

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185. Space democratization is discussed in more detail infra Chapter VIII.

VI. LEGAL AND TECHNO-POLITICAL IMPLICATIONS OF THE USE OF NUCLEAR POWER SOURCES IN OUTER SPACE

Nuclear power is, and properly managed will continue to be, an increasingly widely used source of energy. For each country, the maintenance of safety and security is an international responsibility. And, each country bears full responsibility for the safety of the design, manufacture, operations and maintenance of its installations.[1]

G7

A. INTRODUCTION

There are few issues which can rival nuclear power in its emotivity. There appears to be little vacillation associated with it, vocal decisiveness, either for or against, is the norm. The catalogue of incidents where its use in the terrestrial environment has gone awry is not

1. Statement adopted at the 5 May, 1986 Tokyo Summit meeting of G7 in "Texts of the Statements Adopted by Leaders of 7 Industrial Democracies", New York Times, 6 May, 1986, A 12. G7 comprises: Canada, France, F.R.G., Italy, Japan, U.K. and USA.

inconsiderable,[2] though hardly as grim a record as some would have predicted. The use of nuclear power sources (NPSs) in outer space is no less provocative, its latency perhaps having the potential to eclipse the relative furore caused by its terrestrial use. This applies *a fortiori* in the Space Stations' Era, with its inherent expansion of manned activity in Low Earth Orbit (LEO), the chief orbit for most current and projected NPS utilization. Indeed, this development renders more urgent the current search for answers to the problems precipitated by the use of NPSs in outer space. This chapter shall attempt to evaluate the present climate of informed opinion on this issue and, where appropriate, subjective conclusions will be given *in extenso*.

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2. See "Nuclear Mishaps: Record Since '57" in *New York Times*, 29 April, 1986, A 11, which records the 16 known incidents prior to the recent Chernobyl accident disclosed by the Soviet Union on 28 April, 1986. Notable events include: a fire at Windscale near Liverpool, England on 7 October, 1957; the infamous Three Mile Island débâcle on 28 March, 1979 in Pennsylvania, USA; and exposure of fishermen in Tsuruga, Japan, to radioactive material on 25 April, 1981.

B. TECHNOLOGICAL PERSPECTIVES

1. PAST ACTIVITIES

(a) USA

Eighteen months prior to the Soviet launch of Sputnik, the harbinger of the space age,[3] the US Atomic Energy Commission (AEC) had already contracted with several US companies for the design and fabrication of an NPS for use in outer space.[4] It was not until June 1961, however, that the first US NPS was orbited successfully.[5]

The US launch record, with regard to NPS satellites, has been reasonably good, with three notable excep-

3. 4 October, 1957.

4. See B. Raab, "Unique Features and Spacecraft Applications of Dynamic Isotope Power Systems", 6 Journal of Energy 20 (1982), wherein it is stated that in March 1956 the AEC contractors were Martin Company, Baltimore and Thompson Products, Cleveland.

5. The US Navy TRANSIT 4-A satellite was powered by a SNAP (System for Nuclear Auxiliary Power) 3. This was the first of several incarnations of the SNAP system; see further, UN Doc. A/AC.105/L.102, 15 March, 1978, "Uses of Radio-active (Nuclear) Materials by the United States of America for Space Power Generation", Working Paper submitted by the USA to the Committee on the Peaceful Uses of Outer Space (COPUOS) p. 1 & Attachment 5.

tions occurring at regular intervals throughout the programme. On 21 April, 1964, a Department of Defense (DOD) TRANSIT-5BN-3 Navigational Satellite failed to sustain orbit, resulting in a premature re-entry and burn up over the Indian Ocean.[6] A considerable amount of plutonium (Pu) 238, deadly when inhaled, was released into the upper atmosphere, resulting in a three-fold increase of Pu^{238} contamination in the Southern Hemisphere by the early 1970s.[7]

Four years later,[8] a NIMBUS-B-1 weather satellite had to be destroyed by remote control due to a failure of its booster's guidance system on launch. However, the NPS was recovered intact from the Santa Barbara Channel off California and the fuel reused.[9]

It was during the Apollo programme, however, that the most widely known event occurred. The Apollo 13 lunar landing abort and hazardous circumlunar flight back to earth in April 1970, had a highly significant conclusion in the

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6. Ibid., Attachment 5, pp. 4-5, SNAP 9A power source.

7. W.J. Broad, "Fallout from Nuclear Power in Space", 219 Science 38, 39 (1983).

8. 18 May, 1968, SNAP 19 power source, containing 34,400 Curies (units of radioactivity) Pu^{238}.

9. Op.cit., supra, note 5.

present context. Amidst the euphoria of the successful recovery of the three astronauts, the NPS-powered Lunar Landing Module, which had sustained them, was lost off the Fiji Islands near the Tonga Trench in the Pacific Ocean.[10] It is estimated that the Pu^{238} powered NPS will remain intact for some 860 years.[11]

Whilst all the above-mentioned NPS systems were radio-isotopic thermoelectric generators (RTGs)[12] the USA also experimented with nuclear reactors, orbiting one

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10. Ibid., Attachment 5, p. 8. The Apollo 13 Lunar Landing Module was powered by SNAP-27 containing 44,500 Curies of Pu^{238}.

11. Op.cit., supra, note 7. Pu^{238} has an 87.7 year radioactive half-life, [see infra, footnote 14 for this term] if no damage occurs to the SNAP-27 unit on the ocean bed, it should pose no danger.

12. RTGs used to date incorporate Pu^{238} whose natural decay releases heat which is converted directly into electricity by strips of heat-sensitive metal called thermoelectric generators, see W.J. Broad, "Nuclear Power for Militarization of Space" 218 Science 1199 (1982).

successfully in 1965.[13] Entitled the SNAPSHOT Mission, the SNAP 10A nuclear reactor was powered by 4.5 kgs of Uranium (U) 235 and operated successfully for 43 days.[14] It remains in a 4000 year orbit, after which time it will re-enter the Earth's atmosphere having lost most of its

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13. Unlike RTGs, fission reactors heat water or some other fluid which rotates a turbine which powers a generator so producing electricity. The fuel most often used is enriched U^{235}, i.e. since naturally occurring U^{238}, which is less fissile, only contains 0.7% of U^{235}, the amount of U^{235} is artificially increased to approximately 2-4% to enable fission to be sustained by chain reaction, see further Nuclear Fuels Policy, Report of the Atlantic Councils Nuclear Fuels Policy Working Group (1976 Westview Press), pp. 24-26. Regarding the fission process itself whereby the now unstable enriched U^{235} is bombarded with neutrons which it captures and so releases energy, alpha rays and other neutrons to perpetuate the process; see S. Glasstone, Sourcebook on Atomic Energy (1950 D. Van Nostrand Co. Inc.), pp. 344-364 and P.C.W. Davies, The Forces of Nature (1979, Cambridge University Press), pp. 93-112.

14. The radioactive half life of U^{235} is 7.07×10^8 yrs while that of U^{238} is 4.5×10^{10} yrs i.e. the age of Earth itself, see ibid., Glasstone, pp. 120-129 for further information on radioactive disintegration. The half life of an element is the time required for the radioactivity of a given amount of the element to decay to half its initial value. Thus in the case of U^{238}, "each nucleus has a 50-50 chance of decaying in about 4.5 billion years, so on average, about half the nuclei in a lump of Uranium will have disintegrated after that duration. Of the surviving 50%, one half of that will decay after another 4.5 billion years, and so on." Davies, ibid., p. 97.

radioactivity.[15]

(b) USSR

For obvious reasons, no official records exist in the public domain relating to the Soviet NPS programme prior to 1978. However, western analysts estimate that 20 to 30 nuclear powered Kosmos satellites have been launched since 1967, at a current and projected rate of between 2 and 4 per year.[16] 1978 marked a turning point in both specific awareness of the Soviet programme and general awareness of all NPS activities in outer space. The event which precipitated interest in this area was the infamous Kosmos 954 incident.

Launched on 18 September, 1977, Kosmos 954 was

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15. Op.cit., supra, note 12. Note, unlike a Pu^{238} fueled RTG which is radioactive at all times once manufactured, including prior to launch, a reactor can be started up and shut down by remote control and so rendered more stable. Of course, once started, the reactor will remain radioactive, even after shut-down, until its nuclear fuel decays to a benign form. See M. Benkö, W. De Graff and G.C.M. Reijnen, Space Law in the United Nations (1985, Martinus Nijhoff Publishers) pp. 66-67.

16. Ibid., p. 62. See also "Cosmos Reentry Spurs Nuclear Waste Debate", Aviation Week and Space Technology (AW & ST) 30 January, 1978, p. 33, where the figure for Soviet reactor launches is given at 16 since 27 December, 1967.

described euphemistically by the Soviet Union as carrying "scientific apparatus, [a] radio system for precise measurements of orbital elements and [a] radio-telemetry system."[17] However, there is wide consensus among western experts that 954 was in fact: one of a series of electronic intelligence (ELINT) satellites;[18] designed specifically for ocean surveillance;[19] that it weighed 5000 kg;[20] and contained some 55 kg of enriched U^{235} in its TOPAZ thermionic nuclear reactor.[21] For some

17. UN Doc. A/AC.105/INF.368, 22 November, 1977, information supplied to the UN Secretary General pursuant to Article IV of the 1975 "Convention on Registration of Objects Launched into Outer Space" 28 U.S.T. 695, opened for signature (hereinafter OFS) 14 January, 1975, entered into force (hereinafter EIF) 15 September, 1976.

18. N.L. Johnson, The Soviet Year in Space: 1983 (1984, Teledyne Brown Engineering), p. 31 et seq.

19. Ibid. See also Soviet Military Power (2nd Ed., 1983), p. 69, US Department of Defense publication.

20. "Cosmos Debris Examined in Canada", AW & ST, 6 Feb. 1978, 22, 23.

21. Op.cit., supra, notes 16 and 18.

still unconfirmed reason,[22] Kosmos 954 became uncontrollable and re-entered the atmosphere prematurely without having jettisoned its NPS for transfer to a higher orbit.[23] As is well known, radioactive debris was scattered over Northern Canada, necessitating costly neutralization.[24]

After a short hiatus, the Soviet nuclear-powered ocean surveillance programme resumed successful operation until the 7 February, 1983 re-entry of the Kosmos 1402

22. Whether it was due to collision with man made orbital debris or a meteorite is still unknown, though the Soviet hypothesis of such a sudden catastrophic failure was questioned by western space monitors who were aware of K 954's irregular behaviour long before its 6 January, 1978 recorded failure, see "Intensive Analysis Under Way on Cosmos Debris in Canada", AW & ST 13 February, 1978, 22, 23.

23. A remote controlled separation was to have taken place whereby the non-nuclear portion of the satellite would re-enter and burn up in the upper atmosphere, whereas the NPS would be manoeuvred to an 800-1000 km orbit.

24. For a technical account of the search for K 954, see Q. Bristow, "The Application of Airborne Gamma-Ray Spectrometry in the Search for Radioactive Debris from the Russian satellite Cosmos 954 (Operation "Morning Light")", Current Research, Part B, Geol. Surv. Can., Paper 78-1B, pp. 151-162, 1978.

reactor core.[25] This followed a repetition of the Kosmos 954 failure with the more fortunate conclusion of a High Seas impact in the South Atlantic.[26] Again, after a short hiatus, the programme continued with successful reactor separation and boosting to higher orbits occurring with Kosmos 1579 in September 1984[27] and Kosmos 1607 in February 1985.[28]

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25. For an account of the tracking of the two radio-active segments of K 1402 after separation, see UN Doc. A/AC.105/C.2/L.138, 23 March 1983, Working Paper of the Federal Republic of Germany.

26. Johnson, op.cit., supra, note 18 at 32, the reactor housing had re-entered on 24 January, 1983 over the Indian Ocean, following an initial re-entry of a third non-nuclear segment on 30 December, 1982. This marked a variation introduced after K 954, whereby the reactor core was separated from its housing when it appeared that the NPS could not be elevated to a higher orbit in toto at the conclusion of the satellite's mission. This separation ostensibly facilitates burn-up on re-entry with less fuel reaching the Earth's surface intact. See C. Covault, "U.S. Assesses Hazard of Cosmos Fuel", AW & ST, 31 January, 1983, 20.

27. N.L. Johnson, The Soviet Year in Space: 1984 (1985, Teledyne Brown Engineering), p. 33.

28. N.L. Johnson, The Soviet Year in Space: 1985 (1986, Teledyne Brown Engineering), p. 40.

2. PRESENT DECISIONS AND FUTURE DIRECTIONS

It is apparent that the Soviet NPS programme is continuing with the assiduity that has come to be associated with their space programme as a whole, and shows no sign of either abating or accelerating dramatically in the near future. However, towards the turn of the century, there is a distinct possibility that a follow-on MIR Soviet Space Station will utilize an NPS. This could be dictated by the power requirements of such a station, having both dimensions and capabilities considerably greater than its predecessor.[29]

In the USA, with its more spasmodic approach to space activities,[30] the future is less certain. Nevertheless, a number of significant decisions have been made recently which impact upon this area.

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29. See "Soviet MIR Stirs More Concern", Space Business News, 3 November, 1986, 1, 8.

30. See N.M. Matte, Space Policy and Programmes Today and Tomorrow (1980, The Carswell Company Ltd.), pp. 23-33 for an overview of the contrasting methodologies of the US and Soviet space programmes.

(a) The Centaur Upper Stage

Developed for use with the Shuttle Transportation System (STS),[31] the Centaur upper stage was to be attached to a satellite and placed within an STS payload bay. Upon reaching LEO, the satellite/Centaur package would be deployed on orbit from the STS bay via CANADARM,[32] whereupon the Centaur would be ignited taking the satellite to its desired higher orbit or on an interplanetary trajectory as desired. The first candidate for use with the Centaur was the NASA Galileo Jupiter probe, to be launched aboard the Shuttle Atlantis in May 1986.[33] This was to be followed within the year by the European Space Agency's (ESA's) Ulysses solar-polar satellite.[34] Both Galileo and Ulysses are powered by Pu^{238} 300W RTG's. Concern over the hazardous nature of a Shuttle launch of these NPSs was exacerbated by the volatile nature of the liquid-fueled

31. See A.J. Young, Space Transportation Systems, (1984, 341ff, unpublished LL.M. Thesis, McGill University), pp. 85-90 for an overview of STS upper stages including Centaur.

32. Ibid., p. 84.

33. Washington Roundup, AW & ST 3 March, 1986, 13.

34. "Radioisotope-Powered Payloads May Need Additional Shielding for Shuttle Launch", AW & ST, 21 January, 1985, 80, see supra, Chapter II B I(c) for the legal basis for the ISPM project.

Centaur, described by one source as a "huge bomb".[35]

The tragic demise of Challenger mission 51-L on 28 January, 1986 precipitated a major safety review of the entire US Space programme including the Centaur. Due to the perception that the probability of a catastrophic accident involving the Centaur was now unacceptably high, the programme was cancelled in June 1986.[36] Whilst, as we have seen, ~~RTG's are~~ highly robust,[37] it was thought that, in the "worst-case scenario" of a shuttle/Centaur explosion at Kennedy Space Centre, there was an unconscionable risk of Pu^{238} release through rupture of the RTG housing.[38] In the opinion of one commentator, such an eventuality "could double the entire worldwide burden of plutonium in the atmosphere",[39] irrespective of its local

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35. Space Commerce Bulletin, 9 May, 1986, 10.

36. NASA Drops Plans to Launch Rocket from the Shuttle" New York Times, 23 June, 1986, A1.

37. See supra, the account of the Nimbus-B-1 weather satellite, footnote 9 and accompanying text.

38. "Nuclear Debris Could be Released in Shuttle/Centaur Explosion", AW & ST 10 March, 1986, 288.

39. Comments by Robert K. Weatherwax, author of a USAF sponsored study on Shuttle reliability, as quoted in "Officials Disagree on Data Assessing Shuttle Reliability" AW & ST, 17 February, 1986, 24, 25.

impact on Eastern Florida.

(b) **US/International Space Station Power Requirements**

NASA has estimated that the Initial Operating Capability (IOC) space station,[40] which should be realized in the mid 1990s, will require between 75 and 100 kW of power.[41] If space commercialization materializes as anticipated,[42] power needs would rise to at least 300 kW.[43] Several means of power generation were assessed, the choice being between chemical, solar or nuclear. Chemical energy was rejected immediately, since it required equipment that was too heavy and bulky for efficient place-

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40. See supra, Chapter I B 1(b)(i).

41. A.K. Marsh, "NASA Studies Power System for Station" AW & ST 21 January, 1985, 79, 80.

42. See supra, Chapter IV A.

43. A comprehensive review of space commercialization is beyond the scope of this thesis, see however, International Cooperation and Competition in Civilian Space Activities (1985, US Office of Technology Assessment (OTA) publication 472 ff), pp. 337-367 for an excellent overview of the nascent materials processing in space (MPS) industry, see also Ibid, Chapter IV A for a brief introduction and highlights of the MPS industry in the context of the US/International Space Station.

ment into orbit.[44] . The decision between solar and nuclear power was less easy to make, a function of the reason NPSs are used in space already, despite their negative connotations and the apparent abundance of solar energy.

NPSs have certain advantages over their solar counterparts, other than the obvious one in utilization for interplanetary missions away from the sun where the latter's radiation is too weak for energy production. Thus, they have

> the ability to fly in any orbit without modification, the ability to configure and to orient the spacecraft in much closer conformance with mission requirements, and the ability to eliminate flexible appendages and moving mechanical assemblies which are common to a large number of solar-powered spacecraft.[45]

Large solar arrays are: subject to atmospheric drag;[46]

44. S.W. Kandebo, "Grumman Evaluates Space Station Thermal Control and Power Systems", AW & ST 2 September, 1985, 56.

45. Raab, op.cit., supra, note 4 at 23.

46. "AEG Tests New Materials for Space Station Solar Array", AW & ST 18 November, 1985, 97, 98, even in Low Earth Orbit, the large surface area of the array interacts with the light atmosphere causing drag.

vulnerable to impact from orbital debris;[47] as a function of the two previous factors, more costly in station-keeping propellants;[48] and are shorter-lived, subject to a high number of thermal cycles per year in LEO.[49]

However, concerns over weight difficulties associated with effective shielding, together with potential health hazards in a man-rated system, militated against NPS incorporation within the IOC infrastructure itself.[50] Nevertheless, its potential use as a flexible power system for a reusable Orbital Transfer Vehicle (OTV) is still under

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47. Approximately 20,000 sq. ft., or half an acre of solar panels are required to generate 75 kW of power alone, the larger the surface area of an object, the greater its chances of collision with the approx. 5000 pieces of orbiting debris in LEO at any one time. See "Station Likely to be Hit by Debris" AW & ST 17 September, 1984, 16; N.L. Johnson, "The Crowded Sky" 24 Spaceflight, December 1983, 446; and A. Thomson, "Space Debris - A Growing Hazard", 25 Spaceflight, January 1983, 18.

48. "NASA Projects Potential Nuclear Missions" Space Business News, 10 September, 1984, 4, 5.

49. "A thermal cycle occurs when a satellite moves from sunlight into shadow and back again", op.cit., supra, note 46. The constant expansion and contraction which this procedure induces causes considerable stress on the delicate components of a solar array. The Space Station array would encounter some 60,000 thermal cycles over 10 years. Furthermore, this penumbra effect requires the use of back-up power systems which are independent of the sun.

50. Kandebo, op.cit., supra, note 44.

consideration.[51] The OTV will be indispensable to efficient space station operations,[52] inter alia transporting satellites from LEO to geostationary and lunar orbits, and vice versa for refurbishment in the IOC-integral Canadian Mobile Servicing Centre.[53]

(c) The Strategic Defense Initiative (SDI)[54]

Should the OTV incorporate an NPS, the latter will almost certainly be derived from the SP-100 programme currently being conducted jointly by the SDI Organization,

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51. See M.A. Dornheim, "Space-Based Nuclear Power Projects Near Critical Juncture", AW & ST 27 January, 1986, 89. See also "France Defines Space-Based Nuclear Power Generator", AW & ST 3 March, 1986, 74 where it is stated that Centre Nationale d'Etudes Spatiale (CNES) (the French Space Agency) has developed plans for a nuclear power generator to drive an OTV and, potentially, a future European space station.

52. Civilian Space Stations and the U.S. Future in Space, (1984, OTA publication 234ff), 56 et seq.

53. See: W.H. Gregory, "Canada Redesigns Proposed Station Servicing Facility", AW & ST 17 March, 1986, 61; "$1-Billion Tab For Our Space-Station Garage", The Gazette, Montreal, 19 March, 1986, B-1, see supra, Chapter I B 4(b).

54. For further information on the SDI project, see supra, Chapter V, passim.

the Department of Energy (DOE) and NASA.[55] Formerly a joint DOD,[56] DOE and NASA project formally established in February 1983,[57] the accession of the SDIO occurred in October 1984.[58] The SP-100 programme evaluation of three competing nuclear technologies[59] sought the one with the greatest potential for efficient production of a minimum of 100 kW of electrical power on orbit for up to 10 years.[60] Thermoelectric conversion was selected for continued research,[61] and represents a revival of the SNAP IOA

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55. Op.cit., supra, note 51. See also 'Space Nukes May Power Space Radars', Military Space, 30 March,1987,4.

56. Through its Defense Advanced Research Projects Agency (DARPA).

57. P.J. Klass, "Agencies Agree on Space Power Effort", AW & ST, 21 February, 1983, 22.

58. "Space Power Project Moves to SDI Office" AW & ST, 29 October, 1984, 19.

59. Ibid., Thermoelectric conversion - General Electric Company contractor; Thermionic Conversion - GA Technologies, Inc. & Martin Marietta contractors; and the Stirling Engine cycle - Rockwell International contractor.

60. P.J. Klass, "Defense, Energy Departments to Initiate New Space Power Development", AW & ST, 4 February, 1985, 89.

61. "Space Power System", AW & ST, 12 August, 1985, 21.

technology used in 1965 as discussed *supra*.[62] A nominal 300 kW reactor is to be ground tested in early 1992 with an on-orbit demonstration circa 1993.[63]

There are several reasons to explain the SDI interest in nuclear power. Thus: its innate survivability due to its necessarily "hardened" construction compares highly favourably with the extremely vulnerable solar arrays; its "baseload" or housekeeping power is at least 300 kW in a compact, mobile and independent format; and its "Alert and Burst Mode" capacity, for instant increased power output in an emergency, is unlikely to be matched by any other current technology.[64]

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62. The power output of SNAP IOA was, however, only 500 W for 43 days, *op.cit.*, *supra*, note 5 attachment 5, p. 6.

63. See R.L. Verga & R.L. Wiley, "Multimegawatt Nuclear Reactors in Orbit", *Aerospace America*, April, 1986, 45, where it is stated that there appears to be no technological impediment preventing scaling up of the lithium-cooled reactor to produce 1 MW or more.

64. B. Greeley, "SDIO Emphasizes Research on Improved Power Sources", *AW & ST* 17 March, 1986, 74. Other technologies are under consideration by the SDIO but are more speculative requiring major, and costly, technological innovation.

(d) The National Commission on Space Report[65] - This long awaited report, commissioned by the US Congress,[66] mandated a highly qualified group of experts from defence, science, industry and academe to

> formulate an agenda for the United States civilian space program; and identify long range goals, opportunities, and policy options for civilian space activity for the next 20 years.[67]

Its highly prospective scenario depicts an evolution by various stages from short term increases in transportation capabilities to LEO, to space station construction in LEO and circumlunar space, leading in turn to manned Lunar and Mars bases by 2010 and 2020 respectively.

Considerable attention and advocacy was devoted by the Commission to the development and utilization of NPS technology. Thus, it was averred that "[h]igh-performance nuclear-electric power systems make possible exploration of the outer reaches of the Solar System, and are important for future spaceports and Moon bases."[68] Furthermore, NPSs

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65. Pioneering the Space Frontier (1986, Bantam Books, 211ff).

66. In the National Aeronautics and Space Administration Authorization Act 1985, PL 98-361, s.204.

67. Ibid.

68. Op.cit., supra, note 65 at 95.

were described as being "critical for some future key missions, such as outer planetary ring exploration and human settlements on the Moon and Mars, and offer lower cost and higher reliability for others".[69]

The perception of the importance of space nuclear power, clearly exhibited by the Commission in its report, led it to declare that

> [i]n keeping with the promise of space nuclear power, we recommend: (1) conversion of the SP-100 nuclear reactor from a ground demonstration test in 1992 to a flight test in space; (2) expansion of the research and development effort on a multi-megawatt power system; (3) enhancement of the technology base of the radioisotope thermoelectric generator and

69. Ibid., 100. The report goes on to relate that the successful utilization of Mass Drivers and ion engines, which are both well defined technologies, will require NPSs. As the Report states at 104,

> In an electromagnetic accelerator, electric or magnetic fields are used to accelerate material to high speeds. The power source can be solar or nuclear. There are two types of accelerators for use in space: the "ion engine" and the "mass-driver". The ion engine uses electric fields to accelerate ions (charged atoms). Ion engines are compact, relatively light in weight, and well-suited to missions requiring low thrust sustained for a very long time

Whilst more work needs to be done on Mass Drivers,

> Ion engine technology is highly developed, and ion engines have been used in space. The pacing item for their application to outer planet missions is the power source. For operation far from the Sun, a nuclear electric power source is almost certainly required, and it is, therefore, the pacing technology for the use of ion engines in the outer solar system

Ibid., 103.

> dynamic isotope power system programs; (4) sustained commitment to an integrated space nuclear power program; (5) more active involvement by NASA and DOD in providing guidance and setting target requirements for the national space nuclear program; and (6) an increase in the level of effort in research and technology development on space nuclear power systems to decrease the technical risk of utilizing reactors in space.[70]

Thus, there is widespread current interest in the possibilities of NPS utilization across the entire spectrum of the US space programme. Whilst a greatly increased civilian use in the near future may be more speculative, it would appear that the military SP-100 programme is proceeding apace. This, together with the active Soviet programme of reactor NPS launching, ensures that the use of nuclear technology in outer space will continue, indeed expand. This expansion will further fuel the debate to be discussed in the next section.

C. THE UNITED NATIONS DEBATE

The use of nuclear power in outer space has political connotations which range far beyond the rarefied enclave of the super-power milieu. Just as there has been a

70. *Ibid.*, 101.

technological awakening of other space-capable nations,[71] so too there has been a political catharsis since the beginning of the Space Age as more and more nations come to realize the pervasive and persuasive nature of inherently international space technology. The main forum for debate of such issues has been the UN Committee on the Peaceful Uses of Outer Space (COPUOS).[72] Evolving considerably

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71. See Young, op.cit., supra, note 31, Chapters II and III, pp. 4-183 which presents a technological review of worldwide space transportation systems, followed by a discussion of the various political rationales underlying these programmes. The major space powers are: USA, USSR, ESA, Japan, China and India, the criterion for that appellation being drawn from the 1982 UNISPACE Report (UN Doc. A/CONF.101/10, Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space) which states at 30 that "It was the first launching of an artificial satellite into earth orbit by the USSR in 1957 that marked the beginning of the Space Age, and even today the criterion that defines a 'space power' is the capability of carrying out a complete space mission, including the launch into orbit." (Emphasis added), see further infra, Chapter VIII.

72. COPUOS was established on an ad hoc basis by UN General Assembly (UNGA) Resolution 1348 (XIII) "Question of the Peaceful Use of Outer Space", 13 December, 1958, and formalized on a permanent basis by UNGA Resolution 1472 (XIV) "International Co-operation in the Peaceful Uses of Outer Space" 12 December, 1959. COPUOS is therein mandated to inter alia "review...the area of international co-operation, and to study practical and feasible means for giving effect to programmes in the peaceful uses of outer space which could appropriately be undertaken under United Nations auspices": and "to study the nature of legal problems which may arise from the exploration of outer space."

since its inception in the late 1950s, COPUOS reached its productive peak in the mid-1970s after which its increasing politicization began to adversely affect its balance between pragmatism and ideology, erring on the side of the latter.[73]

The Kosmos 954 incident provoked considerable discussion in both Sub-Committees of COPUOS, the Scientific and Technical and the Legal respectively, in 1978. The debate was formalized by the creation, in 1979, of a Working Group within the Scientific and Technical Sub-Committee to study the issue.[74] Their findings were reported to the Legal Sub-Committee, when the use of NPS in outer space became an agenda item of the latter's in 1980.[75] The NPS issue continues to be one of the three substantive agenda

73. For an uncompromising appraisal of the workings of COPUOS, see N.M. Matte, "Institutional Arrangements for Space Activities: An Appraisal", VI Ann. Air & Space L, 439 (1981) pp. 440-443.

74. Pursuant to UNGA Resolution 33/16, 10 November 1978.

75. Pursuant to UNGA Resolution 34/66, 5 December, 1979, the agenda item was entitled "Review of existing international law relevant to outer space activities with a view to determining the appropriateness of supplementing such law with provisions to the use of NPS in outer space".

items of the Legal Sub-Committee.[76] Whilst much useful work has been done in the last seven years, the greater part remains as yet undone.

No summary of the written record will be attempted here, since this has been done elsewhere.[77] Rather, it may be more instructive to identify the political leitmotivs which have emerged, in order to better illuminate the legal discussion to follow. It is a truism to state that law does not exist in a vacuum, a fortiori international law, which is a distillation of compromises, filtered through the adversarial posturing of power blocs and prey to the often irrational turn of world events. The NPS issue is no exception, the COPUOS discussions having elicited three main strands of opinion which will now be briefly presented.

1. THE CANADIAN CAUCUS

Being justifiably indignant due to having Kosmos 954 distribute itself over its North-West Territories,

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76. The other two items are Remote Sensing and the Definition and Delimitation of Outer Space, including the Geostationary orbit.

77. See: Benkö et al., op.cit., supra, note 15, pp. 75-92; see also, C.Q. Christol, The Modern International Law of Outer Space (1982, Pergamon Press), Chapter 14, pp. 765-790.

Canada was the first to raise major concerns over NPS use in space at the international level. Its earlier reports submitted to COPUOS provoked extensive comment and further study by a growing number of nations. Indeed, it was mainly due to Canadian tenacity that the NPS issue achieved the level of attention its importance merits. The Canadian credo was encapsulated by its delegate to the Legal Sub-Committee in 1981, who, in comparing the Canadian draft NPS principles and extant international law stated that

> [t]he review of these principles, and provisions [of international law], ... has led my delegation and many others to the inescapable conclusion that there should be specific guidelines or principles under international law applicable to the particular case of NPS. However useful applicable general principles may be as a framework to a regime for NPS, guidelines or principles are needed to help ensure that we are not left with a container with little or no content.[78]

This belief in the need for <u>sui generis</u> legal prescripts for NPS gained currency among several delegations, the caucus gradually expanding. At present, major exponents of this viewpoint, other than Canada, include the Federal

78. Canadian Statement before the Legal Sub-Committee of COPUOS, 30 March, 1981, as quoted by J. Reiskind, "Toward a Responsible Use of Nuclear Power in Outer Space - The Canadian Initiative in the United Nations", VI <u>Ann. Air & Space L.</u>, 461, 466 (1981).

Republic of Germany,[79] Sweden,[80] the Peoples Republic of China,[81] The Netherlands,[82] Japan, Italy and Australia, who have all made positive contributions to the drafting process towards a set of NPS principles. The Canadian caucus occupies the middle ground between the two rather more extreme viewpoints which follow.

2. THE NON-INTERFERENCE FACTION

Less co-ordinated than the previous grouping, this is merely a subjective categorization of broadly similar independent positions. In a familiar attempt to pre-empt technological foreclosure by the premature elaboration of legal restraints, the USA has stressed the positive aspects of NPS utilization. Thus, it has been affirmed that "[t]he development of safe, compact nuclear generators to power scientific experiments and communications systems has

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79. See e.g. UN Doc. A/AC.105/C.2/L.146, 26 March, 1984, FRG Working Paper.

80. UN Doc. WG/NPS (1982)/WP/2, 11 February, 1982, Sweden: Working Paper.

81. UN Doc. WG/NPS (1984)/WP.4, 29 March, 1984, Canada, China, The Netherlands, Sweden: Working Paper.

82. Ibid.

contributed much to the exploration of space".[83] Stated succinctly, the US position appears to be general agreement with the concept of the establishment of legal norms in this area, but at some later time when more data is available on the potential of technology.

In 1980 Legal Sub-Committee discussions, the USA, together with most Western nations, supported supplementary legal principles for NPS.[84] However, the USSR and most of its socialist bloc

> did not see any need to elaborate supplementary NPS norms. In her opinion, all of the problems potentially arising in connection with the use of NPS could adequately be handled with already existing legal norms.[85]

The French position has gone from being opposed to discussion of NPS in COPUOS[86] to a focus on the area of potential internationally-developed safeguards for the use of NPS in space, to be discussed presently.[87] At this juncture, it is enough to state that, while not being

83. *Op.cit.*, *supra*, note 5, 2.

84. *Op.cit.*, *supra*, note 15, 84.

85. *Ibid.*

86. *Ibid.*

87. See *infra*, D 2.

opposed to safeguards as such,[88] the French would object to the monitoring by an external agency of its compliance. The rationale for this would appear to be that a launching state is the best qualified to assess its own instrumentality for space-worthiness.[89]

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88. Declaration of the French delegation at the 22nd Session of the Scientific and Technical Sub-Committee 12 February, 1985, where it is stated <u>inter alia</u> that France:-

    réaffirme, tout d'abord, sa conviction que l'utilisation des sources d'énergie nucléaire (S.E.N.) est de nature à présenter un intérêt scientifique ou technologique sans équivalent pour certaines catégories de missions spatiales et que, dans ces conditions, il n'y a pas lieu de l'écarter a priori, étant entendu que la mise en application de cette technologie avancée ne peut s'envisager que dans le respect exigeant de la protection des personnes et de l'environnement.
    Cet objectif primordial ne sera atteint que lorsqu'un niveau de sûreté élevé aura été défini sur des bases techniques et aura fait l'objet d'un agrément international.

89. This point of view has been somewhat undermined by the negative results of the post-Challenger safety review of the US space programme. See e.g.s:, "NASA Official Says Shuttle Program Had Major Flaws", <u>New York Times</u>, 4 April, 1986, A1; C. Covault, "Astronauts Urge Separate Flight Safety Review Process", <u>AW & ST</u>, 7 April, 1986, 23; "NASA Wasted Billions, Federal Audits Disclose", <u>New York Times</u>, 23 April, 1986, A1; "NASA Cut or Delayed Safety Spending", <u>New York Times</u>, 24 April, 1986, A1; and "Shuttle Commission Blames NASA and Rocket Builders for Challenger Explosion", <u>New York Times</u>, 10 June, 1986, A1.

3. THE NON-ALIGNED MOVEMENT (NAM)

Developed as an alternative to the super-powers and their associated blocs within the UN, the NAM has become a 101 member bloc in its own right[90] whose "role has been to articulate and advance the interests and demands of the Third World."[91] At its best, the NAM has ensured that less developed nations have a strong voice in the UN, at its worst,

> [t]he functioning and structure of the Non-Aligned Movement are less and less relevant to the problems of the late twentieth century and the national needs of its members. Regional, political, and economic disparities of 101 members reduce consensus to a high level of generality,

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90. See R.L. Jackson, The Non-Aligned - The UN and the Super Powers (1983, Praeger) 5, where it is stated that

> [t]he NAM should not be equated with the G-77, although the two groupings share economic goals and reinforce each other. The larger G-77, now expanded to 125 members, of whom 80 percent belong to the NAM, was formed to represent the developing countries during the 1964 U.N. Conference on Trade and Development (UNCTAD) at Geneva, and has continued to do so at subsequent UNCTAD meetings, special General Assembly sessions on economic issues, and other specialized conferences. Its focus is entirely economic, and its status as a negotiating body in the North-South dialogue is recognized by the developed countries. ... While the NAM and G-77 memberships overlap, some leaders of the G-77, such as Brazil, Mexico, and Venezuela, are not full members of the NAM, whose orientation tends to be more radical.

91. Ibid.

> limiting the movement's ability to take positive action or to put forward realistic proposals. Its bias, reflecting political realities of its membership, tends to be toward criticism rather than strong leadership.[92]

As a function of its desire to equalise the North-South imbalance, the NAM consistently strives for tangible returns from, inter alia, the exploitation of the outer space milieu. Motivated by the co-existing concepts of outer space being the "province of all Mankind",[93] and the inalienable sovereignty of all nations, the NAM pursues comprehensive international regulation of activities in space, together with significant technology transfer from the space powers. In the NPS context, this manifests itself in radical formulations of international duties in mandatory terms which will be discussed in the next section where appropriate.

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92. Ibid., 241.

93. Article 1(1) of the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" 610 UNTS 206 OFS 27 January, 1967, EIF 10 October, 1967, see supra Chapter IV G and infra, Chapter VIII.

D. AN EMERGING LEGAL CODE

Despite the obvious differences of approach just outlined, the General Assembly, by Resolution 40/162 decided that the Legal Sub-Committee

> should ..., taking into account the concerns of all countries, particularly those of developing countries, undertake the elaboration of draft principles relevant to the use of nuclear power sources in outer space.[94]

A modest victory for the Canadian caucus, the NPS issue is clearly intended to be pursued more vigorously in the near future, with a Working Group being re-established on 24 March, 1986.[95] This intensified effort has already borne fruit, with consensus being reached on the texts of two draft principles, on Notification of Re-Entry and Assistance to States, respectively,[96] which will be analysed in detail presently.

Five principal legal concerns have been identified and acknowledged within COPUOS. These concerns have tenta-

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94. UN Doc. A/AC.105/37, 5 May, 1986, Committee on the Peaceful Uses of Outer Space, Report of the Legal Sub-Committee on the Work of its Twenty-fifth Session (24 March - 11 April, 1986) 9, para. 31.

95. Ibid.

96. "Countries Plan Guidelines on Liability for Nuclear Satellites", New York Times, 22 April, 1986, C3.

tively crystallized into five principles to govern NPS use. The latest statement of these principles is contained in a 1986 Canadian Working Paper[97] submitted to the Legal Sub-Committee at its 25th session.[98]

1. PRINCIPLE 1: LAUNCH NOTIFICATION

In its original formulation this principle sought notification to the UN Secretary General of the presence of an NPS on board a space object prior to its launch. Thus, a 1983 Canadian Working Paper stated, in part, that

> [e]ach launching State should furnish to the Secretary-General of the United Nations, at least one month prior to launching, the planned date and time of launching of a space object containing a nuclear power source. ... [and] ... information relating to generic design, safety tests conducted, basic orbital parameters, and primary and back-up

97. UN Doc. A/AC.105/C.2/L.154, 25 March, 1986, Canada: Working Paper (hereinafter referred to as the Working Paper), derived from an unpublished Report entitled Consideration of the Possibility of Supplementing the Norms of International Law Relevant to the Use of Nuclear Power Sources in Outer Space, 20 December, 1985 (hereinafter referred to as the Report), submitted to the Canadian Department of External Affairs (DEA) and co-authored by the present writer together with Dr. Jean-Louis Magdelénat, Assistant Director, Institute of Air & Space Law, McGill University.

98. The Working Paper text of the five principles is reproduced in appendix 3 to this thesis.

devices, systems and procedures.[99]

This is not a novel idea, having been around at least since 1962, when the Soviet "Draft Treaty on General and Complete Disarmament Under Strict International Control" was promulgated.[100] Article 14 of the latter required States Parties to "provide advance information to the International Disarmament Organization (IDO) about all launchings of rockets for peaceful purposes." Furthermore, article 15 gave the IDO the mandate to establish

> inspection teams at the sites for peaceful rocket launchings who shall be present at the launchings and shall thoroughly examine every rocket or satellite before their launching.

The IDO, which would have monitored a controlled and balanced world disarmament, was too Utopian to be implemented.[101] Indeed, it is questionable whether the IDO was ever considered seriously by the super-powers and any pre-launch notification has long been regarded as tantamount

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99. UN Doc. A/AC.105/C.2/L.137, 28 March, 1983, Canada: Working Paper. (Emphasis added).

100. See UN Disarmament Commission Official Records 66th Meeting 1960 66th-70th Meetings, Supplements 1960-1964, and UN Doc. ENDC/2 19 March, 1962.

101. See Enforcement and Verification of Arms Control Treaties in Outer Space, 31 March, 1986, Report prepared by the Centre for Research in Air & Space Law, McGill University, for the Canadian DEA, pp. 81-85.

to heresy by both. Though various demurrers have been employed, the most cogent appears to be that Soviet NPS and US solar-powered reconnaissance satellites are often launched in response to crisis situations and that prior notification would be impossible.[102] Thus, the existing

102. See Benkö et al., op. cit., supra, note 15, 87, see also A.D. Terekhov, "Nuclear Power Sources in Outer Space - Problem of Notification", Procs. of 27th Colloquium on the Law of Outer Space, Int'l Int. of Space L. of the Int'l Astronautical Fed'n, 218 (1984, Lausanne) where it is stated that

> Notification of the intention to launch an object with NPS as well as of the fact of such a launch would be unnecessary and could even have negative consequences.

Registration Convention formula[103] wording is merely "as soon as practicable", which translates into customary delays of 3 months to a year after launch.[104]

While the latest Canadian draft has abandoned pre-launch notification, some nations, chiefly of the NAM, still

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103. Article IV of the Registration Convention reads as follows:-

1. Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:
(a) Name of launching State or States;
(b) An appropriate designator of the space object or its registration number;
(c) Date and territory or location of launch;
(d) Basic orbital parameters, including:
(i) Nodal period,
(ii) Inclination,
(iii) Apogee,
(iv) Perigee;
(e) General function of the space object.
2. Each State of registry may, from time to time, provide the Secretary-General of the United Nations with additional information concerning a space object carried on its registry.
3. Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit.

104. Infra, Chapter VII B 2(b).

adhere to this concept.[105] As an alternative, the Report[106] submitted the concepts of notification "within 48 hours" or "the minimum technical time possible for communication of such notice" as more realistic formulations for discussion. This proposal follows the time scale achieved by the informal voluntary system adopted by the Committee on Space Research (COSPAR). The latter is a sub-committee of the non-governmental International Council of Scientific Unions (ICSU), and operates an ad hoc information service far superior to that established by the Registration Convention in the UN.[107] Following its reorganization in 1980, COSPAR comprises 12 committees, of which only the "Advisory Committee on Data Problems and Publications" is relevant here. The latter functions

> to elaborate rules concerning rocket and satellite information on data exchange in the frame of (sic) international services

105. See UN Doc. A/AC.105/C.1/WG.5/L.17, 14 November, 1984, Scientific and Technical Sub-Committee Working Group on the Use of Nuclear Power Sources in Outer Space, 3, 5, in which the Indonesian submission demands information one month prior to launching on eight matters, the three supplementing article IV of the Registration Convention being: "safety tests conducted"; "primary and back-up devices, systems and procedures" and a "safety evaluation statement, including an analysis of accident probability, sufficiently comprehensive to assure the international community that the NPS can be utilized safely."

106. Op.cit., supra, note 97.

107. See infra, Chapter VII B 2(b).

such as SPACEWARN, world data centres, and satellite warning centres, and to formulate proposals on COSPAR publication policy.[108]

The SPACEWARN system, designed to promptly inform scientists worldwide of space launchings and their detailed orbital parameters, is managed for COSPAR by the International Ursigram and World Days Service (IUWDS). The latter maintains COSPAR's uniform system of satellite designation, and coordinates four satellite regional warning centres in Japan (Western Pacific region), West Germany and the U.K. (Western Europe), USSR (Eurasia) and the USA (Western hemisphere). "The messages are sent from one continent to another by telegram, and further distribution to national centres and individual laboratories is achieved by the most effective rapid means available."[109]

The question is essentially of the need to know. Although believing that heretofore those who needed to know of the existence and approximate mission profiles of military satellites did so, in the case of NPS this does not hold true, since the implications of a malfunctioning NPS system may potentially affect a far greater section of the population than that comprised in the military establishments of

108. See R. Chipman Ed., <u>The World in Space - A Summary of Space Activities and Issues</u> (1982, Prentice Hall), 656.

109. Ibid., 657.

either super-power.

Thus, the current legal situation, although supplemented by the ad hoc COPUOS system, is inadequate for NPS satellites and requires amendment along the lines advocated.

2. PRINCIPLE 2: SAFETY GUIDELINES

This is perhaps the most intractable issue facing the Legal Sub-Committee due to a concatenation of factors, including: space power trepidation lest they be presented with a regulative fait accompli containing unambiguous stipulations which severely curtail their activities, versus the strong desire of the majority of nations for regulation to varying degrees of restrictiveness; the widely differing interpretation of what safety standards are appropriate; and how to implement safeguards once they are developed. Unfortunately, the area requiring the greatest scientific and technical diligence will, instead, probably attract the finest in political casuistry.

Due to its complexity, which would require an entire chapter on its own to unravel satisfactorily, the ensuing analysis must, perforce, be selective.

(a) The Hazard

It will be recalled from the technological section that U^{235} and Pu^{238} are the principal NPS fuels. Whilst the latter has a relatively more modest half-life, in the opinion of one author, statements

> implying that transfer of the reactor to a higher altitude satisfies safety requirements, should not go unchallenged. All Soviet nuclear reactors placed in orbits below 1,000 km will reenter the Earth's atmosphere within at least 1,000 years. However, since the radioactive half-life of U^{235} is greater than 700,000 years (U^{238} half-life is even longer), the deadly payloads will pose as great a threat to future generations as they would today without the transfer technique. In reality, the Soviets are merely postponing their obligations to safeguard the peoples of the world.[110]

As a corollary to this, the concept of "acceptable risk" must be adverted to. It has been defined as "a risk that is perceived by the public to be comparable to risks of every-day life such as is experienced by office workers in their day-to-day employment".[111] Applying this to the text of principle 2 in Appendix 3, the concept of a "Nuclear Safe Orbit" must be clarified. It has been defined as

> an orbit about the Earth (or other celest-

110. Johnson, op.cit., supra, note 18, 32.

111. UN Doc. A/AC.105/C.1/1986/WP.3, 18 February, 1986 "Definition and Terminology Associated with use of Nuclear Power Sources in Outer Space", Working Paper submitted by Canada to the Scientific and Technical Sub-Committee, 23rd Session, 2.

> ial body) such that the component with an NPS on board will have a natural lifetime in orbit of at least 300 years in the case of a reactor and of at least 10 times the half life of the isotope or isotopes used for generating heat in the case of a radioisotope generator.[112]

The rationale for all the above is, perhaps, that the likelihood of technological progress evolving the ability to ameliorate the hazardous nature of nuclear fuel and its harmful bi-products, is at least as great as our continued presence on planet Earth at the juncture mentioned.

(b) Extant Law

The 1967 <u>Outer Space Treaty</u> contains several articles which are relevant to this area. The article I imperative, that the exploration and use of outer space "shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development", is rather too broadly drafted for strict application. Nevertheless, when read with the more concrete language of article IX of the same

112. <u>Ibid.</u>, 3.

treaty,[113] a distinct impression of the upper boundary of legality is created.

Of less weight, due to the paucity of signatories

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113. Article IX reads as follows:-

> In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment. (Emphasis added).

thereto, is article 7(1) of the 1979 Moon Treaty,[114] which states that

> [i]n exploring and using the moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties shall also take measures to avoid harmfully affecting the environment of the earth through the introduction of extraterrestrial matter or otherwise.

Nevertheless, it may represent a scintilla of evidence towards a general impression of Customary International Law in this area. A further element may be supplied by Principle 21 of the 1972 Stockholm Declaration on the Human Environment[115] whereby

> States 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 responsibilities 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

114. "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies", UN Doc. A/RES/34/68, 14 December, 1979. OFS 5 December, 1979, EIF 11 July, 1984. There are only six signatories to this Treaty: The Netherlands, The Philippines, Chile, Uruguay, Austria and Pakistan, none of which are space powers or ever likely to be on their own.

115. Developed at the 1972 UN Conference on the Human Environment, UN Doc., A/CONF. 48/14 (1972).

jurisdiction. (Emphasis added)

Thus, although not non-existent, the existing law is somewhat disparate and insubstantial.

(c) Suggested Safeguards and Their Arbiters -

(i) The International Atomic Energy Agency (IAEA)[116] - The IAEA was created in 1956 to promote the peaceful use of atomic energy, and to ensure that the technology and fissionable material assigned to it for control by the nuclear powers, would not be used for military purposes.[117] The IAEA also monitors the performance of States under several international arms control treaties

116. For a more detailed appraisal of the IAEA and its activities, see: P.C. Szasz, "International Atomic Energy Agency Safeguards", in M. Willrich Ed., International Safeguards and Nuclear Industry (1973, Johns Hopkins University Press) pp. 73-141; see also, B. Goldschmidt, The Atomic Complex (1982, American Nuclear Society), pp. 277-288 and 386-393; and the 1986 CRASL Report, op.cit., supra, note 101, pp. 74-80.

117. Statute of the International Atomic Energy Agency 276 UNTS 3, 26 October, 1956, as amended to 1-6-1973 TIAS 7668, article II.

concerning nuclear weapons.[118] In the present context, the IAEA has been advocated as an appropriate body to develop safeguards for the use of NPS in outer space.[119] It has already developed an extensive series of safety guidelines for the terrestrial use of nuclear power.[120]

(ii) The International Commission on Radiological Protection (ICRP) - An independent scientific body, the ICRP has published a series of documents relating to radiation exposure limits,[121] documents 26 and 30 of the series being widely lauded as of especial utility in this

118. E.g.s the "Treaty for the Prohibition of Nuclear Weapons in Latin America" 634 UNTS 281 OFS 14 February, 1967, EIF 22, April, 1968 (The Treaty of Tlatelolco); and the "Treaty on the Non-Proliferation of Nuclear Weapons", 729 UNTS 161 OFS 1 July, 1968, EIF 5 March, 1970.

119. UN Doc. WG/NPS (1984) WP.3, 29 March, 1984, Netherlands: Working Paper; and UN Doc. WG/NPS (1984) WP.1, 28 March, 1984, Sweden: Working Paper.

120. See N. Jasentuliyana, "A Perspective of the Use of Nuclear Power Sources in Outer Space", IV Ann. Air & Space L. 519 (1979), at 541, footnote 76, where the 19 item IAEA Safety Series is recorded.

121. See 285 Nature 432, 12 June, 1980, which explains the rather technical ICRP standards in layman's terms.

area.[122] However, the ICRP Standards have been criticised as being designed for normal use, i.e. not applicable to nuclear accidents.[123] Thus, Kosmos 954 debris exceeded their limits in a flagrant manner.[124]

(iii) US Safety Regulation - In its 1978 submission to COPUOS, the US Delegation adverted to the review procedures employed prior to an NPS launch.[125] Thus, "Environmental Impact Statements" are required, which are assessed by an Interagency Nuclear Safety Review Panel consisting of representatives from the DOD, NASA, the Environmental Protection Agency and the Nuclear Regulatory Commission.

> It is the responsibility of this panel to carefully review the technical aspects of the systems and missions and to prepare a report which is used by management in going forward to request Presidential approval for the use of any nuclear powered spacecraft. This panel is made up of personnel not responsible for the application, and thus it provides a third party evaluation. Hardware design, abort

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122. A number of the Canadian Caucus nations have advocated the adoption of ICRP Standards, see UN Doc. A/AC.105/C.1/L.143 15 February, 1985 - COPUOS - Report of the Working Group on the Use of Nuclear Power Sources in Outer Space on the Work of Its Fifth Session, 2.

123. Benkö *et al.*, *op.cit.*, *supra*, note 15, 87.

124. *Ibid.*, 78.

125. *Op.cit.*, *supra*, note 5, pp. 5 and 10.

> environments, normal operational environments, and any potential accident or operation is considered. If modifications of the designs are required, as a result of the reviews, they are accomplished by programme personnel and contractors. The design changes are then further reviewed by the panel.

This may well have proved sufficient in the past, however, should the SDI Programme be fully implemented, the neutrality of the above panel may be undermined. This follows from the clear statements of US policy on atomic energy contained in the Atomic Energy Act[126] which states in section 1 that

> [a]tomic energy is capable of application for peaceful as well as military purposes. It is therefore declared to be the policy of the United States that-
> a. the development, use, and control of atomic energy shall be directed so as to make the maximum contribution to the general welfare, <u>subject at all times to the paramount objective of making the maximum contribution to the common defense and security</u>; and
> b. the development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise. (Emphasis added).

This notwithstanding, any criticism must be tempered by the silence from the Soviet Union in relation to their regime

126. 1946 as amended to 1954, PL-703, 83rd Cong., approved 13 August, 1953.

for nuclear regulation.[127] Nevertheless, an independent agency has been advocated for the USA, entitled the Space Nuclear Power Systems Safety Board.[128]

(d) A Modest Proposal

There are considerable scientific problems posed by the elaboration of safeguards for the use of NPSs in outer space. These would in turn lead to legal drafting difficulties, since their necessary precision requires a specificity heretofore conspicuous by its absence in Space Law. Thus, it is submitted that principle 2 should be a broad statement of intention in line with the pre-existing law, but with the addition of provision for the establishment of a Consultative Committee of Experts.

This has considerable precedent in international law and could resemble that established in the ENMOD Conven-

127. The performance in the amelioration of the 1986 Chernobyl accident does not bode well, see TIME, 12 May, 1986, 27 et seq.

128. Proposed by L. Manning Muntzing, president of the American Nuclear Society, see Broad, op.cit., supra, note 12, 1201.

tion[129] and the Standing Consultative Commission of the SALT Agreements.[130] Instead of comprising the represent-

129. "The Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques", 31 UST 333 OFS 18 May, 1977, EIF 5 October, 1978. Article V of the Convention established the Consultative Committee of Experts as provided for in the Annex to the Convention, which is incorporated by reference into the Convention, and states as follows:-

    1. The Consultative Committee of Experts shall undertake to make appropriate findings of fact and provide expert views relevant to any problem raised pursuant to paragraph 1 of article V of this Convention by the State Party requesting the convening of the Committee.
    2. The work of the Consultative Committee of Experts shall be organized in such a way as to permit it to perform the functions set forth in paragraph 1 of this annex. The Committee shall decide procedural questions relative to the organization of its work, where possible by consensus, but otherwise by a majority of those present and voting. There shall be no voting on matters of substance.
    3. The Depositary or his representative shall serve as the Chairman of the Committee.
    4. Each expert may be assisted at meetings by one or more advisers.
    5. Each expert shall have the right, through the Chairman, to request from States, and from international organizations, such information and assistance as the expert considers desirable for the accomplishment of the Committee's work.

130. The US-USSR Strategic Arms Limitation Talks producing five treaties in 1972 and 1979. In the present context only the Standing Consultative Commission (SCC) is relevant. The SCC was established by the 1972 ABM Treaty (Treaty Between the USA and USSR on the Limitation of Anti-Ballistic Missile Systems), 944 UNTS, signed 26 May, 1972, EIF 3 October 1972, article XIII of which states that

    1. To promote the objectives and implementation of

atives of treaty signatories as in their cases, however, the NPS Committee of Experts could be convened under the auspices of the UN, but independent therefrom like the IAEA. Its membership should reflect the reality of the position of the space powers, which in most cases are also nuclear powers, with the addition of delegates from the neutral IAEA

(continued from previous page)
the provisions of this Treaty, the Parties shall establish promptly a Standing Consultative Commission, within the framework of which they will:

(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification;

(d) consider possible changes in the strategic situation which have a bearing on the provisions of this Treaty;

(e) agree upon procedures and dates for destruction or dismantling of ABM systems or their components in cases provided for by the provisions of this Treaty:

(f) consider, as appropriate, possible proposals for further increasing the viability of this Treaty, including proposals for amendments in accordance with the provisions of this Treaty;

(g) consider, as appropriate, proposals for further measures aimed at limiting strategic arms.

2. The Parties through consultation shall establish, and may amend as appropriate, Regulations for the Standing Consultative Commission governing procedures, composition and other relevant matters.

and ICRP. The UN association is desirable to ensure the direct availability of the Security Council for sanctions. The Committee would function to elaborate specific and uniform standards for NPS usage.[131]

3. PRINCIPLE 3: NOTIFICATION OF RE-ENTRY

There has been growing agreement on the text of this principle since its promulgation in 1981.[132] This has culminated in its achieving consensus within the Legal Sub-Committee in April, 1986.[133] The agreed text is substantively the same as that in Appendix 3 to this

131. This is reminiscent of the function of the International Civil Aviation Organization (ICAO) under the 1944 Chicago "Convention on International Civil Aviation", 15 UNTS 295 OFS 7 December, 1944, EIF 4 April, 1947. Article 37 of the latter states broad policy outlines, while giving the mandate to ICAO to develop specific Standards and Recommended Practices (SARPS) for the safe conduct of civil aviation. Thus, 18 Annexes have been promulgated, Annex 18 being of particular interest in this context, relating to "Safe Transport of Dangerous Goods".

132. UN Doc. A/AC.105/287, 13 February, 1981, pp. 4-5.

133. Op.cit., supra, note 94, pp. 16-17.

thesis.[134]

The major flaw, however, is in the imprecision of the request that a launching state "should timely inform" other States of the re-entry of its NPS. It is obvious that the permissiveness of "should" requires fortification to "shall". The difficulties with the meaning of "timely" are clarion, in view of the possible consequences of any dilatoriness in view of the present inability to accurately predict exact re-entry time.[135] It is submitted, that a more demanding formulation be developed, along the lines of - "as soon as the launching state becomes aware" of the malfunctions leading to re-entry, it shall inform other

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134. In order that the official syntax can be appreciated, paragraphs 2 and 3 of principle 2 are as follows:
2. The information, in accordance with the format above, should be provided by the launching State, as soon as the malfunction has become known. It should be updated as frequently as practicable and the frequency of dissemination of the updated information should increase as the anticipated time of re-entry into the dense layers of the Earth's atmosphere approaches so that the international community would be informed of the situation and would have sufficient time to plan for any national response activities deemed necessary.
3. The updated information should also be transmitted to the Secretary-General of the United Nations with the same frequency.

135. Inexactitudes of + or - 3 to 8 hours still remain, during which time a re-entering NPS satellite passes over nearly all the nations of the world. See the FRG Working paper, op.cit., supra, note 79.

states etc. ... The precision of data from tracking stations is well able to pinpoint the moment a launching state should have been aware of such a serious malfunction.

4. PRINCIPLE 4: ASSISTANCE TO STATES

This principle also achieved consensus in April 1986, the text being virtually identical to that in Appendix 4. It proved less difficult, since the existing legal framework is already clear, this being merely a codification. Thus, the 1968 Rescue and Return Agreement[136] provides in article 5(2) that

> [e]ach Contracting Party having jurisdiction over the territory on which a space object or its component parts has been discovered shall, upon the request of the launching authority and with assistance from that authority if requested, take such steps as it finds practicable to recover the object or component parts.

Furthermore, article VI of the Registration Convention provides, in part, that

> (w)here the application of the provisions of this Convention has not enabled a State Party to identify a space object which has caused damage to it or to any of its natural or juridical persons, or which may be of a hazardous or deleterious nature, other States Parties, including in partic-

136. "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space", 672 UNTS 119 OFS 22 April, 1968, EIF 3 December, 1968.

> ular States possessing space monitoring and tracking facilities, shall respond to the greatest extent feasible to a request by that State Party, or transmitted through the Secretary-General on its behalf, for assistance under equitable and reasonable conditions in the identification of the object.

As a corollary, the USA has consistently renewed a standing offer of assistance, in the search and neutralization of NPS debris, to any requesting State, first made in response to Kosmos 954. During the latter incident, the USA was of considerable assistance to Canada. The IAEA has also expressed itself as being "prepared to provide emergency technical assistance to States in the event of any nuclear accident, including the re-entry of an NPS ..: [and to] ... act as a third party to facilitate technical assistance between States."[137] In addition, a representative from the IAEA addressing the Legal Sub-Committee on 4 April, 1985, advocated that each State should have an emergency plan to deal with the eventuality of an NPS re-entry and offered the services of the IAEA to advise, assist and train

137. UN Doc. A/AC.105/351, Annex II, 28 February, 1985, Report of the Scientific and Technical Sub-Committee on the work of its 22nd session, 25, 30.

personnel to perform this function.[138]

One minor criticism of the agreed text for principle 4, is in its use of the mandatory "shall", creating an obligation on States possessing monitoring and tracking facilities to make them available. A better formulation would establish two levels of responsibility: that of the launching State which has a mandatory obligation to assist since it is its primary responsibility ("shall"); and that of other States not directly involved who may be able to provide assistance due to their possession of appropriate technology, their obligation being a permissive one since they would, essentially, be volunteering their services

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138. UN Doc: A/AC.105/C.2/SR.425, 4 April, 1985, Legal Sub-Committee, 24th Sess. Summary Record of the 425th Meeting, 4. The Representative, Mrs. O'Deli went on to outline the six major objectives of any such safety programme:
1. To insure that States had a common understanding with respect to emergency planning and to preparedness procedures, including the establishment of internationally acceptable intervention levels;
2. To advise Member States on the adequacy of emergency planning and preparedness;
3. To develop and publish technical guidance information;
4. To assist Member States in the preparation and implementation of emergency response procedures;
5. To provide assistance for the assessment of direct emergency plans, including simulated alert exercises; and
6. To organize training courses and seminars for Member States on the various aspects of emergency planning and preparedness.

motivated by humanitarian considerations ("should").

5. PRINCIPLE 5: LIABILITY

Liability for activities in outer space has been clearly established since 1963,[139] and articles VI & VII of the Outer Space Treaty represent a codification of pre-existing Customary International Law. Thus, States "bear international responsibility for national activities in outer space"[140] and launching States are "internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the earth, in air or in outer space".[141]

This was amplified in the 1972 Liability Convention[142] which states categorically in article II that "[a] launching State shall be absolutely liable to pay

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139. UNGA Resolution 1962 (XVIII) "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space", 13 December, 1963, para. 8.

140. Outer Space Treaty article VI.

141. Ibid., art. VII, see also supra, Chapter IV C.

142. "Convention on International Liability for Damage Caused by Space Objects 24 UST 2389 OFS 29 March, 1972, EIF 9 October, 1973.

compensation for damage caused by its space object on the surface of the earth or to aircraft in flight." This is distinguished from the regime that applies to damage caused in outer space, which attracts liability only upon proof of fault.[143]

Although apparently clearly drafted, problems arose in its application to the Kosmos 954 incident. The Canadian Statement of Claim,[144] whereby it sought redress from the Soviet Union for its expenditure in neutralization of the NPS debris,[145] succeeded only partially.[146] Also, no official admission of liability was ever made by the Soviet Union. The latter had argued that its offer of assistance to Canada having been rebuffed, under article 5 of the Rescue and Return Agreement it need do no more. Neither, it was alleged, was it liable for the costs of recovery, since it did not request that its space object be returned to it,

143. Ibid., art. III.

144. Reproduced in Benkö et al., op.cit., supra, note 15, pp. 98-103.

145. "Canadians Plan to Bill Soviets for Cosmos Debris Collection", AW & ST, 20 February, 1978, 24.

146. Instead of the C$6.04 Million claimed, the USSR paid only C$3 Million by Protocol of 2 April, 1981, reproduced op.cit., supra, note 144, 97.

upon which such costs depended.[147]

Not pleaded by Canada, was the Trail Smelter Arbitration,[148] in which it was stated that,

> under the principles of international law ... no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.[149] (Emphasis added)

Given the absolute nature of state of registry jurisdiction over its space object accorded by article VIII of the Outer Space Treaty, and the quasi-territorial nature of the space object on orbit,[150] the position is somewhat less ambiguous. This may have helped assuage doubts about the applicability of space law liability to environmental damage

147. See Jasentuliyana, op.cit., supra, note 120, 546.

148. 35 Am. J. Int. L., 684-736 (1941).

149. Ibid., at 684.

150. See B. Cheng, "The 1967 Space Treaty", 95 J. Droit Int. 532 (1968), pp. 568-574, & C.W. Jenks, Space Law (1965, Stevens), pp. 236-239.

per se.[151]

Liability for terrestrial use of nuclear power is

151. *Op.cit.*, *supra*, note 147, pp. 545-546. The problem is caused by the Art. 1 Liability Convention definition of "damage" as meaning

> loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical or property of international intergovernmental organizations.

clearly established,[152] a fortiori no ambiguity should attend its use in outer space. Thus, the draft principle 5 is a further codification of space law liability, as applied specifically to NPS use, with many of the above-mentioned uncertainties removed.

In conclusion, regarding the question of proof of

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152. See: "Convention on third party liability in the field of nuclear energy", 956 UNTS 263, OFS 29 July, 1960, and Additional Protocol of 28 January, 1964, Registered by the OECD 18 December, 1974, which provides in article 3, that

> [t]he operator of a nuclear installation shall be liable, in accordance with this Convention, for:
> (a) damage to or loss of life of any person; and
> (b) damage to or loss of any property other than
> (i) property held by the operator or in his custody or under his control in connection with, and at the site of, such installation, and
> (ii) in the cases within article 4, the means of transport upon which the nuclear substances involved were at the time of the nuclear incident,
>
> upon proof that such damage or loss (hereinafter referred to as "damage") was caused by a nuclear incident involving either nuclear fuel or radioactive products or waste in, or nuclear substances coming from such installation;

see also the "Vienna Convention on Civil Liability for Nuclear Damage", 1063 UNTS, 265 OFS 21 May, 1963, registered by the IAEA 30 December, 1977, which provides in article IV that the liability of the operator of a nuclear installation is absolute; furthermore, the "Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material", OFS 17 December, 1971, EIF 17 March, 1972, clearly provides for the continued liability of the relevant operator of a nuclear installation during the period of maritime transportation of nuclear fuel subject to "an act or omission done with intent to cause damage" by any of the ship's personnel (arts. 1 & 2).

ownership of an NPS, the information submitted in accordance with principles I and III of the draft would suffice. Evidence from tracking station read-outs, which clearly identify a space object (since they are all monitored continuously by both super-powers from initial launch to final decay) could be made available.[153] Thus, the process should be merely an administrative one for the Liability Claims Commission to assess the quantum of damages or, indeed, handled through diplomatic channels if preferred.

E. CONCLUSION: A RADICAL SOLUTION

The ideal solution to the NPS issue, would be the responsible conclusion of a treaty to govern it. However, given the inability of the UN, through COPUOS, to achieve any worthwhile international space law agreement since the 1975 Registration Convention,[154] there is little likelihood of this transpiring. Unfortunately, it would probably require a major NPS disaster to summon the political will to

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153. See infra, Chapter VIII.

154. The Moon Treaty is somewhat of a dead letter and the emasculated Principles on Remote Sensing and Direct Broadcasting by Satellite are negligible achievements from a legal standpoint, being so vague as to be virtually unenforceable.

precipitate such an occurrence. Therefore, a set of principles, unanimously agreed by the UN General Assembly, is the most that can be expected. Its legal status would, however, be questionable. All that can really be said with certainty, is that it would lie in the grey area between a treaty and an ordinary UNGA Resolution.[155] This being said, the prospect for an early conclusion of such a set of principles is unlikely, given the length of time taken to produce the Remote Sensing principles.[156]

Thus, it is submitted that a three-stage plan of action should be undertaken. Firstly, there should be a moratorium on NPS launching until such time as standards are developed by a Consultative Committee of Experts or its equivalent. This is required due to the imperfection of launch technology, despite nearly 30 years of experience, as evidenced by the decimation of the US and ESA launch capabilities in early 1986.

155. Article 38 of the Statute of the International Court of Justice which identifies the constituents of international law is relevant here; the set of NPS principles would probably be either category (b) "international custom, as evidence of a general practice accepted as law", or category (c) "the general principles of law recognized by civilized nations". See Brownlie, op.cit., supra, note 149, 3 et seq.

156. For the text of the Remote Sensing Principles, see UN Doc. op.cit., supra, note 94, pp. 12-15.

Secondly, there should be a permanent ban on the use of NPSs in LEO. This is not a new idea, President Carter advocated an international ban on the launch of nuclear reactors into outer space in 1978.[157] A protocol to the Outer Space Treaty would be the most desirable method of achieving this "nuclear free zone" in LEO. Our inability to even guarantee the safe terrestrial use of nuclear power, bodes ill for any expansion of NPS use in outer space. The prospect of rendering the LEO environment even more hazardous for space stations' personnel and future generations of spacefarers, regardless of the negative effects on Earth itself, is not an "acceptable risk".

Thirdly, as a corollary to the foregoing, exacting standards should be developed and policed on a basis of reciprocity by the Consultative Committee of Experts or its equivalent, to ensure that launches of NPSs, to higher orbits or on interplanetary missions, are guaranteed safe with a high level of certainty. Thus, the launching of RTGs could be continued, since they are heavily shielded, and the relatively safe start-up of reactor NPSs in high orbits would be retained as an available option. The level of launch reliability achieved during the Apollo programme is

157. Op.cit., supra, note 20, 23; see also M. Mateesco-Matte, "Cosmos 954: Pour une 'Zone Orbitale de Sécurité'", III Ann. Air & Space L., 483, 508 (1978).

testament to man's technological ability in this area.

However, the reality may well be different. The majority of desired NPS use in LEO is for military purposes. There are presently no multilateral legal limitations on military activity in outer space short of placing "nuclear weapons" or other "weapons of mass destruction" in that milieu.[158] What bilateral (US-Soviet) treaty limitations there are do not apply to the present Soviet use of NPS Ocean Reconnaissance satellites. The latter are part of the "national technical means of verification" of arms control treaties, and, as such, are expressly reserved as legal therein.[159]

Thus, the proposed triadic solution will probably be politically unacceptable but had to be ventured nevertheless. All too often national political utilitarianism is inversely proportional to international comity.

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158. Art. IV(1) Outer Space Treaty, see M.L. Stojak, Legally Permissible Scope of Current Military Activities in Space and Prospects for their Future Control (1985, 424ff, unpublished D.C.L. Thesis, McGill University), pp. 148-183 passim, see also supra, Chapter V.

159. See G. Steinberg, Satellite Reconnaissance - The Role of Informal Bargaining, (1983, Praeger) 45 et seq., see supra, Chapter V.

VII. LAW AND PRACTICE CONCERNING SPACE OBJECT REGISTRATION - THE THEORY DEMONSTRATED

> *Ten years after the entry into force of this Convention, the question of the review of the Convention shall be included in the provisional agenda of the United Nations General Assembly in order to consider, in the light of past application of the Convention, whether it requires revision... Such review shall take into account in particular any relevant technological developments, including those relating to the identification of space objects.*
>
> Registration Convention[1]
> Article X.

A. INTRODUCTION - THE PROLIFERATION OF SPACE CAPABILITY

In the decade since the Registration Convention came into force, much has occurred with respect to activities in outer space. Chief among the technological breakthroughs during this period, has been the emergence of the US Shuttle Transportation System (STS). The maiden flight

1. "Convention on Registration of Objects Launched into Outer Space" 28 U.S.T. 695, opened for signature (hereinafter OFS) 14 January, 1975, entered into force (hereinafter EIF) 15 September, 1976.

on 12 April, 1981 was followed by 23 other successful flights, prior to the Challenger disaster of 28 January, 1986. Although there is presently an hiatus, the latest estimates suggest that the STS will be on line in mid-1988.[2]

The Soviet space programme has not been idle either, with a consistently high launch rate comprising 80-85% of the entire world's space launches per year.[3] Furthermore, this period has witnessed the launch and operation of the second-generation Salyut Space Stations 6 and 7,[4] and the recent launch of the MIR modular station.[5] Currently, the Soviet Union has two operation-

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2. "NASA Selects Design Options for Shuttle Booster Joints", E.H. Kolcum, Aviation Week and Space Technology (hereinafter AW&ST) 7 July, 1986, 18.

3. N.L. Johnson, The Soviet Year in Space: 1983 (1984, Teledyne Brown Engineering), 1.

4. M.S. Smith, Space Activities of the United States, Soviet Union and Other Launching Countries/Organizations: 1957-1983 - Congressional Research Service Report No. 84-20 SPR, Library of Congress (136 ff), 19 et seq.

5. See "Age of Space: A Soviet Step", J.N. Wilford, New York Times, 14 March, 1986, A1, and "Soviets Complete First Manned Mir Mission", AW&ST 21 July, 1986, 19; see supra Chapter I-A.

al space stations on orbit simultaneously.[6]

In Western Europe, the European Space Agency (ESA) was created five months after the Registration Convention was opened for signature.[7] Its most significant completed programme, in the present context, was the development of the ARIANE expendable launch vehicle (ELV).[8] There have been 14 successful launches (and four failures) commencing with a Christmas Eve 1979 launch from the Kourou French Guiana site. Projected launch rates of eight per year have been cited,[9] recommencing in September 1987 following an inquiry into the V18 failure.[10]

With steadily increasing Japanese prosperity, has

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6. "Soviets Plan to Keep Salyut 7 in Orbit", AW&ST, 14 July, 1986, 142.

7. Twenty Years of European Cooperation in Space - An ESA Report, '64, '84 (1984, European Space Agency Publication, 259 ff), 29 *et seq.*, see *supra*, Chapters I B 2 (a) and II B 4.

8. See A.J. Young, Space Transportation Systems (1984, Unpublished LL.M. Thesis, McGill University, 341 ff), pp. 7-25.

9. "All Payload Slots on Ariane Booked Through Next Year", AW&ST, 7 April, 1986, 20.

10. On 30 May, 1986, see "Europe Delays Ariane Launches Until 1987 for Modification, Testing of Third-Stage Engine", AW&ST, 14 July, 1986, 31.

come a dramatic expansion of its space programme. Although still limited in its launch frequency,[11] the capacity of its launch vehicles has kept pace with the growing percentage of indigenously developed technology comprising its ELVs. The N-I launcher, largely a US Delta made under licence in Japan, was operational the year the Registration Convention came into force. Since then, it has been superseded by the more powerful N-II and, recently, by the two thirds Japanese H-1 ELV, launched for the first time on 13 August 1986.[12]

The other two "space powers",[13] the People's Republic of China (PRC), and India, have also consolidated significant, though more modest, programmes over the last

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11. Op.cit., supra, note 8, 44.

12. See "Japan Challenging Western Leadership in Space", AW & ST 14 July, 1986, 18, which mentions the H-2 booster, entirely Japanese technology, which will be launched in the early 1990s as a competitor for ARIANE, and the US Shuttle if it resumes its satellite launching role, see supra, Chapter I B 3.

13. The UN defines "space power" as follows:

> It was the first launching of an artificial satellite into earth orbit by the USSR in 1957 that marked the beginning of the Space Age, and even today the criterion that defines a 'space power' is the capability of carrying out a complete space mission, including the launch into orbit. (Emphasis added).

UN Doc. A/CONF.101/10. Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, UNISPACE '82, 30.

decade. The PRC had performed two minor launches prior to 1975, though its major achievements occurred much later, in 1984, with its first satellite launch to geosynchronous orbit, using the Long March 3 ELV.[14] The latter vehicle is currently being marketed commercially, and has already tentatively scheduled three satellite launches before the end of 1987.[15] Estimates of 6 to 7 launches per year appear feasible in the near future.[16] Regarding India, it became a space power in 1980[17] with an amalgamation of Soviet and French technology. Its programme will reach maturation in mid 1987, with the launch of its Augmented Satellite Launch Vehicle.[18]

It is perhaps this growing cadre of space powers

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14. The STW-2 satellite was launched on 29 January, 1984, see "La Chine a lancé un quatorzième satellite", Air et Cosmos #988, 11 February, 1984, 32.

15. "Teresat, Chinese Sign Agreement on Communications Satellite Launch", J.C. Lowndes, AW&ST 23 June, 1986, 20, and "Swedes May Use Chinese Launcher", AW&ST, 24 February, 1986, 21.

16. "PRC Evaluating Possible Participation in Space Station", AW&ST 26 May, 1986, 21, 22.

17. Op.cit., supra, note 8, 29, 33.

18. "India Plans New Launch Site for Polar-Orbiting Satellites", AW&ST, 26 May, 1986, 93. The ASLV has a potential capacity of 150 kg to Low Earth Orbit. However, the ASLV failed in its August 1987 attempted launch.

which recently prompted the French delegate to the UN Committee on Peaceful Uses of Outer Space (COPUOS) to deem "useful and important a study on registration of space-launched objects", including such issues as "obligatory marking or labelling of objects launched into outer space" and a "deadline set for registration".[19] It must be appreciated that this proliferation of launch capability, by its very diversity, complicates the input of registration information. Furthermore, it will soon increase the output of such information, by virtue of the increased world launch frequency which it presages. It is the aim of this chapter to assess the ability of the Registration Convention to deal with this existing situation and to predict its performance during the ensuing decades of exponential development in space technology in the Space Stations' Era.

B. AN EVALUATION OF THE CONVENTION

1. CONVENTION PRE-HISTORY - THE MISCHIEF

Emerging from the seminal 1957/58 International Geophysical Year (IGY), the Committee on Space Research

19. United Nations Press Release, OS/1259, 11 June, 1986, COPUOS 29th Sess., 292nd meeting, 3.

(COSPAR) of the International Council of Scientific Unions (ICSU) commenced early the publication of information concerning launchings. Its informal system became the "Guide to Rocket and Satellite Information and Data Exchange",[20] in May 1962. A continuous record has been maintained in the triannual COSPAR Information Bulletin ever since.[21] A number of criteria are therein recorded,[22] with the aim of providing

> the world scientific community with the means whereby it may exploit the possibilities of satellites and space probes of all kinds for scientific purposes, and exchange the resulting data on a cooperative basis.[23]

Clearly expressed as "supplementing but not duplicating existing technical and scientific exchanges", UN General Assembly (UNGA) Resolution 1721 (XVI) of 20 December, 1961 called upon

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20. See C.W. Jenks, Space Law (1965, Stevens & Sons) 219. The Guide was accompanied by a listing entitled "Unified Synoptic Codes for Rapid Communication of Satellite Orbital Data".

21. Published by Pergamon Press, the latest available issue to this writer was No. 102, of April 1985.

22. Data categories are: COSPAR Designation; Country of Origin; Launch Date; Lifetime or Descent Date; Available Information on the space object and its personnel if appropriate; and the Initial Orbital Elements of Apogee, Perigee, Inclination and Period.

23. Op.cit., supra, note 21, prefatory material.

> States launching objects into orbit or beyond to furnish information promptly to the Committee on the Peaceful Uses of Outer Space, through the Secretary-General, for the registration of launchings.[24]

Furthermore, the UN Secretary-General was to establish a "public registry" of such information.[25] The rationale for this was expressed to be that the UN should become a "focal point" for international co-operation in outer space. Both super-powers, the only space powers at that time, filed retrospective launch notifications in March, 1962[26] in voluntary compliance with the UN system.

In the ensuing legislative decade, three international treaties were developed, cumulatively necessitating the formalization of the UN registration system. Thus, the 1967 Outer Space Treaty[27] in article VIII attributed "jurisdiction and control" over space objects to the State

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24. Part B, para. 1.

25. Ibid., para. 2.

26. C.S. Sheldon II and B.M. DeVoe, "United Nations Registry of Space Vehicles", in Procs. of the 13th Colloq. on the Law of Outer Space (hereinafter Colloq.) of the Int'l Inst. of Space Law (IISL) of the Int'l Astronautical Fed'n, 127, 129 (1970).

27. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", 610 UNTS 206 (1967) OFS 27 January, 1967, EIF 10 October, 1967.

"on whose registry an object launched into outer space is carried." In addition, the 1968 Rescue and Return Agreement[28] mandated the return of re-entered space objects to their launching States, subject to the latter furnishing prior "identifying data".[29] Furthermore, the 1972 Liability Convention[30] expanded upon article VII of the Outer Space Treaty, by establishing the terms of liability of the launching state for damage caused by its space objects. There could be no completed chain of causation, and therefore no proof of liability, without internationally acceptable evidentiary proof of ownership of an offending space object.

28. "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space", 672 UNTS 119 (1968) OFS 22 April, 1968, EIF 3 December, 1968.

29. Ibid., article 5(3).

30. "Convention on International Liability for Damage Caused by Space Objects", 24 UST 2389 (1973), OFS 29 March, 1972, EIF 9 October, 1973, see supra, Chapter IV C for a discussion of liability issues in the space station context.

2. CONVENTION REALISATION - OBJECTIVE AND PERFORMANCE

After seven years of negotiation within COPUOS[31] commencing in 1968, the Registration Convention emerged. Its quadripartite objective was clearly stated in the preamble to be the establishment of: national launch State registration of its space objects; central UN registration on a mandatory basis; "additional means and procedures to assist in the identification of space objects"; and it was intended that the combination of the three foregoing elements "would contribute to the application and development of international law governing the exploration and use of outer space".

(a) National Registries

Regarding the first element, this was clearly intended to facilitate the operation of article VI of the

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31. It is not proposed to review the lengthy negotiations conducted during this period here, this having been done elsewhere, see: N.M. Matte, Aerospace Law - From Scientific Exploration to Commercial Utilization (1977, The Carswell Co. Ltd.), pp. 175-184; A.A. Cocca, "Convention on Registration of Objects Launched in Outer Space", in N. Jasentuliyana and R. Lee (eds.), Manual on Space Law (1979, Oceana Publications Inc.) Vol. I, pp. 173-189; and C.Q. Christol, The Modern International Law of Outer Space (1982, Pergamon Press), pp. 213-234.

Outer Space Treaty. The latter affirms "international responsibility for national activities in outer space", whether carried on intra- or extra-governmentally, and assures "that national activities are carried out in conformity with the provisions ... [of the] ... Treaty". In addition, the article requires each State Party to conduct "authorization and continuing supervision" of its non-governmental agencies' activities in space.[32] Due to the inability to predict with any certainty when and to what extent non-governmental activities, such as those of the private sector, would take place, article II of the Registration Convention gave a wide discretion to each State of registry. Thus, the latter is merely to inform the UN Secretary General (UNSG) of the establishment of its registry,[33] its contents and conditions of maintenance being entirely the purview of the State of Registry concerned.[34]

32. See e.g. The U.S. Commercial Space Launch Act PL 98-575, 98th Cong., 30 October, 1984, 98 Stat. 3055, which mandates the Office of Commercial Space Transportation within the Department of Transportation to establish a licensing process to regulate private sector space transportation systems. Interim regulations were promulgated on 26 February, 1986, "Dot Issues Launch Regs", Space Business News, 10 March, 1986, 5, see also supra, Chapter IV B.

33. Article II(1).

34. Article II(3).

Worthy of note in this context, is the U.K. Outer Space Act 1986 (c. 38). Section 7 of the Act requires the Secretary of State to "maintain a register of space objects" containing

> such particulars of such space objects as the Secretary of State considers appropriate to comply with the international obligations of the United Kingdom.

Regulations will be promulgated in due course by Orders in Council to establish this register and the particulars required to be recorded therein.[35] Although this Act has received the Royal Assent, its provisions will not come into force until the Secretary of State makes an Order by Statutory Instrument to do so. This will be subject to the creation of the aforementioned regulatory regime, with the system expected to be in place by the end of 1987.[36] Sweden has already developed such a regime, pursuant to legislation passed in 1982.[37]

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35. Section II. Regarding access to the register, section 7(3) provides that "any person may inspect a copy of the register on payment of such fee as the Secretary of State may prescribe."

36. Source: Personal correspondance with officials at the British National Space Centre, Millbank Tower, London.

37. See M.G. Bourély 'Quelques Rêflexions sur la Commercialisation des Activités Spatiales', XI Ann. Air and Space L. 171, 179 (1986).

(b) The UN Central Registry

Article III of the Registration Convention mandated the UNSG to "maintain a Register" to which there would be "full and open access". The information to be recorded in the Registry was specified in article IV.[38] More particulars are customarily given in the COSPAR system[39] than are elicited by article IV. Thus, in relation to the US

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38. Article IV states that:

1. Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:
   - (a) Name of launching State or States;
   - (b) An appropriate designator of the space object or its registration number;
   - (c) Date and territory or location of launch;
   - (d) Basic orbital parameters, including:
     - (i) Nodal period,
     - (ii) Inclination,
     - (iii) Apogee,
     - (iv) Perigee;
   - (e) General function of the space object.
2. Each State of registry may, from time to time, provide the Secretary-General of the United Nations with additional information concerning a space object carried on its registry.
3. Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit.

39. See op.cit., supra, note 22.

shuttle transportation system, US notification under article IV 1(e), "general function of the space object", states "reusable space transportation systems".[40] In contrast, a COSPAR entry on this system reads, under the category of "Available Information", as follows e.g. STS-51A

> On board were astronauts F. Hauck, D. Walker, J. Allen, D. Gardner and A. Fisher. The payload included Anik-D2 and Syncom IV-1. This mission recovered two spacecraft: Palapa-B2 and Westar 6.[41]

However, not even the COSPAR system can elicit more information regarding most Soviet launches. Thus, the stock phrase "Carries scientific instruments, radio system for precise measurement of orbital elements and radiotelemetry system",[42] is just as non-descriptive in its ubiquity as that employed in the UN Register, *viz* "investigation of the

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40. See e.g. UN Doc. ST/SG/SER.E/143, 18 April, 1986, "Information Furnished in Conformity with the Convention on Registration of Objects Launched into Outer Space", Note Verbale of 15 April, 1986 from the USA to the UNSG, pp. 2-3.

41. COSPAR Bulletin, op.cit., supra, note 21, 120.

42. Ibid.

upper atmosphere and outer space".[43]

Exceptionally, notifying States go beyond the letter of the <u>Registration Convention</u> and make a full disclosure of information concerning their space objects. The recent Canadian registration of its Anik-D2 communications satellite, launched during the above-mentioned STS Mission 51A, was a model of candour.[44]

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43. See e.g. <u>UN Doc.</u> ST/SG/SER.E/142, 3 April, 1986, "Information Furnished in Conformity with the Convention on Registration of Objects Launched into Outer Space", Note Verbale of 21 March, 1986 from the USSR to the UNSG, <u>passim</u>. US notification is not immune from such meaningless repetition, thus, the phrase "spacecraft engaged in practical applications and uses of space technology such as weather and communications" is very popular.

44. <u>UN Doc.</u> ST/SG/SER.E/137, 13 January, 1986, "Information furnished in Conformity with the Convention on Registration of Objects Launched into Outer Space", Note Verbale of 6 January, 1986 from Canada to the UNSG, which states at page 2:

Name of launching country:	Canada
Designator:	Anik D-2
Date of launch:	8 November 1984
Location of launch:	Cape Canaveral, United States of America
Launch vehicle:	STS - Space Shuttle
Nodal period:	Geostationary orbit
Inclination:	-
Apogee:	-
Perigee:	-
Longitude:	111.5° W
Frequencies and transmitter powers:	Table attached
Purpose:	Telecommunications
Operating entity:	TELESAT CANADA

The appendix contained an extensive listing of the transmitting frequencies and powers to be used.

Though the elements of registration are subject to criticism in their modesty, the major focus for negative comment has been the permissive nature of the time period for the transmission of information, which is "as soon as practicable."[45] Recently, the Czech writer Dr. Lubos Perek, on reviewing registrations from both the former voluntary and the present mandatory UN systems, remarked that "[t]he average delay found was about 4 months while the shortest delay was only 26 days. On the other hand, delays of 9 and 11 months have also been noted."[46] This compares very unfavourably with the SPACEWARN network, set up by COSPAR during the IGY, which transmits launch particulars through its Satellite Regional Warning Centres.[47] Although in some instances pre-launch information is made available under this system,[48] launching announcements are generally made ex post facto. In contrast to the UN

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45. Article IV 1. of the Registration Convention.

46. L. Perek, "Strengthening the Registration Convention", 28th Colloq. IISL 187, 188 (1985).

47. The centres are located at Darmstadt (FRG), Moscow (USSR), Slough (UK), Tokyo (Japan) and Washington D.C. (USA). See C.W. Jenks, op.cit., supra, note 20, 220, and supra Chapter VI D 1.

48. See ibid., Jenks, Appendix VIII, for excerpts from the COSPAR Guide to Rocket and Satellite Information and Data Exchange, 393 at 395.

system, more extensive information than the latter's is relayed "[w]ithin a few hours after successful launching of a satellite or space probe".[49]

(c) Space Object Identification

In view of the foregoing, the role of the Central UN Register in the identification of space objects is minimal. Thus, the aforementioned Dr. Perek states categorically that

> [t]he identification of orbiting space objects is a task beyond the scope of the Registration Convention. The information contained in the Central Register ... is insufficient for the purpose.[50]

Instead, this task is performed by the several extant national tracking and data analysis networks. Thus, the

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49. Ibid., emphasis added. The information furnished is as follows:

    The date and time of launch; date, time, and co-ordinates of injection into orbit, approximate apogee, perigee, orbital period, and angle of inclination of the orbit (for satellites); geocentric or heliocentric co-ordinates at a specific date and time, and expected approximate flight path (for space probes); radio-transmitter frequencies, approximate power, and mode of transmission, size, shape, reflectivity, and weight of the satellite or probe and other significant objects placed in orbit; other information which will facilitate observations or the subsequent computations of orbital predictions; and a brief description of experiments.

50. Op.cit., supra, note 46, pp. 189-190.

North American Aerospace Defense Command (NORAD) constantly monitors over 5000 space objects ranging from active satellites to orbital debris.[51] The Soviet system is no less extensive and, like the NORAD system, is also predicated upon military security.

There has been a recent revival of concern over the debris issue. It is not simply a matter of the large number of trackable pieces of debris. The more sobering fact is the unknown millions of fragments under 4 centimetres which are untrackable by NORAD.[52] Some of these smaller fragments have impacted upon the US Space Shuttle and satellites on orbit.[53] Furthermore, at least two satellites are believed to have broken up on orbit due to collision with debris.[54] With the inevitable increase of activity, particularly manned, on orbit, together with ever larger structures being constructed on orbit, debris can only

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51. See R.C. Hall, "Comments on Traffic Control of Space Vehicles", 31 J. Air L. & Com. 327, 332 (1965), see *infra* section (d)(iii).

52. See 'Space Junk Menace Grows', Space Business News, 6 October, 1986, 6.

53. *Ibid.*

54. *Ibid.* See also N.L. Johnston 'Nuclear Power Supplies in Orbit', Space Policy Vol. 2, No. 3, August 1986, 223, 229.

become a greater hazard. This is an issue which requires more careful study at the international level, most appropriately within COPUOS.[55]

(d) Contribution to the Application and Development of the International Law of Outer Space

Professors McDougal, Lasswell and Vlasic, in their 1963 magnum opus on Space Law,[56] identify the two elements comprising the act of registration, namely: attribution of nationality; and physical identification of a craft.[57]

(i) Physical Identification - We have seen that the physical identification of space objects is better performed by the COSPAR scientific networks and national tracking and data systems. Furthermore, in the only occurrence to date necessitating impartial international identification of a re-entered space object, the Registration Convention proce-

55. See supra, Chapter VI, footnote 47 for some relevant articles on this issue.

56. M.S. McDougal, H.D. Lasswell and I.A. Vlasic, Law and Public Order in Space (1963, Yale University Press).

57. Ibid., 564.

dure was ineffective. Thus, the re-entry of the Soviet nuclear-powered satellite Kosmos 954 in early 1978, came a scant four months after its launch, the average time period for notification to the UNSG. Even if it had been notified in time, the information would have been inadequate for its proper identification, i.e. the crucial fact of its having a nuclear power source on board would not have been disclosed.

(ii) Nationality - Concerning the attribution of nationality element, the concept is so familiar in international law, that the resort to analogy may be justified.[58] In the Law of the Sea, the 1958 Geneva Convention on the High Seas[59] articulated pre-existing customary international law on nationality. Article 5 states in part that:

> [e]ach State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag. Ships have the nationality of the State whose flag they are entitled to fly. (emphasis added)

Thus, registration denoting nationality is entirely the

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58. Ibid., 520 et seq.

59. Adopted at the Law of the Sea Conference on 29 April, 1958; in force 30 September, 1962. This remains unaltered by the Law of the Sea Convention, UN Doc. A/CONF.62/122 7 October, 1982.

preserve of national law and practice which has evolved over the centuries of maritime commerce. This is exemplified by the U.K. Merchant Shipping Act 1894.[60] Part I of this Act[61] details the necessity for and the conditions, form and effects of proper registration of British vessels and the negotiability of property rights in such registered vessels. This form of registration performs a different function from that envisaged for space objects, being more reminiscent of a land registry _inter alia_ facilitating the creation of liens and relating to title or ownership.[62] Worthy of emphasis in this context, is section 7 of the 1894 Act, which established detailed particulars in order that "[e]very British ship shall before registry be marked permanently and conspicuously...."

In Air Law, this distinction in terminology is maintained. Chapter III of the Chicago _Convention on Inter-_

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60. 57 and 58 Vic. C. 60, see 11 _British Shipping Laws_, Temperley, M. Thomas & D. Steel (Eds), _The Merchant Shipping Acts_, 7th Ed. (1976, Stevens & Sons) 3 _et seq._

61. _Ibid._, sections 1-91.

62. See: 13 _British Shipping Laws_, N. Singh & R. Colinvaux, _Shipowners_ (1967, Stevens & Sons) pp. 1-17; and W. Tetley, _Maritime Liens and Claims_ (1985, Business Law Communications Ltd.) _passim_.

national Civil Aviation[63] outlines the law on nationality of aircraft.[64] Thus, article 17 states that "[a]ircraft have the nationality of the State in which they are registered", while article 19 leaves such registration up to the laws and regulations of each contracting State. Instead of the flag concept, article 20 mandates that aircraft shall bear their "appropriate nationality and registration marks". This was developed in Annex 7 to the Chicago Convention, entitled "Aircraft Nationality and Registration Marks". In addition to specifying the characters and location thereof comprising registration marks, the Annex states in paragraph 6, that "[e]ach Contracting State ... shall maintain a current register showing for each aircraft registered by that State ... the information recorded in the certificate of registry." The latter certificate is carried on board the aircraft at all times, together with a fireproof identification plate inscribed with the "nationality" and "registration mark" of the aircraft.[65] Thus, the act of

63. 15 UNTS 295 OFS 7 December, 1944, EIF 24 October, 1945.

64. See B. Cheng, The Law of International Air Transport, (1962, Stevens & Sons) 128 et seq., and N.M. Matte, Treatise on Air-Aeronautical Law (1981, The Carswell Co. Ltd.) 111-113 and 180-181.

65. Annex 7, paras. 7 and 8.

registration confers nationality upon the aircraft, its indicia being the approved markings which it bears.

(iii) The Basic Trichotomy - It is submitted that a contextual analysis of space object registration (see Figure VII-1) discloses a basic trichotomy of systems which are often used interchangeably, leading to confusion. The UN Central Registry functions, at best, to facilitate the operation of the extant space law treaties. At worst, it is no more than a rather inefficient census of space activities which is updated rather erratically both in quality of notification and timing thereof.

In contrast, the national registers confer nationality on space objects, which become quasi-territorial for the purposes of state jurisdiction in international law.[66] This is strongly reminiscent of flag-State jurisdiction in the Law of the Sea. Furthermore, each national register of space objects is intended to promote the orderly development of national space laws and regulations in the future, by identifying the subjects of such laws. This is similar to the way in which national registries of aircraft

66. See B. Cheng, "The Legal Regime of Airspace and Outer Space: The Boundary Problem, Functionalism versus Spatialism: The Major Premises" V Ann. Air & Space L. 323, 342 (1980).

A CONTEXTUAL ANALYSIS OF SPACE OBJECT REGISTRATION

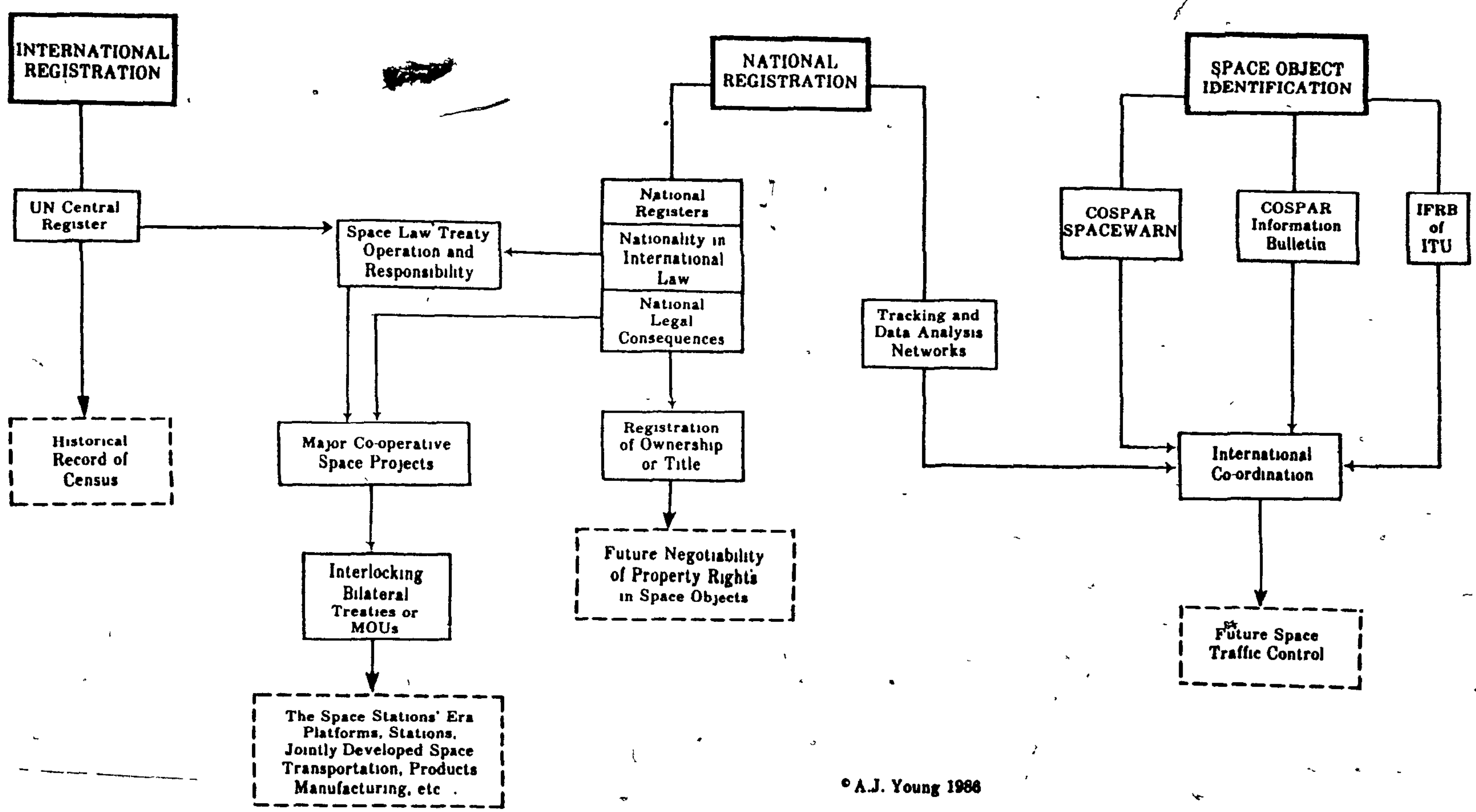

Figure VII-1.

have been utilized in Air Law. As in Air Law, this may ultimately permit the registration of liens and other property rights[67] in space objects and so render them commercially negotiable on an international space market. However, this is a long way off, in view of the prohibitive sums currently required to operate in the space milieu. Thus, only governments (through their administrative space agencies, their procurement from their respective national private sectors and their military-industrial complexes), governmentally-backed international consortia (such as Arianespace S.A.) and the largest aerospace corporations, possess the wherewithal to do so for the foreseeable future. Nevertheless, the foundations are laid to permit such a development.

The third system, that for space object identification, is largely misunderstood or forgotten in this context. It comprises the COSPAR SPACEWARN network and Information Bulletins, which are supplemented nationally by each tracking and data analysis network. In addition, the International Frequency Registration Board of the International Telecommunications Union co-ordinates the frequencies

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67. See D.L. Johnston, "Legal Aspects of Aircraft Finance", Part I 29 J. Air L. & Com. 161 (1963), and Part II 30 J. Air L. & Com. 299 (1964); see also W. Eyer, "The Sale, Leasing and Financing of Aircraft", 45 J. Air L. & Com. 217 (1979).

used by satellites to promote the orderly utilization of the space milieu.[68] The relationship between registration and traffic control was appreciated over twenty years ago by R. Cargill Hall, who wrote that

> the current United Nations launch register offers only limited information on the date, time, and trajectories of spacecraft launches from which, primarily, launch totals and orbital success rates for the United States may be ascertained. Although the launch register generally is recognized to establish nationality and jurisdiction for registered craft (in itself a major achievement), it is not a usable source of information for determining realtime space traffic patterns or for regulating this traffic in airspace and in outer space.[69]

Thus, recalling the fact that one of the two facets of registration is the physical identification of a craft, the UN Central Registry is incapable of performing this function. Therefore, in the future context of space traffic control, for this will one day be necessitated, this lacuna in the registration process will be filled by other means. It is quite probable that the means chosen will involve a co-ordination of the existing national, inter-governmental,

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68. See E. Galloway, "The Relevance of General Multilateral Space Conventions to Space Stations", paper submitted to an International Colloquium on Space Stations organized by the IISL et al. in Hamburg, FRG, 3-4 October, 1984, pp. 17-20; see also N.M. Matte, Aerospace Law - Telecommunications Satellites (1982, Butterworths), pp. 85-106.

69. Op.cit., supra, note 49, 331.

and international non-governmental means in use today. In a 1979 Report of the Secretariat to COPUOS,[70] it was stated that

> it is conceivable that with the projected growth in both launches and the population and size of orbiting satellites there will come a time when the probability of interference with spacecraft performance, and possibly even physical collision, may become high enough to require consideration. ... At such time it might therefore become worth while to establish a centralized global agency to co-ordinate spacecraft launches and orbital transfer operations.[71]

In compliance with its mandate under UNGA Resolution A22-20[72] the International Civil Aviation Organization (ICAO) stated, in its Background Paper to UNISPACE '82,[73] that

> the Organization and its Legal Committee is prepared, if and when necessary, to study with due priority ... the problems of co-ordination of civil aviation with outer space activities traversing the navigable airspace, possible problems which might be created by the space shuttle service, including the registration of such objects and liability for damage caused by their operation in the

70. UN Doc. A/AC.105/244, 16 August, 1979, "International Implications of New Space Transportation Systems".

71. Ibid., 18 para. 68.

72. "Use of Space Technology in the Field of Air Navigation", 1977.

73. UN Doc. A/CONF.101/BP/IGO/1, 1 June, 1981.

airspace or on the ground.[74]

In view of ICAO's seminal influence in the establishment and maintenance of efficient air traffic control,[75] a future role as co-ordinator of space traffic control can readily be envisaged.[76]

As can be seen from Figure VII-1, the international registration system embodied in the Registration Convention was designed for very specific and limited purposes. As presently constituted, the system cannot develop further to meet the exigencies of the future. If it remains unaltered, it will become an anachronism, circumvented by the other two systems, which have an inbuilt flexibility and potential for expansion. In the following section, the latter will be substantiated, for it is a process which has already begun.

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74. Ibid., 6, para. 14.

75. Annex 11 to the Chicago Convention concerns air traffic control standards and recommended practices and is entitled "Air Traffic Services".

76. For further information on space traffic control, see: McDougal, Lasswell and Vlasic, op.cit., supra, note 51, 587 et seq.; A.G. Haley, Space Law and Government (1963, Appleton-Century-Crofts), pp. 136-151; R.C. Hall, op.cit., supra, note 49; Sheldon and Luxenberg, op.cit., supra, note 26, pp. 138-141; L. Perek, "Traffic Rules for Outer Space", 25th Colloq., IISL 37 (1982); and M. Menter, "Legal Regime of International Space Flight", in S. Gorove (ed.), The Space Shuttle and the Law, (1981, L.Q.C. Lamar Society of Int'l. L., Monograph Ser. No. 3, Univ. of Miss. L. Centre), 61.

C. CONVENTION EXPEDIENCE AND TECHNOLOGICAL PROGRESS

1. SOME CONCERNS OF TO-DAY

(a) Nuclear Power Sources (NPSs)[77]

As mentioned above, the Registration Convention was of no assistance during the Kosmos 954 incident in 1978. Nor did it assist in the subsequent Kosmos 1402 re-entry in late 1982 and early 1983. In response to this deficiency, after eight years of negotiation, COPUOS has evolved a draft principle in mitigation.[78] The latter reiterates the familiar article IV criteria, but supplements these with the requirement of "Information on the radiological risk of nuclear power sources", including disclosure of the type of

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77. In this context, the complex NPS issue can only be dealt with superficially. For an in-depth treatment of the issue, supra Chapter VI passim.

78. See UN Doc. A/AC.105/370, 5 May, 1986, "Report of the Legal Sub-Committee on the Work of its Twenty-fifth Session (24 March-11 April, 1986) Annex II, pp. 16-17.

NPS used and the quantities of fuel involved.[79]

(b) The Militarization of Outer Space

In the opinion of Professor Ivan Vlasic,

> [t]he reporting record of the major space powers under the Registration Convention consistently exhibits a lack of candour and minimal concern for the interests of other states. It suffices to recall that no space mission has ever been reported by these powers as serving military

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79. The principle states in part that:
(1) Each State launching a space object with nuclear power sources aboard should, in a timely manner, inform States concerned in the event the space object is malfunctioning with the risk of re-entry of radioactive materials to the earth. The information should be in accordance with the following unified format:
1. System parameters
1.1 Name of launching State or States including the address of the authority which may be contacted for additional information or assistance in case of accident.
1.2 International designation.
1.3 Date and territory or location of launch.
1.4 Information required for best prediction of orbit life-time, trajectory and impact region.
1.5 General function of spacecraft.
2. Information on the radiological risk of nuclear power source(s)
2.1 Type of NPS: radioisotopic heat source or reactor.
2.2 The probable physical form, amount and general radiological characteristics of the nuclear fuel and contaminated and/or activated components of the space object likely to reach the ground.

purposes.[80]

A number of amendments have been suggested in order to render the Convention functional in this area. Thus, in a June 1984 statement by the French delegation to the UN Conference on Disarmament an amendment to the Convention was proposed, to the effect that every State or launch body would commit itself

> to provide more detailed information on the features and missions of objects launched into space in order to improve the possibilities of verification.[81]

Furthermore, the legal advisor to the Ministry of Foreign Affairs of the PRC, proposed a protocol to the Convention to add the following paragraph to article IV thereof:-

> The State of registry shall immediately inform the Secretary-General of the United Nations in case any object carrying any kind of outer space weapon has been launched into outer space.[82]

Regardless of the questionable viability of amending the

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80. I.A. Vlasic, "Disarmament Decade, Outer Space and International Law", 26 McGill L.J. 135, 191 (1981), this issue is dealt with in more detail <u>supra</u> Chapter V.

81. The 12 June 1984 statement is reproduced in <u>Survival</u>, vol. XXVI, Sept./Oct. 1984, 235-37.

82. He Qizhi, "The Registration Convention and Maintenance of the Peaceful Uses of Outer Space", in N. Jasentuliyana (ed.), <u>Maintaining Outer Space for Peaceful Uses</u> (1984, UN University), 120. See also by the same author "The Militarization of Outer Space and Legal Controls" IX <u>Ann. Air & Space L.</u> 439, 448 (1984).

Registration Convention sufficiently to achieve the objective of controlling outer space weaponization, it is sufficient to note at this juncture that it performs no such function at the moment.

2. PROBLEMS OF TOMORROW - THE SPACE STATIONS' ERA

(a) The US/International Space Station

Whichever space station design is decided upon, the larger more expensive "dual-keel" design,[83] or a more modest version,[84] it is reasonable to assume that the goal of modular construction will be pursued. Furthermore, among all the myriad problems of aspiration, co-ordination and integration requiring solution to enable this venture to proceed on its envisaged international basis, registration will be a significant concern. Stated succinctly, the difficulty lies with according proper recognition to the considerable investment of money and expertise in the venture made by the several partners. Under the Registra-

83. See "Space Station Redesigned for Larger Structural Area", C. Covault, AW & ST 14 October, 1985, 16.

84. See "Launch Capacity, EVA Concerns Force Space Station Redesign" C. Covault AW & ST, 21 July, 1986, 18, see supra, Chapter I B 1(b)(i).

tion Convention system, one registration of the station by the USA would suffice, since it will undoubtedly be launched primarily by the US Shuttle Transportation System.[85] Thus, as a "launching State" under article 1 of the Convention, the USA would be the logical choice to be the "State of registry" also, a fortiori in view of its majority investment share in the project. It will be recalled that the act of registration in a national register confers nationality and accords jurisdiction and control over and international responsibility for a space object. Clearly, a sole US registration would lead to injustice and would be unacceptable to Canada, ESA and Japan. However, as part of the ongoing Phase C/D negotiations, for development and construction of the US/International Space Station, an inbuilt "escape clause" in the Convention is being employed. The latter occurs in article II 2 of the Convention, which states as follows:-

> Where there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object in accordance with paragraph 1 of this Article, bearing in mind the provisions of Article VIII of the Treaty on Principles Governing the Activities of States in the

85. There is a possibility that some modules could be launched aboard ESA and/or Japanese ELVs, though it is more likely that, in the context of the Space Stations' Era, they will be used to launch nationally developed station-associated free-flying platforms.

> Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and without prejudice to appropriate agreements concluded or to be concluded among the launching States on jurisdiction and control over the space object and over any personnel thereof. (Emphasis added).'

Such an agreement is currently being negotiated between NASA and ESA.[86] It is submitted that a series of interlocking bilateral treaties or Memoranda of Understanding will be developed, to govern the operation of the US/International Space Station and its associated hardware.[87] Separate series' of bilateral inter-governmental negotiations are occurring between the USA and each of its prospective partners. These will lead to the conclusion of at least three inter-governmental agreements (USA-ESA; USA-Japan and USA-Canada) together with supplementary executive agreements between NASA and its counterparts in the other three partners.[88] Of course, as we have seen registration is only one of the many issues to be dealt with in such agree-

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86. "European Role in Space Station - Autonomy Vs Cooperation", Space Commerce Bulletin, 31 January, 1986, 5.

87. See Figure VII-1, see also Chapters I & II passim.

88. NASA counterparts would be ESA; for Japan, the Science and Technology Agency (STA); and for Canada, the Ministry of State for Science and Technology (MOSST).

ments.[89] Nevertheless, it would appear more pragmatic and logical to include this matter in the context of the other legal issues involved, such as: intellectual property rights; liability provisions; and the regulation of managerial and contractual responsibilities in the programme's administration.

(b) The Role of Markings in On Orbit Identification

It will be recalled from the opening quotation to this chapter, that article X of the Registration Convention left open the question of "technological developments ... relating to the identification of space objects". The issue of markings was so intractable before COPUOS during the negotiation of the Convention, that it was left unresolved.[90] The basic obstacle was the belief by some delegations, notably the USA, that markings were of no value, since the technology to render them re-entry-survivable did not exist. In contrast, it is the contention of this chapter that, in view of state-of-the-art technolo-

89. See supra, Part Two of this thesis, Chapters II-IV.

90. See Christol, op.cit., supra, note 31, 224 et seq.; and ibid., Cocca, 184 et seq.

gy, this objection has been rendered moot.

State practice in this matter is, perhaps surprisingly, quite consistent. However, whether it is done in contemplation of legal consequences, or merely out of national pride is debatable. Regarding Soviet practice, it has been stated by Dr. Piradov that

> [t]he national ownership of space objects is established on the basis of their national identifying markings. The Soviet Union, for instance, places pennants with appropriate inscriptions and the emblem of the USSR on all the objects it launches into space.[91]

As for US practice, a casual perusal of industry, press stills, or video footage of shuttle missions, clearly discloses a plethora of national and corporate emblems on display. Heretofore, these may have been dismissed as mere decoration. However, with the realisation of the anticipated expansion in orbital activity, particularly manned, such markings may well assume greater significance. Although predictive scenarios abound and are renowned for their inaccuracy, there is a realistic likelihood of the following being in operation by the end of the century:

- several space stations - Soviet (currently two), US/-International, European (Columbus) and possibly Japanese;

91. A.S. Piradov (ed.), International Space Law (1976, Progress Publishers) 96.

- a flotilla of separately-owned and tended platforms, developed and launched both independently (governmentally and by the private sector) and co-operatively (inter-governmentally);
- and several manned shuttle transportation systems, in addition to the extant US system, there should be a Soviet system (perhaps two), ESA's HERMES and a Japanese shuttle.[92]

A scant decade or so away, this activity presages a dual development. On the one hand, there will be a continuous manned presence on orbit. Indeed, we will already be close to that objective, with the Soviet space stations and an operational US STS on orbit simultaneously. A formidable array of highly sensitive optical devices[93] is at the disposal of the personnel aboard these instrumentalities. In addition, there will be a concomitant development in "teleoperation" (remote manipulation) with necessarily

92. See Young, op.cit., supra, note 8, pp. 82-100.

93. Ibid., pp. 225-243.

efficient optical capabilities.[94] Also, once the potentialities of artificial intelligence are harnessed, the possibilities are numerous.[95] Together, these developments will render the space objects operating in near-Earth space visible. This will not only facilitate future space traffic control, paralleling the developments in aerial regulation, it will also aid in the operation of the Liability Convention. Article III of the latter establishes fault liability for damages which occur to space objects and personnel in outer space. Obviously, the availability of visual data would be of considerable assistance in providing evidence. Furthermore, with the increasing perfection of salvage operations, such as that performed during Challenger mission 41-B of 3 February, 1984,[96] the necessity for a dangerous large satellite re-entry will be reduced. Thus,

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94. As an indication of the potentialities of this process, J.P. Aerospace in the USA is developing the EOHIPPUS Probe. The latter could be carried into space aboard most US and international launch systems, and will propel itself to rendez-vous with any chosen satellite to gather data on any malfunctions, such data being relayed to Earth. Test flights are expected in 1988. Space Commerce Bulletin, 9 May, 1986, 10.

95. See "Europeans Accelerate Work in Artificial Intelligence" AW & ST 10 March, 1986, 261, and "AI Projects at NASA Encompass Processing for Shuttle, Station", E.H. Kolcum, AW&ST 24 March, 1986, 86.

96. See op.cit., supra, note 92, 287 et seq.

markings will remain inviolate and the old objection is circumvented.

D. CONCLUSION - A MORIBUND CONVENTION

It will be apparent from the foregoing that the Registration Convention is in need of a major overhaul. Not only was it formulated with very limited goals, but it also fails to achieve these with any great efficiency. No doubt the drafters of the Convention were cognisant of its shortcomings, since one of its only 12 articles is a ten-year review clause.[97] Despite this clear need for review, the excruciatingly deliberate operation of the COPUOS- administered international space legislative process is a formidable obstacle. It is almost certain that, long before this can be done, national and private international law will have irreversibly extended their jurisdictions to meet the exigencies of space exploitation. This is a development countenanced by the Convention itself, which will remain as a quaint historical record of the early days of space

97. Review clauses also appear in the Liability Convention, article XXVI and the Moon Treaty ("Agreement Governing the Activities of States on the Moon and Other Celestial Bodies" UN Doc. A/Res/34/68, OFS 14 December, 1979, EIF 11 July, 1984), article 18, both of which are much more complex treaties.

activity.

The fate of the <u>Registration Convention</u> is the prime exemplar of the theory outlined in the Introduction to this thesis. Thus, the inapplicability, by deliberate omission, inherent ambiguity and ensuing State practice, of a significant part of current global Space Law is clearly demonstrated. The following and final chapter of this thesis will address this issue in more detail.

VIII. CONCLUSION - DEMOCRATIZING THE MILIEU IN THE SPACE STATIONS' ERA

> *[E]ach state must now recognize that what it solemnly says it will do, or, more important[ly], what it says it will not do become a part of that trellis of reciprocal expectations on which the fragile international system grows.*
>
> Prof. Thomas M. Franck.[1]

> *Happily, law has not been quite proof against utopian idealism.*
>
> Prof. Percy E. Corbett.[2]

A. SETTING THE STAGE - THE DRAMATIS PERSONAE

The stage for outer space activities is founded upon four basic industries: telecommunication; remote sensing; space transportation; and materials processing in space (MPS). Access to this stage and participation in the play of events which take place therein, exhibits a pyramidal structure. At its apex are the six space powers who possess the capability to launch a mission into outer space,

1. T. M. Franck, 'World Made Law: The Decision of the ICJ in the Nuclear Text Cases', 69 Am. J.Int'l L. 612, 616 (1975).

2. P.E. Corbett, The Growth of World Law (1971, Princeton Univ. Press), 178.

though they are by no means equally capable: the USA; the USSR; the ESA nations; Japan; the People's Republic of China; and India.[3] Leading the next layer of nations who have flown representatives in space is Canada which, as we have seen, is prominently involved in major space activities with the USA and ESA.[4] This is a group which is gradually expanding as both super-powers play host to chosen ambassadors from their respective friendly nations. Thus, the USA has employed its Shuttle STS to fly payload specialists

3. See A.J. Young, Space Transportation Systems, (1984, unpublished LL.M. thesis, Institute of Air and Space Law, McGill University), passim.

4. Marc Garneau was a payload specialist aboard STS-41-G, 5 October, 1984, ibid., 161.

from ESA,[5] France,[6] Saudi Arabia,[7] and Mexico,[8] and had intended, before the Challenger demise, to continue with representatives from the United Kingdom, Japan, Australia and the People's Republic of China.[9] Paralleling these developments, the Soviet Union has employed its Salyut-Soyuz system to permit Cosmonaut-Researchers from all the Interkosmos nations to visit Salyuts 6 and 7.[10] In addition Salyut 7 hosted French and Indian envoys and MIR

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5. Dr. Ulf Merbold (West Germany) flew aboard STS-9, 28 November, 1983, the first Spacelab mission. Other ESA payload specialists have since flown in subsequent Spacelab flights, e.g. Dr. Wubbo Ockels (The Netherlands), and Claude Nicollier (Switzerland). Ibid.

6. Patrick Baudry was aboard STS-51-G of 12 June, 1985, 'Saudi Prince Chosen to Fly Shuttle Mission that will Launch Arabsat 1B', AW&ST, 13 May, 1985, 21.

7. Sultan bin Salman Abdel Aziz al-Saud, the nephew of King Fahd of Saudi Arabia, was aboard STS mission 51-G, 'Saudi Astronaut's Islamic Mission', The Times, 6 May, 1985, 4.

8. Rudolfo Neri was aboard STS-51-E which inter alia launched the Mexican MORELOS satellite, 'Shuttle Mission EVAs to Demonstrate Space Station Assembly Techniques', AW&ST, 25 November, 1985, 63.

9. Op.cit. supra, note 3, 163.

10. See supra, Chapter I A 1, representatives have flown from Czechoslovakia, Poland, German Democratic Republic, Bulgaria, Hungary, Vietnam, Cuba, Mongolia and Romania.

will continue this trend with Syrian, Pakistani, French and perhaps British Cosmonaut-Researchers.[11] At the bottom of the pyramid are those majority of developing nations which are either striving for a launch capability, such as Brazil and Indonesia, or participate through utilization of telecommunication services or remote sensing data at various levels of commitment, depending upon resources, education and requirements.

This space constituency reflects existing terrestrial political orientations only up to a point. Undoubtedly the super-powers have employed their manned space systems for propagandistic and political purposes since existing alliances are clearly mirrored. As space has always been a prestige milieu, and no doubt always will be so, this is hardly surprising. At the same time, there are trends which transcend customary barriers, though this may not be free from the taint of propaganda also. The ultimate goal must be to create a climate in which the use of space assets is divorced from terrestrial political concerns and unaffected thereby. However, there are major obstacles in the way of this development, sustaining the massive inertia of geopolitics, and it will be a slow process. Nevertheless, it has begun, as indicated by the coordinated Soviet,

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11. *Ibid.*

ESA and Japanese missions to view Halley's Comet in 1986 with US participation also.[12] The international Inter-Agency Consultative Group (IACG) was established in 1981 to conduct the Halley watch.[13] Comprising representatives from Interkosmos, NASA, ESA, and the Institute of Space and Aeronautical Science (ISAS) of Japan, the IACG has plans for future missions in solar-terrestrial science.[14] In addition, the British National Space Centre has concluded a cooperative agreement with the Soviet Institute of Space Sciences.[15] This is augmented by continued Franco-Soviet

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12. See for example 'Comet Spectacular', Editorial by D.E. Fink, in AW&ST, 17 March, 1986, 11, Soviet spacecraft Vega 1 and 2 were joined by ESA's Giotto. There was US participation by individual American scientists who supplied experiments for the Vega spacecraft and shared Soviet data through third party intermediaries.

13. 'International Efforts Bolster East-West Space Cooperation', J.M. Lenorovitz, AW&ST, 17 November, 1986, 45.

14. 'Multinational Cometary Watch Group Plans New Ventures', J.M. Lenorovitz, AW&ST, 10 November, 1986, 28.

15. 'British-Soviet Space Pact', AW&ST, 3 November, 1986, 41.

cooperation through CNES.[16] Furthermore, Sino-Japanese cooperation is proceeding in relation to launches for small scientific and commercial satellites,[17] while Sino-British activities have commenced regarding joint satellite launching and design.[18]

These, then, are the main actors on the space stage. We must now seek to create a more meaningful role for the vast majority of nations who are only peripherally involved in space activities. However, they must not be mere stagehands or extras, but must be given supporting actors' roles of growing import.

B. WRITING THE SCRIPT - THE AETIOLOGY OF SPACE LAW

Throughout this thesis, global space law relevant to the Space Stations' Era has been exposed in all its vulnerability and inapplicability. Unfortunately, this has been matched at the bilateral level by US-Soviet so-called

16. The Centre National d'Études Spatiales, see 'France will Perform Medical, Industrial Experiments on Mir', AW&ST, 20 October, 1986, 101, and 'Soviets Woo Europeans to Mir', Space Business News, 20 October, 1986, 1.

17. 'China and Japan Study Launchers For Small Satellite Payloads', AW&ST, 13 October, 1986, 20.

18. Space Commerce Bulletin, 19 December, 1986, 9.

arms control treaties. On the positive side, there are the numerous international agreements for space cooperation at the global, multilateral and bilateral levels, together with significant national legislation in the registration and licensing fields for space commercialization. In addition, negotiations proceed, though somewhat precariously, towards an unprecedented cooperative venture, the US/International Space Station. This is presently being conducted along bilateral lines, but this may evolve into a limited multilateral arrangement.

Meanwhile, discussion continues in such fora as the UN Committee on Peaceful Uses of Outer Space (COPUOS) and the Conference on Disarmament (CD). Some progress has been made, producing principles for remote sensing, direct broadcasting by satellite (DBS) and nuclear power sources (NPS). Although motivated by the highest of ideals, these measures suffer from both a questionable status in International law and, being the result of myriad compromises, from being emasculated to an acceptable benign form. The consensus methodology employed by both the 53 member COPUOS and the 40 member CD, together with their continued failure to produce any treaties in the outer space context applicable to the needs of the present and immediate future, indicate that both bodies are stagnating. This is a fact, despite the thousands of hours of stale rhetoric reproduced in millions of pages of documented records in both New York and Geneva. Such a global legislative system functions, propelled by its own self-fulfilling momentum, until it is confronted by problems requiring near-term solutions. It is submitted that the forces of space commercialization, spearheaded by the stations, and space weaponization, as exemplified by BMD research and development, demand immediate response. The written record of space law as recounted throughout this thesis clearly indicates that the response will be furious paper-shuffling, resounding oratory and perhaps a set of principles or a carefully drafted, basically inapplicable, treaty or two, as a palliative to still the debate.

In contrast, there is a growing corpus of lex spatialis at the national, bilateral and multilateral levels which represent pragmatic solutions to real issues as they occur. The zenith of this process will be the successful conclusion of agreements for the US/International Space Station. This will, in a single step, advance the science of space law on a realistic plane further than it has come since its beginning in 1957 with the first UN resolutions on space matters. Developments are proceeding apace, in the absence of global legislation State practice leading to customary international law, or piecemeal multi-level legislative action will ensue, indeed they have done so already. This does not have to be perceived as veiled imperialism or colonialism in the res extra commercium space milieu, but may be seen as its maturation, paralleling developments in maritime and air law. What must be avoided is the cumulative legislative reinforcement of the terrestrial status quo in the "province of all mankind", doing by collateral means what could not be done openly at the global level.

C. DIRECTING THE PLAY. - THE MORPHOLOGY OF SPACE COOPERATION

Many have advocated the creation of a World Space Organization, these desires finding their ultimate expression in a set of principles submitted to the Special Political Committee of the UN General Assembly by the Soviet Union on 14 November, 1985.[19] As conceived by the Soviet Union, such an organization would have the following duties:

> a) To ensure, under conditions of mutual advantage , the access of all States on a non-discriminatory basis to the results of scientific and technical achievements connected with the study and peaceful exploitation of outer space;
>
> b) To carry out international projects connected with the uniting of efforts and resources for the scientific investigation of outer space and the utilization of space technology;

19. UN Doc. A/SPC/40/3, 14 November, 1985.

> c) To provide assistance of every kind to developing countries in gaining access to the exploration and use of outer space and in using the practical results of such activity to speed the economic and social development of those countries, according to their needs and without any condition limiting their sovereignty;
>
> d) To co-ordinate on an international scale the activities of other international organizations in connection with the peaceful utilization of outer space;
>
> e) To help, where necessary, in monitoring the observance of agreements which have already been concluded or will be concluded with a view to preventing an arms race in space.[20]

This is a wonderful panacea provided it is protected from any tinge of reality. This propaganda ploy is at variance with the stated opinion of foremost Soviet space jurists Gennady Zhukov and Yuri Kolosov. The latter state categorically that

> in the epoch of the peaceful coexistence of States, there continues a competition between different socio-economic systems. This competition precludes any possibility of replacing the sovereignty of States with supranational bodies. All acts of international law framed in our day must reflect the realities of the times. Otherwise these acts will come into conflict with the realities of life and will, as has often happened in the past,

20. *Ibid.*, 5.

prove unviable.[21]

In view of the difficulties involved with intra-G7 space cooperation, let alone bilateral US-Soviet cooperative ventures, a World Space Organization is a universalist's pipe-dream.

Nevertheless, the other extreme viewpoint which would refute the relevance to developing nations of space activities, or impute nefarious rationales thereto,[22] must be avoided also. Developing nations need prestige and goals above the mundane just as much as developed ones. Of

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21. G.P. Zhukov and Y. Kolosov, International Space Law, (trans. Belitsky) (1984, Praeger). 187. See also the US National Commission on Space Report, Pioneering the Space Frontier (1986, Bantham) at 165 where it is stated that

> The Commission... recommends that: The United States avoid accepting international arrangements that give broad jurisdiction over American activities in space to international bodies in which adversaries have undue influence or in which decisions will be made by majorities with little current competence in the space field. In addition, we recommend against U.S. support for any global organization that purports to regulate broadly the utilization of outer space.

(emphasis added).

22. See A. Karp, 'Space Technology in the Third World - Commercialization and the Spread of Ballistic Missiles', Space Policy, May, 1986, 157, where it is averred that developing nations are actively in pursuit of commercial launch technology in order to establish their own ballistic missile capabilities. This may be partially true of some of those nations so involved, but by no means all. In any event, they have had the finest teachers in the world as shining examples - the USSR and the USA.

course their problems are acute and the vast majority cannot hope to attempt what the existing space powers are doing, particularly in the manned field. However, to continue their effective exclusion from full participation at the earliest possible moment in this era, which will change the world as we know it, will result in the maintenance of their technological (and thus economic) subjugation to the developed nations ad infinitum. It is trite to dismiss the participation of developing nations in the Space Stations' Era as unrealistic, unnecessary or irrelevant to either their circumstances or those of the guaranteed participants. What this writer envisages is participation according to the abilities of each nation. Obviously the major space powers will perform the greatest tasks and merit the fruits of their work. However, unless developing nations are permitted to participate, as observers and experimenters, they can never become contributors and the ills of the North/South disparity will simply be exported to the space milieu. If all the grand rhetoric of the UN Charter and the Outer Space Treaty is ever to mean anything, the process must commence with the Space Stations' Era. If they are excluded from this, developing nations will forever remain in passive dependence. Their utilization of telecommunication and remote sensing technology was a necessary beginning and not all could or should be involved in launch technology. Much better, would be for them to form consortia of their own behind lead nations such as India to pool resources and effort.[23] Organizationally, the ASEAN Bloc might serve as a model.[24] In lieu of this, each developing nation, regardless of political orientation (Eastern, Western or non-aligned) can find an avenue for participation in the Space Stations' Era. Being there, through one's own representative in space, may be just as important as what one does there for the forseeable future. Each astronaut or cosmonaut may then become the focus for a campaign of education and dissemination within each nation to raise the collective consciousness of our essential interdependence to a level impossible to achieve in any other manner. This is where the UN can play its finest role as a coordinative mechanism to facilitate this process through inter alia its Development Programme. The resultant generation of space-conscious mankind, educated through existing institutions in

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23. See 'Scientists Urge Third World's Space Use', M. Feazel, AW&ST, 25 April, 1983, 129.

24. 'Asean Bloc at a Glance', New York Times, 30 April, 1986, A6. Membership of ASEAN, the Association of Southeast Asian Nations, is composed of Indonesia, Malaysia, the Philippines, Singapore, Thailand and Burma. ASEAN objectives are "to foster regional economic, social, and cultural progress in the interest of stable growth. To that end, Asean instituted joint research and technological programs, closer cultural ties and student and teacher exchanges".

the developed nations, is a heady prospect indeed. There will no doubt always be economic and technological disparities between nations, as there are within each nation, and what is proposed will not change this. What it would do, however, is give credence to the perception of the world as a family of nations, and, as a corollary to that, of outer space as the "Province of All Mankind".

D. AWAITING THE PERFORMANCE - A HOPE FOR MANKIND

With the freedom inherent in the global legal framework, to develop the substance of the law for space by national and private international means, comes a concomitant responsibility to use space in the interests of all mankind. This cannot mean that every single activity in space must be immediately subjected to a global committee to farm out any benefits it may produce. Such a course would frustrate developments in space and most likely result in the space powers abandoning international space law altogether as a failed egalitarian experiment. Instead, there should remain a wide discretion, for the forseeable future, given to States to operate in space, except where their activity may potentially have adverse effects upon other States' utilization of the space milieu, i.e. article IX of the Outer Space Treaty. Global institutions should function to ameliorate the individual excesses of nations operating in space through timely and appropriate legislation. As a quid pro quo for acceptance of such legislation, commercialization should be allowed to proceed responsibly, with a public commitment by the space powers to increasing pragmatic participation by developing nations as it unfolds.

We are still at the beginning, there is so much to do before we can consider full-scale space industrialization in low-Earth orbit (LEO). This does not even begin to address lunar and asteroid mining and habitation on other celestial bodies. The timescale has expanded considerably beyond what any of the original and latter day seers would have predicted. The cost is too great, the task is too mammoth, and our progress, though wondrous, is too slow. It is as much as we can do as a species to have several small stations in LEO by the end of this century. This follows upon 40 years of the fastest technological advancement in the history of mankind. Tremendous as television, computerization, telecommunications, etc... are, even at our present pace, we are a considerable way from significant off-planet habitation. This must come, if we manage to deal with our destructive tendencies, and will do so only through extensive international cooperation. However, there is no urgency here, instead, there is a necessity to monitor activities in the short term, i.e. the next 25 to 30 years. We now know enough to legislate properly, with the right goals in mind. There remains the necessary political will to carry this out. The US/International Space Station is a major trial ground. We have already proven that we can cooperate scientifically and have done so since the inception of the Space Age. Applications cooperation is a different matter altogether. If this can be done successfully along cooperative lines, perhaps with East/West cross-utilization of space based capabilities, we may yet be able to journey to other planets and settle them together. However, there is a darker side which is also caught in the prism of the US/International Space Station. Thus, also present are the forces of nationalism, as expressed by protectionism, in association with expanded militarization, even space-based weaponization. This does not mark qualitative progress, but is merely a quantitative expansion of all that has gone before, done with full knowledge of and in deliberate opposition to the other more positive way.

All this is not to say that the Space Stations' Era should be saddled with the equalization of the North/South dichotomy, which is the product of centuries of world history. It is ultimately destructive to perceive it this way. Instead, it is a testing ground where more and more nations can participate and be seen to do so. The growing cadre of people from all nations who perceive the fragility of our blue-green sphere from the vantage point of space may effect a second terrestrial renaissance. In conclusion, it seems appropriate to quote the words of one of the greatest men of our age, a true renaissance man, Albert Schweitzer, who stated the following:

> Just as the water of the streams we see is small in amount compared to that which flows underground, so the idealism which becomes visible is small in amount compared with what men and women bear locked in their hearts, unreleased or scarcely released. To unbind what is bound, to bring the underground waters to the surface: mankind is waiting and longing for such as can do that.[25]

25. A. Schweitzer, Out of My Life and Thought, (1963, Mentor) 77.

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APPENDIX 1

US Code of Federal Regulations, Title 22 Foreign Relations, Chapter 1 Department of State, SubChapter S - International Agreements, Part 181.

181.2 Criteria

(a) General. The following criteria are to be applied in deciding whether any undertaking, oral agreement, document, or set of documents, including an exchange of notes or of correspondence, constitutes an international agreement within the meaning of the Act, as well as within the meaning of 1 U.S.C. 112a, requiring the publication of international agreements. Each of the criteria except those in paragraph (a)(5) of this section must be met in order for any given undertaking of the United States to constitute an international agreement.

(1) Identity and intention of the parties. A party to an international agreement must be a state, a state agency, or an intergovernmental organization. The parties must intend their undertaking to be legally binding, and not merely of political or personal effect. Documents intended to have political or moral weight, but not intended to be legally binding, are not international agreements. An example of the latter is the Final Act of the Helsinki Conference on Cooperation and Security in Europe. In addition, the parties must intend their undertaking to be governed by international law, although this intent need not be manifested by a third-party dispute settlement mechanism or any express reference to international law. In the absence of any provision in the arrangement with respect to governing law, it will be presumed to be governed by international law. This presumption may be overcome by clear evidence, in the negotiating history of the agreement or otherwise, that the parties intended the arrangement to be governed by another legal system. Arrangements governed solely by the law of the United States, or one of the states or jurisdictions thereof, or by the law of any foreign state, are not international agreements for these purposes. For example, a foreign military sales loan agreement governed in its entirety by U.S. law is not an international agreement.

(2) Significance of the arrangement. Minor or trivial undertakings, even if couched in legal language and form, are not international agreements within the meaning of

the Act or of 1 U.S.C. 112a. In deciding what level of significance must be reached before a particular arrangement becomes an international agreement, the entire context of the transaction and the expectations and intent of the parties must be taken into account. It is often a matter of degree. For example, a promise to sell one map to a foreign nation is not an international agreement; a promise to exchange all maps of a particular region to be produced over a period of years may be an international agreement. It remains a matter of judgment based on all of the circumstances of the transaction. Determinations are made pursuant to section 181.3. Examples of arrangements that may constitute international agreements are agreements that: (i) are of political significance; (ii) involve substantial grants of funds or loans by the United States or credits payable to the United States; (iii) constitute a substantial commitment of funds that extends beyond a fiscal year or would be a basis for requesting new appropriations; (iv) involve continuing and/or substantial cooperation in the conduct of a particular program or activity, such as scientific, technical, or other cooperation, including the exchange or receipt of information and its treatment, or the pooling of data. However, individual research grants and contracts do not ordinarily constitute international agreements.

(3) Specificity, including objective criteria for determining enforceability. International agreements require precision and specificity in the language setting forth the undertakings of the parties. Undertakings couched in vague or very general terms containing no objective criteria for determining enforceability or performance are not normally international agreements. Most frequently such terms reflect an intent not to be bound. For example, a promise to "help develop a more viable world economic system" lacks the specificity essential to constitute a legally binding international agreement. However, the intent of the parties is the key factor. Undertakings as general as those of, for example, Articles 55 and 56 of the United Nations Charter have been held to create internationally binding obligations intended as such by the parties.

(4) Necessity for two or more parties. While unilateral commitments on occasion may be legally binding, they do not constitute international agreements. For example, a statement by the President promising to send money to Country Y to assist earthquake victims would not be an international agreement. It might be an important undertaking, but not all undertakings in international

relations are in the form of international agreements. Care should be taken to examine whether a particular undertaking is truly unilateral in nature, or is part of a larger bilateral or multilateral set of undertakings. Moreover, "consideration", as that term is used in domestic contract law, is not required for international agreements.

(5) Form. Form as such is not normally an important factor, but it does deserve consideration. Documents which do not follow the customary form may constitute evidence of a lack of intent to be legally bound by the arrangement. If, however, the general content and context reveal an intention to enter into a legally binding relationship, a departure from customary form will not preclude the arrangement from being an international agreement. Moreover, the title of the agreement will not be determinative. Decisions will be made on the basis of the substance of the arrangement, rather than on its denomination as an international agreement, a memorandum of understanding, exchange of notes, exchange of letters, technical arrangement, protocol, note verbale, aide-memoire, agreed minute, or any other name.

(b) Agency-level agreements. Agency-level agreements are international agreements within the meaning of the Act and of 1 U.S.C. 112a if they satisfy the criteria discussed in paragraph (a) of this section. The fact that an agreement is concluded by and on behalf of a particular agency of the United States Government, rather than the United States Government, does not mean that the agreement is not an international agreement. Determinations are made on the basis of the substance of the agency-level agreement in question.

(c) Implementing agreements. An implementing agreement, if it satisfies the criteria discussed in paragraph (a) of this section, may be an international agreement, depending upon how precisely it is anticipated and identified in the underlying agreement it is designed to implement. If the terms of the implementing agreement are closely anticipated and identified in the underlying agreement, only the underlying agreement is considered an international agreement. For example, the underlying agreement might call for the sale by the United States of 1000 tractors, and a subsequent implementing agreement might require a first installment on this obligation by the sale of 100 tractors of the brand X variety. In that case, the implementing agreement is sufficiently identified in the underlying agreement, and would not itself be considered an international agreement within the meaning of the Act or of

1 U.S.C. 112a. Project annexes and other documents which provide technical content for an umbrella agreement are not normally treated as international agreements. However, if the underlying agreement is general in nature, and the implementing agreement meets the specified criteria of paragraph (a) of this section, the implementing agreement might well be an international agreement. For example, if the underlying agreement calls for the conclusion of "agreements for agricultural assistance", but without further specificity, then a particular agricultural assistance agreement subsequently concluded in "implementation" of that obligation, provided it meets the criteria discussed in paragraph (a) of this section, would constitute an international agreement independent of the underlying agreement.

APPENDIX 2

Excerpts from Volume 11 Chapter 700 of the U.S. Department of State Foreign Affairs Manual.

721.3 Criteria for Selecting Among Constitutionally Authorized Procedures. In determining a question as to the procedure which should be followed for any particular international agreement due consideration is given to the following factors along with those in section 721.2.

(a) Domestic factors: (i) Whether the agreement involves important interests, commitments or risks affecting the nation as a whole;

(ii) Whether the agreement would affect State laws or the powers reserved to the States under the Constitution;

(iii) Whether the agreement can be given effect without the enactment of subsequent legislation by the Congress;

(iv) Past United States practice with respect to similar agreements;

(v) The preference of the Congress with respect to a particular type of agreement.

(b) International factors: (i) The degree of formality desired for an agreement;

(ii) The proposed duration of the agreement, the need for prompt conclusion of an agreement and the desirability of concluding a routine or short term agreement;

(iii) The general international practice with respect to similar agreements.

In determining whether any international agreement should be brought into force as a treaty or as an executive agreement the utmost care shall be exercised to avoid any invasion or compromise of the constitutional powers of the Senate, the Congress as a whole, or the President.

721.4 <u>Questions as to Type of Agreement to be Used: Consultation with Congress.</u>

...(b) When there is any question whether an international agreement should be concluded as a treaty or as an executive agreement, the matter is brought to the attention of the Legal Adviser of the Department. If the Legal Adviser considers the question to be a serious one, he will transmit a memorandum thereon to the Assistant Secretary for Congressional Relations and other officers concerned. Upon receiving their views on the subject he shall, if the matter has not been resolved, transmit a memorandum thereon to the Secretary for his decision...

(c) Consultations on such questions will be held with congressional leaders and committees as may be appropriate. Arrangements for such consultations shall be made by the Assistant Secretary for Congressional Relations and shall be held with the assistance of the Office of the Legal Adviser and such other offices as may be determined. Nothing in this section shall be taken as derogating from the requirement of appropriate consultations with the Congress in accordance with section 723.le in connection with the initiation of, and developments during, negotiations for international agreements, particularly where the agreements are of special interest to the Congress.

<u>Source</u>: Federal Register, Vol. 18, No. 157, Wednesday, 15 August, 1973, 22085.

APPENDIX 3

Principle 1: Notification

(1) Taking into account the obligations of the Convention on Registration of Objects Launched into Outer Space, in particular Article IV thereof which stipulates the information to be furnished by States when registering space objects, States recognize the special hazards inherent in the use of nuclear power sources in outer space and as a result, the need for information additional to that called for in the Convention.

(2) States shall therefore, in addition to existing notification requirements, include information as to the presence of an NPS on board a space object and its generic classification, (i.e. nuclear reactor or radiosotopic heat source) and shall so notify, together with the other elements contained in the aforementioned Article IV, within [48 hours] [the minimum technical time possible for communication of such notice] of the launch of such an object having a nuclear power source on board. Each launching state shall also provide a safety evaluation statement, including an analysis of accident probability sufficiently comprehensive to assure the international community that the nuclear power source can be utilized safely.

Principle 2: Guidelines for Safe Use

(1) States shall ensure that the design, construction and use of space objects containing nuclear power sources meet generally accepted international guidelines for radiological protection. Inter alia, radiological risks involved should conform to the recommendations of the International Commission on Radiological Protection and the International Atomic Energy Agency.

(2) Unless a space object with an NPS on board has been designed to re-enter and land safely, a nuclear safe orbit must be used.

(3) Reactors should not be activated until the space object carrying them has reached a safe operating altitude.

(4) Where such a nuclear safe orbit is not used, States undertake to employ an in-space recovery system or orbital lifetime extension technique in association with the nuclear

power source so as to render it as safe as if it were in a nuclear safe orbit.

(5) Given the potential risks associated with the use of NPS in space objects, States have a particular responsibility to ensure that such use in any orbit is as safe as if it were in nuclear safe orbit.

Principle 3: Notification of Re-entry

(1) Each State launching a space object with nuclear power sources aboard should, in a timely manner, inform States concerned in the event the space object is malfunctioning with the risk of re-entry of radioactive materials to the earth. The information should be in accordance with the following unified format:

1. System parameters

1.1 Name of launching State or States including the address of the authority which may be contacted for additional information or assistance in case of accident.

1.2 International designation.

1.3 Date and territory or location of launch.

1.4 Information required for best prediction of orbit life-time, trajectory and impact region.

1.5 General function of spacecraft.

2. Information on the radiological risk of nuclear power source(s)

2.1 Type of NPS: radioisotopic heat source or reactor.

2.2 The probable physical form, amount and general radiological characteristics of the nuclear fuel and contaminated and/or activated components of the space object likely to reach the ground.

(2) The information supplied in item 1.4 and, wherever necessary, in item 2.2 of the format should be updated by the launching State. The data distribution should commence with the notification of malfunction, and the updating

frequency should increase as the time of the expected re-entry approaches.

(3) All of the foregoing information should be transmitted simultaneously in a comprehensive and complete form to all States concerned and to the Secretary-General of the United Nations.

Principle 4: Assistance to States

(1) Upon the notification of an expected re-entry into the earth's atmosphere of a space object containing a nuclear power source on board and its components, all States possessing space monitoring and tracking facilities should co-operate in order to improve the monitoring of such malfunctioning space objects. Any additional information and its interpretation should be made available as promptly as possible to allow States which might be affected to assess the situation and take any precautionary measures deemed necessary.

(2) After the re-entry into the earth's atmosphere of a space object containing a nuclear power source on board and any components thereof:

a) The launching State shall promptly provide the necessary assistance to eliminate actual and possible harmful effects, upon request by affected States, bearing in mind the special needs of developing countries;

b) All States, other than the launching State, with relevant technical capabilities and international organizations with such technical capabilities should, to the extent possible, provide necessary assistance upon request by affected State, bearing in mind the special needs of developing countries.

Principle 5: Responsibility and Liability of States

(1) The State launching a space object containing a nuclear power source bears international responsibility and liability for such space object in accordance with international law, including Articles VI and VII of the Outer Space Treaty and other relevant outer space agreements.

(2) Such responsibility should include the obligation of the launching State to offer to provide all necessary assistance to States likely to be affected by the re-entry or impact of its space object containing a nuclear power source.

(3) States launching space objects containing nuclear power sources will be internationally liable for the direct, indirect or delayed damage to States or to their natural or juridical persons. Such liability includes compensation for damage and for all costs for search, recovery and clean-up operations.

(4) If no settlement of a claim is arrived at through diplomatic negotiations, in accordance with the principles set out in the Convention on International Liability for Damage Caused by Space Objects, the parties shall establish a claims' commission as provided in Article XV of the Convention.

(5) Nothing in these principles shall have the effect of reducing the responsibility of States and international, intergovernmental organizations under international law, including the relevant outer space conventions.