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Disarmament: Problems related to Outer Space

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Introduction

The United Nations Institute for Disarmament Research (UNIDIR) is an autonomous research institute within the framework of the United Nations. The mandate of the Institute, as laid down in its statute,[1] includes the following objectives:

a) Providing the international community with more diversified and complete data on problems relating to international security, the armaments race and disarmament in all fields, particularly in the nuclear field, so as to facilitate progress, through negotations, towards greater security for all States and towards the economic and social development of all peoples;

b) Promoting informed participation by all States in disarmament efforts;

c) Assisting ongoing negotiations on disarmament and continuing efforts to ensure greater international security at a progressively lower level of armaments, particularly nuclear armaments, by means of objective and factual studies and analyses;

d) Carrying out more in-depth, forward-looking and long-term research on disarmament, so as to provide a general insight to the problems involved and stimulating new initiatives for new negotiations.

In accordance with these objectives, UNIDIR proposed to undertake a research project on outer space problems. In conformity with the statute of UNIDIR, this project was approved by the Institute's Board of Trustees. The project was referred to in resolutions 40/87 and 41/53 of the UN General Assembly. In response to an invitation contained in resolution 40/87 (para. 12), States transmitted their views on the scope and content of the report to the UN Secretary-General who conveyed these views to the UNIDIR Board of Trustees to enable it to give the Institute guidance with respect to the elaboration of this project.

Since the first launching of a satellite in 1957 the exploration and practical uses of space have increased rapidly. Satellites of various kinds are now being launched regularly. Due to both the benefits of peaceful use of outer space and latent dangers of an arms race in outer space, the future utilization of that environment is considered to be one of the most important issues of modern times.

It has been found that, apart from its potential for scientific progress and its economic promises, the use of outer space has important military implications. Problems relating to the military use of outer space, and to the limitation of military activities and disarmament in outer space, have become a focus of international concern. Advances in space technology have added considerable impetus to the arms race.

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[1] See General Assembly resolution 39/148 H of 17 December 1984; the annex of which contains the statute of UNIDIR.

Satellites are being used for military purposes, anti-satellite weapons have been tested, and partially or fully space-based anti-ballistic missile systems are under consideration, giving rise to politico-military controversies.

Questions relating to the future of outer space have been raised repeatedly at the United Nations and the General Assembly has expressed concern about the danger posed to all mankind by an arms race in outer space. The General Assembly also reaffirmed that general and complete disarmament under effective international control warrants that outer space shall be used exclusively for peaceful purposes and that it shall not become an arena for an arms race.[2]

The goal of UNIDIR has been to identify the different issues relating to the prevention of an arms race in outer space, that is to say: current military uses of outer space; the possibilities of further development of space-related armaments; the implications of those developments; the nature of the existing legal regime regarding outer space; as well as proposals put forward by States to prevent an arms race in outer space. The overall aim is that this research report should be useful as a reference work, particularly for government officials and diplomats, as well as for concerned members of the scientific community and the public.

Recognizing the existence of divergent views on the utilization of outer space for military purposes, UNIDIR has worked in co-operation with a group of experts, representing various schools of thought. Those experts are Alexei Arbatov (Union of Soviet Socialist Republics), Yves Boyer (France), James Dougherty (United States of America), Sergio de Queiroz Duarte (Brazil), Rikhi Jaipal (India), Andrei Karkoszka (Poland), Roberto Garcia-Moritan (Argentina), Boris Maiorsky (Union of Soviet Socialist Republics), later succeeded by Ednan Agaev (Union of Soviet Socialist Republics), and Stephan Freiherr von Welck (Federal Republic of Germany). While these experts were asked to offer guidance and advice to UNIDIR as to the general outline of the report and to subsequently offer comments on the draft manuscript, the report was written by a team of the Institute. Even though UNIDIR could not incorporate all of their comments in the final text, the Institute avails itself of this opportunity to thank the experts for their critical remarks and constructive suggestions.

The Institute assumes responsibility for the contents of the report. UNIDIR has made a determined effort to arrive at a balanced presentation

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[2] See in particular General Assembly resolutions 38/70 of 15 December 1983, 39/59 of 12 December 1984, 40/87 of 12 December 1985, and 41/53 of 7 January 1987.

of the different points of view and has, whenever possible, based the description of the position of individual States or groups of States on official documents.

The report consists of four parts: I - Current uses of outer space; II - Technological and conceptual challenges; III - Legal aspects of an arms race in outer space and of the means for its prevention; and IV - Proposals and negotiations related to arms limitation in outer space.

The first part contains a brief description of how outer space is currently being utilized for civilian and military purposes. On the civilian side, this is confined to a description of the main civilian applications of satellites. Regarding the military utilization of outer space, three areas are covered. A first section seeks to describe the military applications of satellite functions that are basically similar to the civilian functions, only directed towards other purposes. It is also mentioned how satellites can be utilized to facilitate agreements on arms limitation or disarmament. The following two sections, concluding the first part, seek to present the currently existing anti-satellite and anti-ballistic missile capabilities. Even though no space-based ABM systems are at present tested or deployed, they are mentioned under the heading of "current uses of outer space" because they have the capability to intercept re-entry vehicles outside the atmosphere, hence in outer space.

Part two deals entirely with questions concerning the possibility and consequences of creating weapons that are not yet in existence but which may become possible with the advance of technology. A first section covers the historical background of space weapons and provides a brief description of their technical aspects as well as of potential countermeasures. One of the most important elements of the current debate on space weapons concerns their implications and consequences. The research report seeks then to give a balanced presentation of the different points of view regarding the potential implications of space weapons for strategic stability, the military balance, the arms race, and arms limitation. Furthermore, collateral implications are discussed, i.e. the potential impact of space weapons on the peaceful uses of outer space, on the economy, on society, and on science and technology. A description of the position of various States regarding the prospect of space weapons concludes this second part of the report.

The third part is devoted to the legal aspects of an arms race in outer space and of the means for its prevention. It contains an account of international law in force, as far as it relates to arms limitation in outer space. The description of positive treaty law and other elements of law in force (international custom, acts of international organizations and unilateral acts of States) is followed by a general discussion of the main characteristics of applicable law. Unilateral acts and attitudes are very important in this field. Emphasis is put on two issues: the status of self-defence and countermeasures, and the interpretation of the ABM Treaty by its two parties.

Ongoing negotiations directed towards the prevention of an arms race in outer space, both multilateral and bilateral, are discussed in part four. A brief account is given of the role that the United Nations has played and continues to assume in the elaboration of this type of arms limitation. This is followed by a résumé of contemporary proposals by States presented to the Conference on Disarmament. Lastly, a brief account is given on recent and contemporary negotiations between the USA and the USSR concerning arms limitation and arms prevention issues regarding outer space.

The chief contribution this research report seeks to make towards the prevention of an arms race in outer space is to identify the issues and the parameters of the subject and, as far as possible, the points of agreement and disagreement among States regarding the technical, legal and political issues involved. It is UNIDIR'S hope that this publication will be a useful contribution to the ongoing multilateral process aimed towards the prevention of an arms race in outer space.

This research project was initiated in UNIDIR under the Directorship of Mr. Liviu Bota with, at that stage, Professor Hubert Thierry, Deputy Director, and Dr. Julie Dahlitz, Senior Research Associate. Subsequently, the project was continued with Professor Serge Sur, Deputy Director, and Christian Catrina, Research Associate. I want to thank them for their work. I would also like to record my appreciation of the assistance given by Dr. Bhupendra Jasani as a consultant.

Jayantha Dhanapala
Director
UNIDIR

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LIST OF ACRONYMS

ABM	anti-ballistic missile
ASAT	anti-satellite
BMD	ballistic missile defense
BMEWS	ballistic missile early warning system
CCD	charge-coupled device
CD	Conference on Disarmament
COCOM	Co-ordinating Committee for Multilateral Export Controls
COPUOS	Committee on the Peaceful Uses of Outer Space
DEW	directed-energy weapon
DOD	United States Department of Defense
ELINT	electronic intelligence
EMP	electromagnetic pulse
ERIS	exo-atmospheric re-entry vehicle interceptor subsystem
FEL	free-electron laser
FLAGE	flexible lightweight agile guided experiment
FY	fiscal year
GEO	geosynchronous earth orbit
GLONASS	global navigation satellite system
GPS	global positioning system
HEDI	high endoatmospheric defense interceptor
HOE	homing overlay experiment
ICBM	intercontinental ballistic missile
ICJ	International Court of Justice
INF	intermediate-range nuclear forces
INMARSAT	International Maretime Satellite Organization
ISMA	international satellite monitoring agency
KEW	kinetic-energy weapon
kt	kiloton
LoADS	low-altitude defense system
MHV	miniature homing vehicle
MSR	missile site radar
MSS	multispectral scanner system
Mt	megaton
NATO	North Atlantic Treaty Organization
NORAD	North American Aerospace Defense Command
NTM	national technical means
NPT	Non-Proliferation Treaty
PTBT	partial test-ban treaty
R&D	research and development
RSMA	regional satellite monitoring agency
RTG	radionuclide thermo-electric generator
RV	re-entry vehicle
SALT	Strategic Arms Limitation Talks
SAM	surface-to-air missile
SAR	synthetic-aperture radar
SARSAT	search and rescue satellite
SCC	Standing Consultative Commission
SDI	(United States) Strategic Defense Initiative

SDIO	Strategic Defense Initiative Organization
SLBM	sea-launched ballistic missile
SRAM	short-range attack missile

Part I
Current Uses of Outer Space

This part pursues the aim of giving a comprehensive, if brief, overview of the ways in which outer space is currently being used for civilian and military purposes. In the civilian field, this relates mainly to the use of satellites. In the military field, it relates on the one hand to the use military support satellites (not destructive in themselves) in ways similar to those serving civil purposes. On the other hand, military use of outer space does also relate to devices destructive in themselves. It is *current* uses and *existing* capabilities, i.e. systems which have been deployed, or at least tested this part focusses upon. Systems at the stage of research are not covered. Some of them may be mentioned, however, if they have a close relationship with systems that are deployed or have been tested. This part deals with the current uses of *outer space*, but it is not only space-based systems that have to be included. Weapons that are ground-, sea- or air-based but whose targets are in space also have to be covered.

In the first chapter of this part, some basic technical information on objects in outer space is provided. The second chapter presents the functions of satellites which can be used for civilian or military purposes. The third chapter deals with the current uses of outer space for military purposes; *inter alia* it includes sections on the functions of military support satellites, on existing ASAT capabilities, and on existing ABM/BMD capabilities.[1] Some ABM systems are designed for intercepting re-entry vehicles (RVs) within the atmosphere. While they would not be considered as space weapons (under the most likely definitions), they are mentioned as far as they are in a close relationship with systems designed for the interception of missiles or RVs in space.

1. Physical properties of objects in outer space

The possibilities and dangers associated with outer space are interrelated and both are dependent on the physical properties of that environment. For the consideration of the relevant disarmament questions, some understanding of the physical properties of outer space is necessary. While a profound understanding of the technical issues may be preferable, it is not essential for making responsible decisions in this sphere of the arms limitation process. The first chapter consists

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[1] In this research report, the terms ABM (anti-ballistic missile) and BMD (ballistic missile defense) are in principle used synonymously. However, ABM is generally used historically, and BMD for future systems.

of a summary of technical information that is thought to be minimally essential for an understanding of military and disarmament implications.

1.1. WHERE DOES OUTER SPACE BEGIN?

There is no precise natural boundary between air space and outer space, and no artificial demarcation has yet been agreed upon. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967 (Outer Space Treaty) which laid down the basic rules for outer space is silent on the meaning of *outer space*. In theory, the boundary is where terrestrial air space ends. In practice, the atmosphere becomes progressively thinner.

For a number of years, the issue has been under consideration by the Legal Sub-Committee of the Committee on the Peaceful Uses of Outer Space (COPUOS).[2] Some States have taken the view that a precise designation of the commencement of outer space would be unnecessary or inappropriate and that the regulation of specific activities will distinguish between activities that can be performed in outer space and those that cannot be performed in that environment.[3] A variant of an indeterminate frontier for outer space would be achieved by imposing changeable designations of borderlines, depending on the purpose of a given provision, so as to determine issues of sovereignty, overflight, economic utilization, or arms limitation.

Other States have favoured a more rigid definition of the parameters of outer space. In that regard, one criterion has been in the forefront of interest: the lower limits of the altitude where an object can perform a full orbit around the earth in uncontrolled ballistic flight, namely, the lowest possible altitude of an object orbiting the earth in a circular orbit. About 100 km it the lowest altitude at which the atmospheric density is low enough to allow a complete (circular) orbit.

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[2] First considered in the Report of the General Assembly *ad hoc* Committee on the Peaceful Uses of Outer Space, in July 1959. The matter was formally put on the agenda of the Legal Sub-Committee of COPUOS (which body succeeded the *ad hoc* Committee) in 1967.

[3] The United States representative told the Legal Subcommittee of COPUOS in April 1986 that two factors would have to be present before any demarcation of a boundary between outer space and air space could make a constructive contribution to the body of space law and to the use and exploration of outer space: the existence of a substantial practical problem arising from the absence of such a demarcation, and a demonstration that such problems could be resolved by means of "an essentially arbitrary line" separating air space and outer space into two distinct spatial arenas, each with its own body of relevant law, without giving rise to additional problems of its own. In the view of the United States, none of the two conditions is fulfilled. (*Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 60, April 11, 1986).

1.2. SOME BASIC ORBITAL MECHANICS

The launching of an object into outer space became possible with developments in rocket engineering. A rocket behaves in accordance with physical laws first elaborated by Isaac Newton and designated to be the Third Law of Motion, to the effect that for every expenditure of physical force there is an equal and opposite reaction. Thus, propulsion into and within outer space is achieved as the result of expelling gasses under high pressure derived from combustion in the rocket engine. Liquid or solid fuel may be used for this purpose. Escape of the combustion gasses through the narrow nozzle of the rocket can reach supersonic speeds, sending the rocket in the opposite direction with great force. Limits of the force that may be employed are set by the strength of the materials from which the rocket is made and, in the case of manned flights, the acceleration that the human body can tolerate. Objects can be launched in this manner from the earth, sea or air space - referred to as *terrestrial* space; or from satellites or celestial bodies, all being part of *outer* space.

When an object is launched into outer space in this manner from the terrestrial environment, its path will follow one of three basic patterns, depending on the angle and velocity of the final thrust. That path will either:

a) follow an arc and fall back to earth;

b) go into circular or elliptical orbit around the earth; or

c) follow a very wide arc and eventually escape from the earth's gravitational field.

For instance the path described in a) is the one followed by a ballistic missile. The path described in c) can, under certain conditions, lead to an orbit around a celestial body, such as the moon, a planet or the sun. An object whose motion is in accordance with the path described in b) is called an earth satellite.

Whether an object in earth orbit is very large - a space station; very manoeuvrable - a space ship; or reusable - a space shuttle; it still comes under the generic designation of *satellite*. In this report, any artificial object in outer space that does *not* follow the path described in a) will be referred to as a *space object.*

The altitude, shape and direction of orbit into which a satellite is placed depends on the functions it is required to perform. Satellites are usually placed in orbit by large multi-stage rockets which apply accelerating forces over a period of several minutes. In the initial phase of the flight, it accelerates through the atmosphere in a nearly vertical direction and gradually bends over into a horizontal path. The vertical phase lasts for a very short time (about 10 seconds). The first stage of the launcher takes the satellite to the upper atmosphere at an altitude of about 60 km. The satellite is then gradually brought to its orbital height by the second and the third stage of its launcher. If then the satellite above the earth's surface is given sufficiently high horizontal velocity, it will not fall back to earth but instead continue in a circular or elliptical path round the earth. This velocity is known as the *injection velocity*.

In order to remain in circular orbit, the satellite has to have a sufficient velocity to create a centrifugal force equal to the gravitational pull of the earth at that altitude. Having attained that velocity, the satellite will go into circular orbit around the earth in free flight, that is to say, without the need for further propulsion.

If the injection velocity is greater than required for a circular orbit but less than an *escape velocity* - a velocity that would project the object beyond the gravitational field of the earth - it will go into an elliptical orbit. In general terms, the greater the injection velocity, the more elongated the elliptical path will be. The extent of elongation is called the *eccentricity* of the ellipse.

The direction and speed of the satellite can be altered with further minor rocket thrusts which makes the satellite *manoeuvrable*. Such corrections are also necessary to compensate for the natural forces acting on the satellite that would otherwise modify, namely *degrade* its orbit. Those natural forces include the somewhat uneven shape of the earth and its varying density; atmospheric drag slowing low-orbit satellites; the magnetic field of the earth and the gravitational fields of the sun and moon acting more significantly on satellites in high orbit; radiation pressure, and solar wind.

It is possible for two satellites to be manoeuvred in such a manner that they can meet in space and be joined together. This is called space *rendez-vous* and *docking*. Docking may be necessary in order to make repairs on a satellite or to relieve astronauts. Larger structures in outer space would have to be assembled from several pieces transported separately, achievable by manoeuvres similar to those used in docking.

The navigation of both manned and unmanned objects in space largely relies on *inertial guidance* provided by the recorded movement of at least three spinning gyroscopes. The direction and position so established can be checked against the positions of celestial bodies, other satellites or points on the ground track. Inertial guidance can also be supplemented by *homing devices* sensitive to heat or other attributes of the object to be approached.

In free fall to earth at a steep angle, a satellite would burn up by heating due to friction with the atmosphere. This can be avoided by *re-*

entry at a shallow angle and with the aid of heat-resistant coatings. Satellites are parachuted to earth - or splashed down at sea - a the final stage of re-entry. In the case of a re-usable space vehicle, the satellite itself lands in a manner similar to an aeroplane.

1.3. ORBITAL ELEMENTS

A satellite usually describes an elliptical orbit. There are six parameters, called orbital elements, which define such an orbit in space. The size and shape of the orbit are determined by its *semi-major axis* and its *eccentricity*. (See figures 1 and 2, page 10, for the orbital elements.) The eccentricity is defined as the ratio of half the distance between the foci of the ellipse and the semi-major axis (i.e. c/a in figure 1). During the lifetime of a satellite, most of the orbital elements are continuously changing, so that the values of all the elements must be given for a particular time. Often this is chosen to be the *passage time of the satellite through the perigee point*. This time, the third orbital element, together with the semi-major axis and the eccentricity defines the ellipse in a plane. The perigee is the point where a satellite is nearest to the earth in its elliptical path; the farthest point is the apogee of the orbit.

If a co-ordinate system is chosen such that its origin, O (see figure 2) is the centre of the earth and its z-axis is oriented towards the North Pole and the earth's equatorial plane contains the xy-plane, then it is possible to define the position of the orbital plane. The x-axis is oriented towards the Vernal equinox of the first point of Aries.[4] In figure 2, the point (N) of intersection of the satellite ground track with the equator is known as the ascending node. The angle Ω between the x-axis and the line ON defines the fourth orbital element called the *right ascension of the ascending node*. During the lifetime of a satellite, Ω does not remain fixed except for a particular value (90°) of the *orbital inclination* (i), the fifth orbital element. The orbital inclination, perhaps the most important orbital element, is the angle between the orbital plane of the satellite and the equatorial plane of the earth. It is the value of i which determines the range of latitudes over which a satellite travels during each revolution. Thus an orbital inclination of 90° facilitates complete coverage of the earth's surface for observation purposes. The orientation of the ellipse within the orbital plane is given by the sixth orbital element, known as the *argument of perigee* (ω). Again ω varies continuously except for a particular value of the orbital

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[4] The equatorial plane of the earth is inclined to the plane of the earth's orbit around the sun. The line of intersection of these two planes is called the line of the Vernal equinox leading to the first point of Aries.

inclination. If a satellite is launched at an orbital angle of 63.4°, its perigee will remain stable along any chosen latitude. For other values of the orbital inclination, ω could vary up to 5° per day.

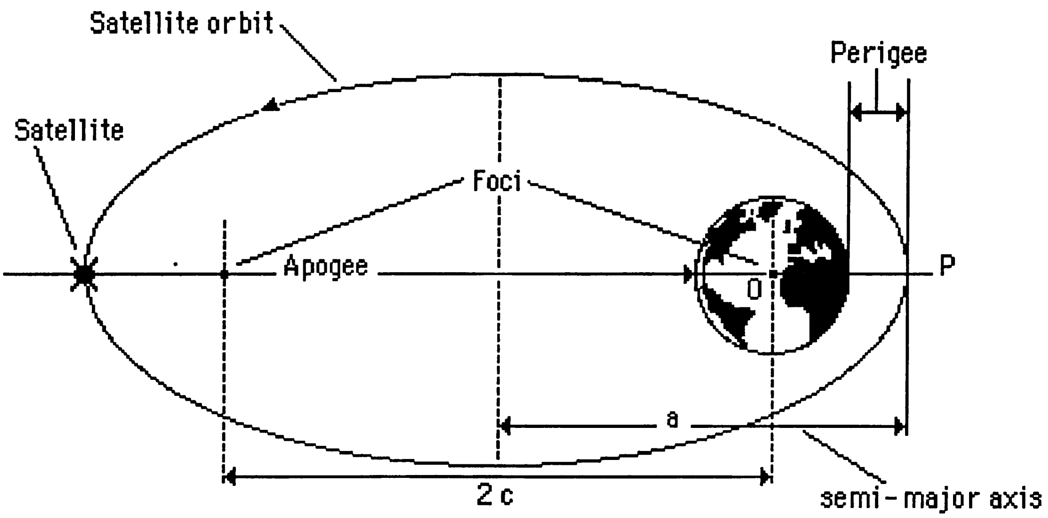

Figure 1: Geometry of a satellite orbit

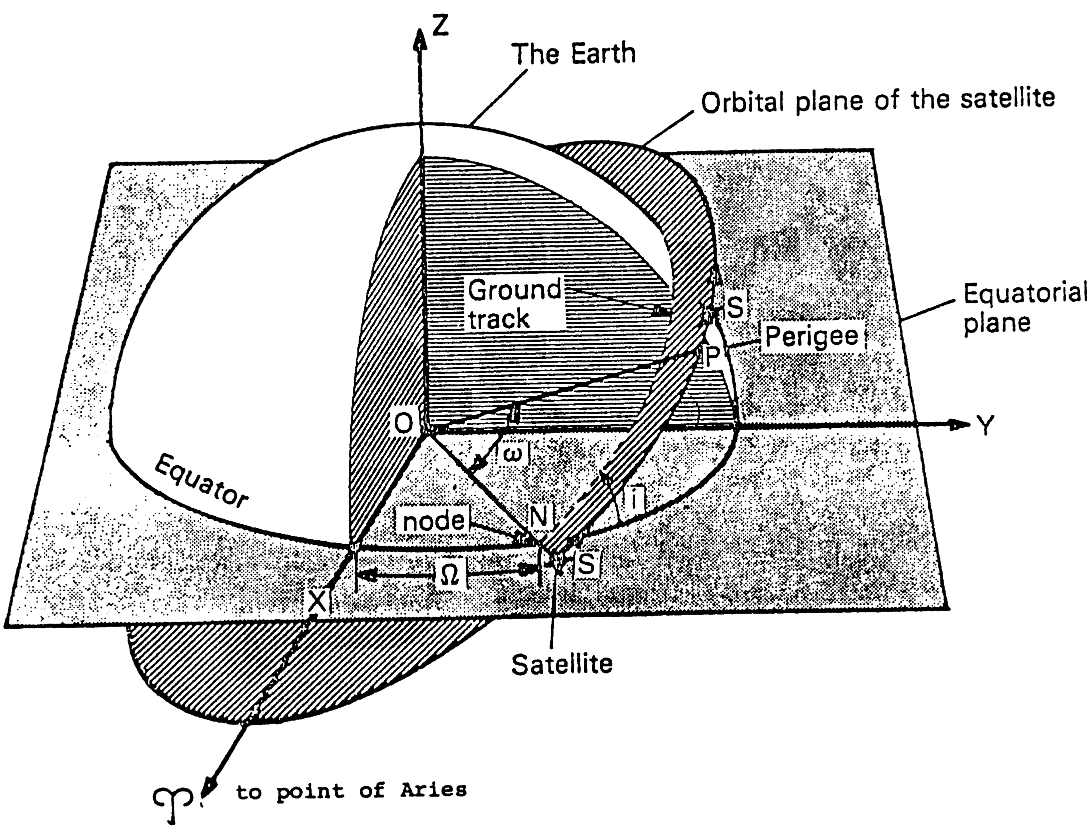

Figure 2: Geometry of a satellite orbit

The time it takes for a satellite to complete an orbit is called its *period*. Beyond the altitude where the atmosphere is an impediment, satellites travel faster the nearer they are to earth and more slowly if they are in higher orbits. The gravitational pull of the earth decreases with increasing altitude, hence lower centrifugal forces - lower velocity - are necessary to offset this gravitational pull and keep the satellite in a circular or elliptical earth orbit. Satellites in circular orbit at an altitude of 35,900 km have a period of 24 hours, the same time that it takes for the earth to revolve around its axis. If their orbital inclination is zero, such satellites will appear stationary with respect to the earth. They are called *geostationary* satellites, and their orbit is called the *geostationary* orbit. The term *geosynchronous* applies to any satellite with a period of 24 hours, including those with non-zero inclination.

2. Current and imminent satellite functions

Satellites can perform a number of functions useful for civilian and military purposes. While it is possible to analyse the individual functions separately, one must bear in mind that there are satellites that perform only one function as well as those that perform several functions.

In many cases, the classification of satellites as being either for civilian or military use is difficult. Here again, satellites may be limited to one of these types of use, or they may encompass both. As an illustration of the latter, civilians have access to many space programmes. Data from meteorological satellite systems are distributed worldwide for civilian weather forecasting. Certain data sets from ocean monitoring satellites are made available for civilian research.

2.1. COMMUNICATION

Communication satellites receive signals from antennas based on earth (or more generally, terrestrial space), amplify them and then relay them back to another antenna in terrestrial space. These satellites are classified into three categories, according to their orbital characteristics: they are geosynchronous, semi-synchronous or non-synchronous.

Most communication satellites are in the geostationary earth orbit (GEO). An important advantage of a satellite in GEO is that it can be tracked by an almost stationary aerial rather than by a rapidly moving one. Since the signals have to travel at least 72,000 km, sensitive radio receivers must be used. On the other hand, a satellite in GEO can be seen from about one-third of the earth's surface so that only three satellites would be needed for a complete coverage of the earth. Thus such satellites can serve distant locations lacking ground communication links. A disadvantage of GEO for countries situated far from the equator is that, for a latitude of 70° or more North and South, the satellite is below the horizon and therefore unusable.

Since these satellites operate within limited designated frequency bands and therefore need to be sufficiently separated to avoid interference with one another, and also to avoid collisions, there is a limit to the total number of satellites that can operate in the geostationary orbit in the different frequency bands and also in any given frequency band. There is concern by some States that parts of the orbit are approaching saturation in certain frequency bands. Technological advances are under way, however, which will probably permit, among other changes, the closer spacing of satellites.

Telecommunication was one of the first applications of space technology and, beginning with the passive relay of voice and television signals by a satellite in 1960 (the Echo, launched by the United States of America), it progressed rapidly to operational international service in 1965 (the Early Bird, launched by the USA), using active geostationary satellites and satellites in high elliptical orbits. In August 1964, Intelsat was established, and in 1971 Intersputnik. It was not until 1974 that satellites built by countries other than the USA or the USSR were launched, but the number has grown large since that time. Communication satellites have now become a routine and vital element of the international telecommunication network. They have also become an integral part of the domestic network in several countries.

The launching, deployment or fabrication of large structures in space could lead to further improvements in communication. Such structures could have large antennas and high power outputs making possible communication between small terminals. The possibility of repairing satellites in orbit would also allow for the use of more sophisticated systems, thereby permitting simpler ground equipment for reception.

Large "telephone exchanges" in space - receiving, processing and transmitting signals to appropriate locations through large, narrow beam antennae are now feasible. Most of the technology for implementing such a system is at hand, although its launch and assembly may at the moment be difficult and uneconomical. An alternative available technology to single large platforms would be clusters of electronically interconnected satellites.

The increasing power that enables satellites to broadcast directly to small receivers, and high-gain receiving system on satellites make communication possible with ships, aircraft and ground vehicles, as well as *inter alia* facilitating direct television broadcasting to private homes. A system of global maritime communication is now also operational (operated by the International Maritime Satellite Organization, Inmarsat, etablished in 1981). Satellite communication is being put to wider uses. These include video conferencing and various types of interactive use, computer interconnection, data communication and electronic mail.

On 10 December 1982, the UN General Assembly adopted resolution 37/92 on principles governing the use by States of artificial earth satellites for international direct television broadcasting.[5]

2.2. METEOROLOGY

Methods of weather prediction in the past have relied on meteorological data collected by a worldwide network of observers. While much information can be obtained in this way, the inability to observe a large part of the earth at one time limited the usefulness of this method. The first important change in meteorology occured with the development of aircraft, but it was satellite technology (sensors mounted on board of satellites) that effectively altered the view of the earth. In the few years since the transmission of the first visible cloud images from space in 1959, much progress has been made through space meteorology in weather forecasting. Technological progress has permitted the extension of observations from the visible to the infra-red, ultra-violet and microwave regions of the electromagnetic spectrum. Geostationary meteorological satellites provide continuous coverage around the world. Since they observe a large part of the earth continously, they are able to detect, track and monitor the growth and decay of weather systems. Sequential images from geostationary satellites can determine wind direction and speed at cloud level. Concurrently, polar-orbiting satellites operate in sun-synchronous orbits at altitudes of 800 to 1,500 kilometres. Profiling sensors provide measurements of atmo-

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[5] Activities in the field of international direct television broadcasting by satellite should be carried out in a manner compatible with the sovereign rights of States, including the principle of non-intervention. These activities should promote the free dissemination and mutual exchange of information and knowledge in cultural and scientific fields, assist in educational, social and economic development, particularly in the developing countries. Every State has an equal right to conduct activities in the field of international direct television broadcasting by satellite, and these activities should be based upon and encourage international co-operation. A State which intends to establish or authorize the establishment of an international direct television broadcasting satellite service shall without delay notify the proposed receiving State or States of such intention and shall promptly enter into consultation with any of those States which so requests. (RES 37/92, Annex)

spheric temperature and humidity as a function of altitude for use in computer models for weather forecasting. Satellite observations over the oceans, particularly of such parameters as sea-state, sea-surface temperatures and precipitation, are also important for meteorologists, as are data on snow and ice coverage of the earth's surface.

2.3. REMOTE SENSING

Remote sensing is the acquisition of information about an object or an area without any direct physical contact. The most obvious example of a remote sensor and closest to man is his eyes. The eyes visually sense information from the world around us. In the present context - remote sensing of the earth - sensors placed on a variety of air- or space-based platforms operating at different altitudes and sensitive to different wavelengths of the electromagnetic radiation replace the eyes. *Satellite* remote sensing is just one component in an integrated systems approach.

The sensor is the essential element of remote sensing system. With respect to sensors used, a principal distinction has to be made between *passive* and *active* remote sensing systems. The first requires a natural supply of reflected (solar) or emitted (earth) radiation; while the latter provides the initial signal itself and records the object's response, such as reflection, scattering, fluorescence emission. There are imaging sensors and other sensors that measure parameters along a line beneath the satellite. The former cover, inter alia, through photography (a passive sensor) the visible range of the electromagnetic spectrum; the synthetic aperture radar (an active sensor) is another important imaging device.[6] Even when in orbit around the earth at altitudes of between 200 and 600 km, satellites can image objects on the ground with extraordinary clarity. Radars can penetrate heavy clouds covering the earth's surface, and heat-sensing infra-red sensors can effectively see in the dark.

While electronic sensors tend to have poorer resolution than photographic systems, the advantage of regular coverage over many years offsets the resolution disadvantage. Furthermore, electronic sensors can make observations at wavelengths beyond the sensitivity of photographic film.

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[6] A synthetic aperture radar (SAR) is essentially a side-looking radar with a relatively short antenna which is made to behave like a very long one with a narrow beam. A short antenna can be simulated to represent a very long one by taking advantage of the motion of an aircraft or a satellite. Signals from a short antenna are added electronically and synthesized to give the effect of a long one. A long antenna is a requirement for high resolution.

Images collected by the sensors can either be recorded on film or be converted into electrical signals. In the first instance, the exposed film can be brought back to earth or developed and scanned on board the satellite by electronic devices. If data, from imaging or non-imaging sensors, are not transmitted "live" to the ground, they are generally stored on magnetic tape.

Since 1972, remote sensing has become increasingly operational. The United States Landsat, as well as the Soyus, Salyut, and Meteor spacecraft of the USSR have collected extensive remote sensing data. While until recently the United States of America and the Soviet Union dominated the field of remote sensing from outer space, the present trend is the proliferation of this technology to some other nations. By the end of the decade there are likely to be six or more remote-sensing satellite systems operated by national or regional agencies. Apart from those of the Soviet Union and the United States, remote-sensing satellite systems have been established, or are thought likely to be set up soon, by Canada, China, France, Japan, India, and possibly other countries. In addition, a remote-sensing satellite system is being established by the European Space Agency.

Meteorological satellites as well as earth-resources and environmental satellites use remote sensing techniques. They can be considered as complementary and partially overlapping subsystems of a global earth-observation system. This is the reason why certain remote sensing applications such as large-scale air and water pollution monitoring are also referred to in this connection.

During the past three decades, the number of nations embarking upon space programmes has increased significantly. Many of these are potentially capable of developing civilian satellites with capabilities of generating data with relatively high resolution. For example, the French Spot-1 earth-resources satellite, launched on 22 February 1986, carries two high-resolution visible (HRV) instruments: panchromatic images have a 10-metre ground resolution while multispectral images have a 20-metre ground resolution.[7]

But even though there may be many satellites providing remote sensing data, not many nations may be able to take full advantage of them because the types of sensors used and the operating conditions of satellites differ from each other. For instance, the sensors may be

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[7] *Aviation Week & Space Technology,* 3 March 1986, p. 21; 10 March, pp. 136-137. By May 1986, before it was formally declared operational, Spot-1 had already returned 18,000 60x60 km scenes (*Aviation Week & Space Technology,* 5 May 1986, p. 101). Spot-4 and Spot-5, expected to be launched in the early 1990s, are to have resolutions of 2.5 metres (*Aviation Week & Space Technology,* 8 September 1986, p. 38).

operating at different spectral bands, the data may be transmitted over different frequencies and telemetry format, and ground tracks may be different for different satellites. Thus, different ground receiving equipment would be needed for different spacecraft. Even the software used for computers which analyse and enhance images may be different.[8]

There is a tendency to commercialise the data. Developing countries are particularly concerned that data on their economic resources and also information relevant to their national security would become available to whoever can pay for it.

The Committee on the Peaceful Uses of Outer Space (COPUOS) formulated a draft on principles relating to remote sensing of the earth from space, and these principles were adopted by the General Assembly on 22 January 1987 as resolution 41/65.[9]

2.4. NAVIGATION, GLOBAL POSITIONING

The use of satellites for navigation began early with the use of Doppler analysis of signals received from continuously radiating space-based radio beacons of high frequency stability. When a satellite passes overhead, the frequency of its radio signal changes continuously. First the frequency increases, then, as the satellite moves beyond the zenith, the frequency decreases. This effect, which is known as the Doppler effect, is the basis of the operational principle of navigation satellites. If the exact satellite location, the frequency of its radio signals and the speed of the satellite are known, then, from the Doppler effect, an observer on the earth can deduce his exact geographical position. Basically, the navigation satellite's function is to transmit, on very stable frequencies, signals that provide a constant reference frequency,

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[8] While all countries have been able to use remote sensing data without having their own ground stations by obtaining data received and processed by other countries, it must be pointed out that countries without own ground stations do not receive the raw data, but only processed data. The need for different ground receiving equipment has significant cost implications for countries wanting to receive data from different remote sensing satellites.

[9] Remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries. States carrying out remote sensing activities shall promote international co-operation in these activities and make available technical assistance to other interested States. As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. (See report of COPUOS [Document A/41/20 and Corr. 1] and the resolution, the annex of which contains the principles.)

a navigation message describing the satellite's position as a function of time, and timing signals. Updated navigation messages and time corrections are periodically transmitted from the ground stations to the satellite. In order to fix the position of a navigator in three dimensions, simultaneous observations from at least three satellites are needed. The US Navstar Global Positioning System (GPS) will provide poisitioning data with an accuracy of about 10 m to US-authorized military users and about 100 m to anyone else.

Position determination in real time with the aid of satellites is useful for a wide range of human activities, such as civil engineering, environmental planning, resources exploration and management, transportation and traffic control, as well as search-and-rescue operations.

Within the framework of an understanding signed in November 1979, the US National Aeronautics and Space Administration, the Ministry of Merchant Marine of the USSR, the Canadian Department of Communications and the French Centre National d'Etudes Spatiales started the development of a satellite-borne system to locate aircraft and ships in distress. Low-altitude polar-orbiting satellites launched under this programme, called COSPAS/SARSAT,[10] constantly listen to emergency transmissions (SOS signals) from aircraft and maritime vessels in distress. The transmissions are picked up by receivers on satellites and retransmitted to ground stations where they are analysed to determine the position of the signal emitter to within 20 to 25 kilometres. Search and rescue teams are then sent out.

Within this multinational co-operative venture, the USSR launched the Cospas programme. The first satellite of the Cospas system (Cosmos 1383) was launched on 30 June 1982. The first US Sarsat satellite was launched on 28 March 1983. The parties to the understanding of 1979 concluded after a four-year establishment, demonstration and evaluation phase that COSPAS/SARSAT had proven to be effective, and on 5 October 1984 they agreed in a memorandum of understanding to begin operational service of COSPAS/SARSAT in 1985. Control stations and ground facilities are in the USA and in the USSR, as well as in Canada, France, Norway, and the United Kingdom. A number of other States are either taking part in the development of COSPAS/SARSAT or have expressed their interest in joining it.[11]

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[10] COSPAS is the USSR search and rescue satellite system; SARSAT is the US, Canadian and French search and rescue satellite system.

[11] Bhupendra Jasani: "Satellite monitoring - programmes and prospects." In: Bhupendra Jasani and Toshibomi Sakata (Eds.): *Satellites for Arms Control and Crisis Monitoring.* Oxford: Oxford University Press, 1987. p. 41.

2.5. GEODESY

Geodesy is the science of the physical nature of the earth. It deals with the shape of the earth, its gravitational field and the exact relationship between the positions of various points on the earth's surface. An accurate knowledge of the latter and the shape of the earth are essential for mapping purposes. The earth's gravitational field is not uniform because large parts of the earth's crust have different densities. Geodetic satellites determine the shape of the earth and the parameters of its gravitational field more accurately. Satellite laser ranging and radar altimetry have also greatly contributed to a much more detailed presentation of the earth's gravitational potential.

Similarly, satellite technology can be used to solve important problems of geodynamics, in particular direct measurement over large distances of plate-tectonic movements with sufficient accuracy. Laser ranging to satellites was originally developed to improve the precision of satellite orbit determination. It has become a geodetic tool to determine station positions with an accuracy ranging from several decimetres down to 1 to 2 centimetres. Studies have shown that space-based laser-ranging equipment, with passive retroflectors attached to ground targets might be a cost-effective alternative system for rapidly surveying the relative positions of sites within a few tens of kilometres of each other spread over tectonically active regions.

2.6. SCIENTIFIC RESEARCH

In addition to meteorology, earth survey (remote sensing) and geodesy there are some other research fields the investigation of which is facilitated by satellites.[12] Several new sciences have emerged, such as extra-atmospheric astronomy, space biology and space medicine.[13]

Space science has made rapid progress since the launch of the first artificial earth satellite in 1957; the Sputnik launched by the Soviet Union. It has brought new understanding about the solar system and indeed about the whole universe. Because observations in the ultra-violet, X-ray and gamma-ray wavelengths are possible only from above the atmosphere, satellite observations have led to remarkable advances in *astronomy* in the last twenty years. Space astronomy is a form of very remote "remote sensing". Space capabilities also provide the possibility of observing and studying some of the relevant objects and phenomena at close range. Landing has been achieved on the moon, both by manned missions and by unmanned robots, and several hundred

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[12] Communication and navigation are less fields of research than such of application.

[13] *Soviet Space Studies.* Novosti Press Agency Publishing House, Moscow, 1983. p. 2.

kilograms of lunar material have been brought back to earth. Apart from the moon, instruments have been placed on only two other celestial bodies, namely, Venus and Mars. However, Mercury and all three of the giant planets - Jupiter, Saturn and Uranus - have already been observed by planetary probes and probes have also inspected Halley's Comet. The sun interacts with the earth not only through its light and heat, but also through emission of some of its material in the form of ions and electrons, which impinge on top of the magnetosphere of the earth. This stream of plasma, called the solar wind, varies in temperature, intensity and speed. Space observations have unravelled many of the features of this complicated interaction.

The space environment can be reproduced on earth only with great difficulty or even not at all. In space there is a virtual absence of gravity a a near-vacuum exists. The cosmic spectrum of radiation cannot be sampled and studied on earth. *Materials science* experiments in a space environment, coupled with ground-based research, led to a new understanding of basic processes. Fluid physics, chemistry, metallurgy, single crystals and pharmaceuticals are specific areas of activity.

Manned space missions have stimulated research in *space biology and medicine*. Neither the microgravity environment nor the complex spectrum of space radiation can be produced or effectively simulated in ground-based laboratories. Consequently, for biology and medicine, space is a environment that makes possible a variety of experimental investigations which cannot be accomplished on earth. Whilst most biological experiments in space have focussed on practical problems of manned space flight, some missions have studied the fundamental biological effects of micro-gravity. Effects of stimulated growth of micro-organism, muscular and skeletal abnormalities in rats, and multidirectional growth in plants, are some of the phenomena that were found to be of special interest during preliminary observations.[14]

3. Utilization of outer space for military purposes

MILITARY SUPPORT SATELLITES AND SPACE WEAPONS

The military uses of outer space are frequently grouped into two categories: a) the use of satellites as integral part of military activities on earth and to enhance the performance of weapons based in terrestrial space and targeted to that environment (military support

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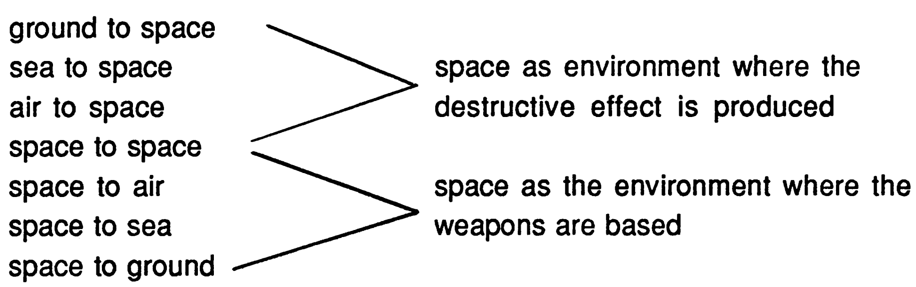
[14] The information presented in the section on "Current and Imminent Satellite Functions" relies in part on the Report of the Second UN Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-21 August 1982; UN Document A/CONF. 101/10.

satellites); and b) the use of outer space as environment for basing or employing *devices for the destruction* of satellites, missiles and nuclear warheads after they have been launched. In common, if not undisputed terminology, the second category is referred to as space weapons (or "space strike weapons", for part of the literature), which includes weapons capable of destroying objects in outer space and weapons which are space objects themselves. In this distinction, the stress is on space *weapons*, as opposed to other systems utilizing space.

Another distinction is also relevant for the understanding of the term *space weapons*. Since the negotiation of the Outer Space Treaty in the mid-1960s, a generic term has been sought that would distinguish between a) "earth" weapons which enter outer space for part of their trajectories, namely weapons targeted from terrestrial space to terrestrial space, and b) all other weapons that could be used within, to or from space, including weapons utilizing new technologies. The latter category is essentially what is widely understood as space weapons. In this distinction the stress is on *space* weapons, as opposed to other weapons neither based in nor targeted to outer space.

Space weapons, so understood, could be divided into the following subcategories:



Weapons of at least one of these subcategories are officially acknowledged to be *deployed* (ground to space), others are acknowledged to have been *developed and tested* (ground to space, air to space, depending on the definition of "basing" also space to space), most are the subject of *research*, but regarding some categories (space to sea, space to ground) no State is acknowledging R&D. Essentially space weapons currently under discussion are weapons to counter satellites in orbit and missiles in flight.

None of the arms limitation treaties regarding outer space, nor any of the six United Nations General Assembly resolutions entitled *Prevention of an Arms Race in Outer Space,* provides a general definition or description of the *arms* or *weapons* capable of being used in that environment which are the subject of prohibition or restriction.

The Outer Space Treaty variously refers to *nuclear weapons; weapons of mass destruction; military manoeuvres*; and *any type of weapons*. The ABM Treaty does not prohibit *weapons* as such but limits all systems *to counter ballistic missiles or their elements in flight trajectory*. The Antarctic Treaty also refers to *any type of weapons* and *measures of a military nature*. The Registration Convention requires information with respect to *general function*. The ENMOD Convention prohibits *hostile use*. In addition to prohibitions that are also contained in the Outer Space Treaty, the Moon treaty forbids *any threat or use of force or any hostile act or threat*. The Nuclear Accidents Agreement seeks action *in the event of signs of interference* with missile warning systems. The Agreement on Basic Principles of Relations endeavours *to avoid military confrontations* and *conflicts*.

The problem of the definition of space weapons has been discussed in the Conference on Disarmament, but no agreement has been reached.

There is no settled practice in the use of the terms *based* and *stationed*. In this report the terms are used interchangeably, to indicate the placement of an object in outer space that is of longer duration than direct return to the terrestrial environment would require. There is a close relationship between some terrestrially based and space-based weapons. In that rsepect the two categories cannot be treated in isolation from each other.

A further distinction has been made between *dedicated* and *non-dedicated* weapons. Each can cause damage. Two criteria may be used to identify a dedicated weapon: that it is specifically designed to cause damage, or that it is efficient in causing damage.

MILITARIZATION AND WEAPONIZATION

The relevance of the distinction between the utilization of outer space for enhancing the performance of military activities on earth and terrestrially based weapons, on the one hand, and the utilization of space as basing environment for weapons that are destructive in themselves, on the other hand, is subject to dispute. To put it briefly, one view stresses that outer space has experienced *militarization* (in the sense of military utilization, including target acquisition information; mainly through military use of satellites which are considered an integral part of nuclear weapons systems, but also through testing and deployment of weapons not based in space, but designed to produce their effects in this environment) for more than two decades. Research into technologies which would enable space-based objects to be used in the second role (for destruction of satellites, missiles, and warheads) is in this view just one further, albeit significant, step in the utilization of space for military purposes.

Another view stresses that although satellites have been used for military purposes for at least two decades, no actual*weaponization* of space has as yet taken place. Proponents of this view say that there is a fundamental difference between satellites which enhance the performance of earth weapons and satellites which are destructive in themselves. Only the latter are called weapons or, more exactly, *space weapons, strike weapons* or *space strike weapons*. It is argued that communication, navigation, early warning and other satellites already in military use are not weapons "in the generic sense of the word". The existence of "military satellites" is in this view no reason to assert that outer space is already militarized.[15]

Some neutral and non-aligned countries argue that both militarization and weaponization involve projecting the arms race into outer space. They conceive the problem of the prevention of an arms race in outer space a direct consequence of the nuclear arms race.[16] Accordingly, they claim that a solution to the increasing militarization of space and the avoidance of its weaponization will be achieved by addressing the nuclear arms issue. The debate itself, whether weaponization would involve a qualitative leap or a mere difference of degree in relation to the present *status quo* does not appear to matter to analysts from many of these countries; in fact, they argue that it does not contribute to adopting concrete measures for the prevention of an arms race in outer space, and that the interpretations advanced by either parties in the debate should not warrant the deployment of space weapons.

OFFENSIVE AND DEFENSIVE SPACE WEAPONS

In parts of the literature, a distinction is drawn between *offensive* and *defensive* space weapons. As simple as this distinction sounds, it is difficult to sustain in reality. The basic idea seems to be, roughly stated, that the first group of weapons (offensive) can be used against military, economic and other assets of the adversary in their peacetime configuration while weapons of the second group are effective only against the adversary's weapons, and even only after these have been launched. Some weapons, such as earth-based terminal defenses against ballistic missiles, cannot be used directly for launching an attack,

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[15] *Star Wars" Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 8.

[16] An example of this view was forwarded by the representative of India at the plenary session of the Conference on Disarmament that took place on 12 August 1986 (CD/PV.378). In general, non-aligned countries claim that the connection between both nuclear and space arms resides in the process of integrating space capabilities to the strategies and doctrines associated with nuclear weapons. Nigeria went as far as saying that in order to stop an arms race in outer space the Conference should first agree on a nuclear test ban treaty (CD/PV.391, 24 February 1987, p. 21).

while some other weapons may, in contrast, in addition to their defensive quality also be directly utilizable for launching an attack.

This is not a sufficient basis to speak of defensive and offensive weapons. On the one hand, even those weapons that would normally be considered offensive can be used defensively, most clearly if they are used only to retaliate after an attack. On the other hand, all weapons - even those which would normally be considered defensive, such as earth-based terminal defenses against ballistic missiles - can be used as part of an offensive strategy. Defensive tactics may serve an offensive strategy just as well as offensive tactics may serve a defensive strategy.

For some aspects of arms limitation, it could nevertheless be useful to distinguish between weapons which, in themselves, have destructive capabilities and those which do not.

BALLISTIC MISSILES

For more than 80 per cent of their overall travel time most intercontinental ballistic missiles travel through outer space on a earth-to-earth (or sea or air space) trajectory. In spite of this fact they are generally not considered to fall under the definition of a space weapon. That is not to say that they are irrelevant for the debate on space weapons, and the utilization of outer space for military purposes. But it does mean that subsuming ballistic missiles under the rubric of space weapons would constitute a deviation from terminology which is widely used.

3.1. MILITARY ASPECTS OF EXISTING SATELLITE FUNCTIONS

This section deals exclusively with support that might be given by objects in earth orbit to assist military activities on earth and the performance of weapons based in terrestrial space, i.e. with military support satellites.

The available data do not allow an accurate and undisputed assessment of how many of all satellites launched since 1957 were for military and for civilian purposes, respectively. Such an assessment would also be complicated by the fact that many satellites perform dual (civilian and military) functions. While it is believed that a large proportion of satellites serve military purposes, there is a clear divergence of views held by different sides regarding the relative importance of civilian and military activities performed by satellites.

It should be kept in mind that the *direct* military utilization of satellites (not covering the distribution of satellite-gathered data to

States not operating satellites) is for the time being limited to a small number of States.

Satellites such as those used for the verification of arms limitation agreements or those for early warning of missile attack can be helpful for the preservation of peace, and build confidence that arms limitation treaties are being observed. Some believe that these satellites could be managed by an international organization.

COMMAND, CONTROL, AND COMMUNICATIONS

The transmission of data gathered by space-, air- and land-based surveillance sensors, together with other data for military purposes, needs highly reliable and secure communications systems. A space-based communications network normally requires a number of operating satellites. Satellites are believed to serve the following military purposes in the area of command, control, and communications:

- First, they may transmit data gathered by satellites to military control and command centres at various levels of command.
- Second, they may transmit electronic signals between earth-based military command and control centres and military units. They can thus provide military authorities with a worldwide command and control capability. In comparison with traditional earth-based communication networks, they have large transmission capacities.
- Third, they may provide communication links for mobile military forces such as air forces, naval units and ground forces. High-orbit communication satellites cover large geographical areas.
- Fourth, they can be used for communication between national military authorities. High-orbit communication satellites may be less vulnerable than earth-based communication links in wartime.

METEOROLOGY

Information about the weather has always been useful for military operations. Military commanders have a need to know, for the success of a mission, what the weather will be at a precise time and location. The knowledge of cloud formation and their movements is of importance for planning photographic reconnaissance and bombing missions. Weather information is helpful for the selection of weapons systems and launch times. Knowledge of the precise conditions of the atmosphere can also help improve the accuracies of ICBMs. The accuracy of an ICBM depends on, among other factors, the knowledge of the earth's gravitational field (geodesy), of the relative positions of the target and the missile launcher (reconnaissance/navigation) and the knowledge of the meteorological conditions along the missile's possible trajectory. Meteorological conditions determine corrections that have to be made to the missile trajectory.

Military weather satellites are thought to occupy characteristic orbits. One such orbit is the "sun-synchronous" orbit. Satellites in this orbit pass over the poles at an altitude of about 800-900 km at a period of 100 minutes. They pass over an area on the earth's surface at the same time of the day every day.

REMOTE SENSING

Photographic reconnaissance

According to an estimate, about 40 per cent of all satellites for military use launched in the last twenty years are photographic reconnaissance satellites.[17] One type of satellite for military use carries photographic and television cameras, a multispectral scanner system (MSS), infra-red sensors and microwave radars. Such reconnaissance satellites are believed to serve the following range of military purposes:

- targeting support for terrestrially-based conventional military forces
- targeting support for terrestrially-based nuclear weapons
- assessment of military capabilities (construction/production facilities/field testing)
- monitoring of crisis and conflicts
- verification of arms-limitation agreements

Cameras operating in the visible range of the electromagnetic spectrum are considered to be able to spot objects 0.3 m in size.[18] Technical progress is also providing civilian satellites with capabilities that could have military significance.[19]

Both the Soviet Union and the United States of America launch photographic reconnaissance satellites regularly, and the People's Republic of China has also launched several such spacecraft. Some other States also plan or develop satellites for military reconnaissance.

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[17] Bhupendra Jasani: "The military use of outer space". In: *World Armaments and Disarmament, SIPRI Yearbook 1986.* Oxford: Oxford University Press. pp. 131-157.

[18] R. G. Blair: "Reconnaissance satellites". In: Bhupendra Jasani (Ed.): *Outer Space - A New Dimension of the Arms Race* . London: Taylor & Francis, 1982. p. 130.

[19] Spot-1 images (with ground resolution of 20 metres) of Murmansk and Severomorsk, headquarters of the Soviet Northern Fleet, were published in *Aviation Week & Space Technology* (2 March 1987, pp. 44-45), with the comment that the photographs illustrated the growing capability of civilian remote-sensing satellites to provide detail on military facilities previously available only through military/intelligence reconnaissance satellites. Further it reported that the US Deputy Under Secretary of Defense for Policy, has asked a White House Senior Interagency Group for Intelligence Committee to report on the national security aspects of civil remote sensing programmes.

Electronic reconnaissance/electronic intelligence

Electronic intelligence (ELINT) satellites carry equipment designed to monitor and detect radio and radar signals generated by military activities, for example, from military communications between bases, from early-warning, air-defence and missile-defence radars, or from missiles during test flights. The latter measurements could yield data on performance of missiles. Such satellites not only locate systems producing military-related electronic signals but they also measure the characteristics of the signals. This information could facilitate the penetration of defences. In addition, ELINT satellites provide early warning of attack by monitoring the flow of military communications.

It is possible to put electronic reconnaissance satellites into orbit simultaneously with photographic reconnaissance satellites for co-ordinated missions. While both the United States and the Soviet Union have in orbit electronic reconnaissance satellites, little is known about such spacecraft.

Ocean surveillance

A group of several satellites having ocean surveillance functions can detect, identify and monitor the location of surface ships in all oceans. In order to increase the capability of military reconnaissance satellites, long-range radars, microwave and infra-red radiometers, radar altimeters and other microwave devices are often used on board satellites. Some of these are used to detect and track military surface ships, while others are used to determine various ocean properties. The latter helps in weather forecasting. A detailed understanding of the characteristics of oceans also permits the design of better sensors for submarine detection.

Ocean-surveillance satellites may be equipped with synthetic-aperture radars (SARs) with imaging capabilities. Information about the location of surface ships, gathered by means of these satellites, can be transmitted without delay to military command and control centres.

Radar sensors require considerable power. In most satellites the power is generated by solar cells. However, many such cells have to be used, so that the spacecraft experiences considerable drag, causing it to fall back to the earth's surface unless a large amount of fuel is spent to keep it in orbit. Moreover, such large solar power panels become vulnerable to attack. In order to overcome some of these problems, considerable impetus was given to the development of nuclear power generators. The two most commonly used nuclear energy sources are the energy released when a radionuclide decays and the energy released when a fissile atom fissions. In the former, the heat produced by decaying radionuclides can be converted into electricity. The most commonly used radionuclide for this purpose is Plutonium-238; a typical power generator is called a radionuclide thermoelectric generator (RTG). The power output ranges from 2 to about 500 watts. RTGs have been used by both the USA and the USSR. The radars, particularly the SAR sensors, usually require considerably more power (at least 3.5 kilowatts) than the RTGs can provide. Thus nuclear reactors for use on board satellites have been developed by the USSR. The USA is developing large nuclear reactors for use on board satellites. On more than one occasion, accidents involving space-based nuclear power supplies have resulted in contamination of either the earth's atmosphere or the earth's surface, or both. This situation suggests the need to further consider the consequences of attack to those satellites and the need of granting protection of attack, given the widespread adverse effects that the destruction of those satellites could cause.

Early warning

Early-warning satellites carry infra-red sensors to detect enemy missile launches by observing the hot plume of a rocket. In the early days, *radars* provided about 15 minutes warning time of intercontinental ballistic missile attack. The use of early-warning *satellites* has extended this time to some 30 minutes for ICBMs. US early warning satellites are placed in the GEO where they are able to observe missile and satellite launch sites of the USSR and of the People's Republic of China. Information from such satellites is transmitted to ground stations and then relayed to the North American Aerospace Defense Command (NORAD)/Space Command at Colorado Springs. NORAD receives and verifies the launch of a Soviet missile within 180 seconds. Within 300 seconds after the launch of the missile, NORAD is able to ascertain the nature of the launch (test/attack).[20] The Soviet Union operates early warning satellites in highly elliptical orbits (period 12 hours), arranged that their apogees are located over the northern hemisphere so that the satellites are for a considerable part of their orbit in sight of both the mid-western USA and the ground stations in the USSR. The view has also been expressed that the early warning satellites should be part of a multilateral center for crisis control to prevent nuclear war.

Prompt warning of nuclear attack is an element in the credibility of assured retaliation to nuclear missile attack, which is thought to be essential for maintaining the existing state of deterrence and

[20] Craig Covault (1985): "USAF initiates broad program to improve surveillance of Soviets". In: *Aviation Week & Space Technology*, 21 Jan 1985. pp. 14-17.

prevention of nuclear war. It is important for States to have the means of knowing with certainty that they are *not* under attack, so as to avoid any possibility of pre-emptive steps being taken in the mistaken belief that an attack against them had been launched.

NAVIGATION, GLOBAL POSITIONING

Modern warfare involving mobile weapons systems such as aircraft, missiles and ships, together with the need for accurate knowledge of targets, puts considerable demands on military navigation systems. For accurate targeting it is important to know the exact positions of the aircraft, missiles and surface and submerged ships. Satellites are beginning to fulfill these requirements. Signals emitted by satellites have replaced the light emitted by stars used by navigators for centuries. In order to have continuous coverage around the globe, a relatively large number of navigational satellites in orbit are necessary.[21]

The military purposes of space-related navigational networks are believed to include:

- en-route navigation and accurate positioning of mobile land-based, sea-based and air-based military forces; this helps in achieving rendez-vous (airborne refuelling, close air support, cargo drops)
- accurate positioning of weapons systems enhances weapons accuracy (the clearest example are probably SSBN; bombing accuracy can also be improved through precise knowledge about position and velocity of the aircraft)
- positioning and determination of velocity of space vehicles and satellites

Both the USA and the USSR have developed or are developing navigation satellite systems. The US *Navstar Global Positioning System* (GPS), is to include 18 satellites in 6 planes in its final stage. In his report to the Congress in early 1986, the US Secretary of Defense stated that the deployment of the 18-satellite network, scheduled for 1988, would provide a global, three-dimensional navigation/position fixing and timing capability.[22] 11 Navstar GPS satellites are now deployed in space; the last of these was launched on 9 October 1985.[23] After the Space Shuttle accident it appeared in mid-1986 that it could be as late

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[21] In order to determine the position in three dimensions, three satellites have to be in the user's field of view.

[22] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987 FY 1991 Defense Programs, February 5, 1986. Washington, DC: US Government Printing Office. p. 250.

[23] *World Armaments and Disarmament, SIPRI Yearbook 1986.* Oxford: Oxford University Press. p. 154. At least part of the present 11 satellites are part of a developmental system and not of the production run of 28 satellites.

as 1991 before the system would have a full capability.[24] Operational testing of GPS receivers on persons, land vehicles, aircraft, submarines and surface ships demonstrated position accuracy of approximately 11 metres vertically and 9 metres horizontally for US-authorized military users.[25] (These figures probably are to be interpreted that the horizontal accuracy is equal or better than 9 metres for 50 per cent of the time. Most likely the accuracy would be equal or better than about 20 metres for 90 per cent of the time.)[26]

Technical details of the Soviet Global Navigation Satellite System (Glonass) are at present not available.[27]

GEODESY

Without the collection of geophysical data of the earth (shape and gravitational field) by geodetic satellites, the performance of some weapons delivery systems would be much lower than it is now. Some of the sytems might not even be feasible. For example, knowledge of the earth's gravitational characteristics is needed for the correction and improvement of a nuclear missile's flight trajectory in order to attain increased accuracy. The lack of precise knowledge of the shape of the earth and its gravitational field would introduce considerable errors in the computations of trajectories and in the inertial guidance systems of missiles, aircraft and surface and submerged ships.

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[24] *Aviation Week & Space Technology,* 30 June 1986. p. 21.

[25] *Aviation Week & Space Technology,* 9 June 1986. p. 25.

[26] For a thorough description of Navstar GPS see K.D. McDonald: "Navigation satellite systems: their characteristics, potential and military applications". In: Bhupendra Jasani (Ed.): *Outer Space A New Dimension of the Arms Race.* London: Taylor & Francis, 1982; pp. 155-188. The Navstar satellites are also an example of satellites performing two functions: in addition to the equipment needed for GPS, they also carry equipment for the detection of nuclear explosions.

[27] *Aviation Week & Space Technology,* 27 July 1987, pp. 38-39.

3.2. SATELLITES, DISARMAMENT AND ARMS LIMITATION

Many of the capabilities of satellites that have military utility can also be turned to verification functions. Reconnaissance and remote sensing of every kind that could reveal threatening military activities can also confirm the absence of such activity. This can relate to naval, air or troop movements in accordance with restraints, the non-deployment of certain classes of weapons, destruction or dismantling of weapons, or the absence of testing of weapons. Thus one main task of satellites has been to provide the technical means whereby arms limitation treaties can be verified in order to give assurance that the provisions of those treaties are being observed. Observations from outer space, by so-called *national technical means* (NTMs) have been used for monitoring some of the bilateral agreements between the two major nuclear Powers since 1972, most prominently the SALT and ABM treaties.

The non-intrusive nature of observations from satellites facilitates their use for verification purposes. The most advanced technology for reconnaissance from outer space is classified, because it is used on board military satellites. But in recent years, remote sensing technology by civilian satellites has become sophisticated enough, so that a new potential emerges for international co-operation in the verification of arms limitation or disarmament treaties. The same technology would also be suitable for monitoring crisis areas of the world. A number of techniques and procedures can be employed to verify compliance with agreements. Which type or combination of methods is used depends essentially on the nature of the treaty and the extent to which violations could be tolerated if they occurred. Among the proposed treaties for which verification procedures will be important are a chemical weapons convention, a comprehensive test ban treaty, a radiological weapons treaty and an outer space treaty. In the following table, a number of arms limitation agreements are listed and the potential contribution of satellites to their verification is indicated.

Treaty	Type of satellite; sensors needed for observation	Type of activity prohibited	Comments
MULTILATERAL TREATIES			
Geneva Protocol (1925)		Use in war of asphyxiating, poisonous or other gases and of bacteriological agents	See BW Convention
Antarctic Treaty (1961)	Military; synthetic aperture radar (SAR), optical cameras, electronic surveillance equipment	Any measures of a military nature, such as the establishment of military bases, military manoeuvres and testing of weapons - e.g. nuclear explosions or any type of weapon	Some of the activities prohibited could be observed by some civilian satellites; more details could be observed if sensors on civilian satellites were orbited at lower altitudes; on-site inspection and aerial observation allowed (article 7)

Treaty	Type of satellite; sensors needed for observation	Type of activity prohibited	Comments
Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water (1963)	Military; nuclear radiation detectors, X-ray and optical sensors	Any nuclear weapon test in the atmosphere, in outer space and under water	Optical and heat sensors on some civilian satellites (e.g. weather satellites) could observe atmospheric and outer space nuclear explosions; preparatory activities for a nuclear test and subsequent radiation could be observed
Outer Space Treaty (1967)	Optical cameras; infrared sensors and SAR	Placing in orbit of nuclear weapons and other weapons of mass destruction; establishment of military installations and fortifications; military manoeuvres on celestial bodies	
Treaty of Tlatelolco (1968)	Military; optical and SAR	Testing, use, manufacture, production, acquisition, receipt, storage, installation or deployment of any nuclear weapon by States Parties or by the nuclear weapons States Parties to the First and Second Additional Protocols	Optical and radar sensors on civilian satellites (e.g., weather satellites) could observe construction of clandestine nuclear facilities, particularly if they are orbited at lower altitudes, and preparatory activities for a nuclear test
Treaty on the Non-Proliferation of Nuclear Weapons (NPT, 1968)	Military; optical and SAR	Transfer of nuclear weapons by nuclear-weapon State parties and receipt, manufacture or other acquisition of nuclear weapons by non-nuclear weapon State parties	Optical and radar sensors on civilian satellites, particularly if they are orbit-orbited at lower altitudes, could observe construction of clandestine nuclear facilities, enrichment plants, roads and railway tracks and preparatory activities for a nuclear test
Sea-Bed Treaty (1972)		Emplacement of nuclear weapons and other weapons of mass destruction	Satellites cannot contribute to verificaction of this treaty
Biological Weapons Convention (1975))	Military; optical sensors in visible and IR range, SAR	Development, production, stockpiling or acqusition of bacteriological and toxin weapons; provides for the destruction of existing stocks	Optical sensors and SAR on some civilian satellites could detect some of the BW activities if the sensors are orbited at lower altitudes; manoeuvres connected with testing and training drills; decontamination facilities and segregation barriers; railway lines and specially designed tanker-wagons
Environmental Modification Convention (1978)	Military and civilian weather satellites; visible, IR and microwave radiometers; optical sensors	Engaging in military or any other hostile use of environmental modificaction techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury	Although satellites may detect any unusual developing weather pattern, it would be difficult to know who might have caused such a change
Moon Treaty (1984)	Optical cameras, infrared sensors and SAR	Threat or use of force or any hostile act on the moon and celestial bodies including orbits around them; prohibits the use of the moon, etc., as a base for hostile acts; nuclear weapons, or other weapons of mass destruction are banned from the moon, etc.; establishment of military bases, installations and fortifications, the testing of weapons and the conduct of military manoeuvres are also prohibited	
BILATERAL TREATIES			
Limitation of Anti-Ballistic Missile Systems (ABM Treaty, 1972)	Military; optical and electronic sensors; SAR	Limits deployment of ABM systems to national capital regions of each country plus one other area; this was later modified by a 1974 Protocol to a single site for each country	ABM systems normally consist of launchers, interceptor missiles and radars which can be easily observed by military satellites; high-energy beams of ABM radars are detected by electronic reconnaissance satellites; civilian satellites are not equipped with sensors to detect electronic signals but their optical sensors may be able to detect large radar installations from low altitudes

Treaty	Type of satellite; sensors needed for observation	Type of activity prohibited	Comments
Strategic Arms Limitation Talks (SALT I, 1972)	Military; optical and electronic sensors; SAR	Places a freeze on aggregate numbers of fixed land-based ICBM launchers and ballistic missile launchers on submarines	The following could be observed: telemetry of missile test; construction of missile silos; launch and impact areas, to obtain missile range; shipyards, for submarine construction; some of these activities, e.g., construction of silos, may be detected by some civilian satellites, but the sensors do not have high enough resolution to observe details
Threshold Test-Ban Treaty (TTBT, 1974)		Underground tests of nuclear weapons with a yield of more than 150 kt	Satellites cannot contribute to verification; in future sensors to measure ground motion and atmospheric overpressure due to underground nuclear explosion may be developed
Peaceful Nuclear Explosion Treaty (PNET, 1976)		Underground nuclear explosions for peaceful purposes in excess of 150 kt or aggregate yield in excess of 1500 kt	Satellites cannot contribute to verification; in future sensors to measure ground motion and atmospheric overpressure due to underground nuclear explosion may be developed
SALT II Agreement (1979) not ratified but observed until 1986	Military; optical and electronic sensors; SAR	Provides for overall ceiling on strategic nuclear delivery vehicles, subceiling on launchers for all MIRVs plus heavy bombers with air-launched cruise missiles over 600 km range, MIRV launchers, warheads, etc.	Similar to SALT I and ABM treaties

An international satellite monitoring agency

The idea of international participation in the verification of arms control treaties is not new. In 1978, France proposed the establishment of an international satellite monitoring agency (ISMA) under the United Nations. This proposal was examined by a group of governmental experts who submitted their report to the United Nations General Assembly in June 1981.[28] The proposal envisaged monitoring not only the arms control treaties but also crisis areas in order to settle disputes between nations. The UN report concluded that the current state of space technology was such that it were possible and feasible to verify compliance with certain arms control treaties and to monitor crisis areas. The report also noted that there were no provisions in international law, including space law, that would prevent an ISMA

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28 For the French proposal, see UN document A/S-10/AC.1/7, 1 June 1978. For the report, see UN document A/AC.206/14, 6 August 1981. Also published as *The Implications of Establishing an International Satellite Monitoring Agency* . Volume 9 of the Disarmament Study Series published by the UN Department for Disarmament Affairs. New York: United Nations 1983. (see also p. 149 of this study)

from carrying out monitoring activities from outer space. The constraints are of a political and financial nature.

The ISMA concept faces problems concerning the dissemination of sensitive data. They might be made less intense if the number of nations involved in the monitoring process were small. Thus, a *regional satellite monitoring agency* (RSMA) is an alternative idea, particularly if it relates to a regional arms control measure. The problems of availability and dissemination of sensitive data would still exist, but in the case of an RSMA they would be less extensive. The sensitivity of data dissemination could be reduced if a SALT-type of standing consultative commission were to be established.

An RSMA may, for example, be relevant to the Conference on Confidence- and Security-Building and Disarmament in Europe. The infrastructure needed for an RSMA already exists in Europe. The European Space Agency (ESA) and the Interkosmos Council have active programmes in the field of remote sensing, an essential technology for verification of arms limitation treaties and monitoring crisis areas. Moreover, co-operation between these organizations has already been established.

Proposals concerning international co-operation among neutral and non-aligned States in the use of satellites for verification and crisis monitoring purposes have been made by neutral States in Europe. A Canadian programme (PAXSAT) centres on assessing the feasibility of applying space-based remote sensing technology to the tasks of verification in the context of multilateral arms control and disarmament.[29] In the Ixtapa Declaration, the Heads of State or Government of the Group of Six agreed to consider steps by which the non-nuclear weapon States may co-operate in international arrangements related to future nuclear disarmament. In this context an international data exchange satellite was envisaged for a nuclear test ban.

An RSMA or an arms control and conflict observation satellite would not only provide information on the status of the arms race and crisis development but could also provide an independent check on claims by

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[29] PAXSAT research has concentrated on two potential applications of space-based remote sensing to multilateral arms control verification. The first is space-to-space remote sensing (PAXSAT "A") which deals with verification of agreements involving space objects. The second, space-to-ground remote sensing (PAXSAT "B") focusses on how to assist in the verification of agreements involving conventional forces. (*PAXSAT Concept: The Application of Space-Based Remote Sensing for Arms Control Verification* [Verification Brochure No. 2]. Ottawa: Department of External Affairs, 1987.) (see also p. 154 of this Study)

the USA and the USSR regarding research and development by the other side of space weapons. At present, there is no way of independently checking such claims, despite the fact that there are no technical or legal constraints to such an activity by any group of nations. Neutral and Non-aligned countries would find it desirable to take part in such an initiative because it would allow them to overcome the existing gap in this field.[30]

3.3. EXISTING ANTI-SATELLITE AND ABM CAPABILITIES

The following section seeks to describe space weapons (in the more narrow sense of the term) that have been - or are being - *tested or deployed* (or both). Two categories make up space weapons in this more narrow sense: anti-satellite (ASAT) weapons on the one hand, and anti-ballistic missile (ABM) weapons on the other hand.[31] Research programmes which have not yet resulted in tested or operational systems (and thus do not at present constitute "existing capabilities") will be covered in part two, "Technological and Conceptual Challenges".

Even though currently existing ABM capabilities are not space-based, ABM capabilities have to be described as well as ASAT capabilities. There are several reasons for this. First, and most importantly, some types of deployed or tested ABM systems are designed to destroy incoming RVs above the atmosphere, thus they are weapons which could intercept objects in space.[32] Secondly, ABM weapons are now usually considered to make up one of the categories of space weapons. Even if this assessment is partly based on contemplated ABM/BMD systems which might be deployed in space, this argues that the current situation in the ABM field should be described to give an accurate picture and provide a background to present activities.

ASAT weapons and ABM/BMD systems have some basic principles in common, even though some operational requirements are quite different. Technologies researched and developed for one application are likely to be utilizable also for the other application. Both categories, ASAT and ABM/BMD weapons, could be divided into two kinds: kinetic-energy weapons (KEW) and directed-energy weapons (DEW). The KEWs, which can be propelled either by chemical rockets or

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30 See for instance the statement of the representative of Pakistan at plenary session of the Conference on Disarmament on 22 April 1986 (CD/PV.358).

31 In a third conceivable category of space weapons, such as those based in outer space and targeted against terrestrial space, there are at present no known capabilities. No weapons systems falling into this category have been deployed or tested.

32 ABM interceptor missiles of this type include: Spartan (USA, no longer deployed), Homing Overlay Experiment (USA, tested), ABM-1b/Galosh (USSR, deployed).

by electromagnetic forces, derive their destructive energy from the momentum of an object. A target is then destroyed on impact. Some KEWs may even carry chemical explosives. On the other hand, in DEWs energy in the form of beams propagated with the speed of light (300,000 km/sec) is used for the destruction of a target. Both the KEWs and the DEWs can, in principle, be earth-, air-, or space-based. In the case of KEW, it is possible to deploy them on submarines while in the case of an earth-based laser weapon, for example, mirrors can be placed in orbit to reflect the energy to the target. The *existing* capabilities, both in the ASAT and in the ABM fields, all refer to kinetic-energy weapons.

No State acknowledges having operationally deployed any dedicated anti-satellite system at present, and only one State, the Soviet Union, has an operational ABM system, for a limited area and in accordance with the terms of the ABM Treaty.

EXISTING ANTI-SATELLITE CAPABILITIES

Any weapon that could destroy or damage a satellite is referred to as an anti-satellite weapon, irrespective of basing mode or energy source. A first distinction is between dedicated and non-dedicated ASAT weapons. In principle the use of satellites could also be impaired or disrupted by attacking ground facilities and by jamming the communications link between satellites and ground facilities. However, in this subsection only ASAT capabilities in the more narrow sense, those which would directly impact on satellites, will be considered.

At present there are only self-imposed political limitations on the development, testing and deployment of non-nuclear ASAT weapons. The Outer Space Treaty of 1967 prohibits the placing in orbit of nuclear ASAT weapons.

Non-dedicated ASAT capabilities

Any ballistic missile capable of reaching outer space, including nuclear-armed ICBMs and SLBMs, has inherent anti-satellite capabilities. However, this would not be an attractive option in most circumstances.

Furthermore, all *satellites* with extensive capabilities of manoeuvring in orbit could be programmed as ASAT weapons. After approaching less manoeuvrable and unarmed, or unsuspecting, satellites, they could be used for destroying or disabling those satellites by *deliberate collision*. They could also be equipped with interceptors to destroy other satellites, but at that point one would no longer speak of non-dedicated

ASAT capabilities. Satellites could also be programmed for *electronic interference* with adversary satellites. Satellites able to retrieve other satellites could be used to *retrieve the satellites* of other States in a hostile manner, although there exist relatively simple countermeasures.

At present, and in the near future, all of the non-dedicated ASAT capabilities referred to above could be utilized to damage only a few satellites at a time. Such attacks would possibly elicit immediate retaliation in space, and maybe also on earth, carrying a risk of escalation. The military benefits to be attained from ASAT attack by non-dedicated means would be minor, compared with the risks involved.

However, the possibility of damaging satellites by non-dedicated means is a complicating factor bound to make arms limitation in this field more difficult than it would be otherwise. But in view of the limited strategic utility of exercising non-dedicated ASAT capabilities, the persistence of those capabilities should not be an insurmountable obstacle to the conclusion of arms-limitation agreements prohibiting development, testing, deployment and use of strategically significant ASAT weapons.

Dedicated ASAT capabilities

Dedicated ASAT capabilities refer to systems that have either been tested or deployed in the past or in the present. These ASAT weapons are able to attack satellites in low orbits only. The majority of satellites used for military purposes are at present beyond the maximum range of these systems, though those within their range are very important for many purposes, including verification.[33]

Nuclear ASAT capabilities

As early as 1959 tests were conducted with nuclear-armed ASAT weapons. (These tests did, however, not include the nuclear warhead.) Satellites were supposed to be destroyed by the nuclear blast and/or by nuclear radiation. These weapons, tested by the United States, were crude and indiscriminate in their destructive capabilities. In the first half of the 1960s, the United States developed and deployed two nuclear-armed direct-ascent ASAT weapons systems. The systems are now obsolete and were withdrawn from deployment in 1967 and 1975, respectively. The fixed site and limited range meant they would only

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[33] John Pike: "Anti-satellite weapons and arms control". In: *Arms Control Today*, December 1983. pp. 5-7.

have been able to attack low-altitude targets in a direct-ascent mode.[34]

Non-nuclear ASAT capabilities

A non-nuclear ASAT system has been tested by the *Soviet Union*. It could be categorized as a rocket-propelled kinetic-energy weapon. Rather than using a nuclear warhead, orbiting satellites were used to destroy a target by direct impact or by exploding nearby. These interceptor satellites which weighed about 2.5 tons were launched by modified SS-9 boosters and exploded on ground command within 30 metres of the target satellite. The target was destroyed by debris.[35] Between 1968 and 1971, the Soviet Union conducted a number of ASAT tests. After a hiatus of more than five years, ASAT tests were resumed in 1976. The following methods of interception have been attempted in these tests:

> First, the interceptor satellite, usually launched at an orbit inclination of 62-66 degrees and having a highly elliptical orbit, passes the target satellite either at apogee or perigee, where it explodes.
>
> Second, the interceptor and target satellites are in the same orbital plane. Both, the interceptor and the target satellites are co-orbiting. During one or two earth orbits the interceptor slowly approaches the target satellites and explodes.
>
> Third, the interceptor is popped up from a lower orbit, using on-board propulsion, to the flight path of the target satellite. Soon after the successful interception it is either recovered or disintegrates in the earth's atmosphere.

A military drawback of such a system is the long time needed for the intercept. It takes up to three hours from the time of launch until the target is intercepted. The US system tested in the 1980s (see below) is faster.

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[34] John Pike: "Anti-satellite weapons". In: *Federation of American Scientists Public Interest Report*, Vol. 36, No. 9. November 1983. Paul B. Stares: "Déjà vu: The ASAT Debate in Historical Context". In: *Arms Control Today*, December 1983. pp. 2-3. Raymond L. Garthoff: "ASAT arms control: still possible". In: *Bulletin of the Atomic Scientists*, Vol. 40, No. 7. August/September 1984. p. 30. Thomas H. Karas: *The New High Ground.: Systems and Weapons of Space-Age War*. New York: Simon & Schuster, 1983. pp. 148-149. Fiscal Year 1984 Arms Control Impact Statements. Washington, DC: US Government Printing Office, April 1983. p. 110. *Star Wars" Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 18.

[35] Bhupendra Jasani: "Outer Space: Militarization Outpaces Legal Controls". In: *Maintaining Outer Space for Peaceful Uses*. pp. 227-231. Details of the tests are not corraborated by Soviet sources.

In 1982, tests of the Soviet ASAT system were terminated.[36] They have not been resumed at the time of this writing (September 1987). The Soviet Union unilaterally pledged in 1983 not to place any type of anti-satellite weapons in outer space first as long as other States refrain from doing so.[37]

The United States Secretary of Defense claims that Soviet ASAT weapons are operational.[38] The Soviet Union does not consider that system operational and states that it was in the test stage when a moratorium on launching was declared.

In the last days of the Ford Administration, in early 1977, the *United States* took the decision to engage in full-scale development of an air-launched ASAT weapon. It consists of a miniature homing vehicle (MHV) mounted on a two-stage rocket carried by an F-15 aircraft. The MHV weighs about 15 kg and has an infra-red heat-seeking homing guidance sensor. The entire weapon, with the rocket, is about 5.5 m long and about 0.5 m in diameter. Unlike the Soviet ASAT weapon this weapon can directly ascend to the target satellite. Depending on the location of the aircraft which carries the interceptor missile, the US ASAT can disable a target satellite within minutes. For the current model that has undergone tests, the maximum altitude this ASAT weapon can reach probably does not exceed 500 km.[39]

The US Air Force has conducted five live-fire tests of the MHV ASAT system from F-15s, but only one was against a target in space. Four other tests were conducted against pre-determined points in space or used the infra-red radiation emitted by stars to test the guidance systems.[40] On 13 September 1985, the F-15 released its ASAT missile at about 10 km above the earth's surface against a real target, the

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36 According to an estimate, a total of some 20 ASAT tests were carried out by the Soviet Union between October 1968 and June 1982. (Bhupendra Jasani: "Emerging Technologies". In: Disarmament; a period review by the United Nations, Vol. X, No. 2, Summer 1987; p. 26.

37 *Star Wars"- Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 12.

38 Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987 - FY 1991 Defense Programs, February 5, 1986. Washington, DC: US Government Printing Office. pp. 222-223.

39 Paul B. Stares: "Déjà vu: The ASAT Debate in Historical Context". In: *Arms Control Today*, December 1983. p. 3. John Pike: "Anti-satellite weapons and arms control". In: *Arms Control Today,* December 1983. p. 4.

40 *Aviation Week & Space Technology,* 16 March 1987. pp. 19-21. The aircraft and the missile part of the system (without an MHV) were flight-tested on 21 January 1984. The second flight test, with an MHV, was conducted on 13 October 1984. The MHV was aimed against a distant star used as a weak infra-red source. Two further tests were carried out on 22 August 1986 and 30 September 1986.

Solwind P78-1 satellite which was placed in orbit in February 1979. On interception at about 500 km, both MHV and Solwind ceased to transmit. The Altair booster (the second stage), using its inertial guidance system, directed the MHV until it was close to the target. The MHV was made to rotate at about 20 rev/sec to stabilize its trajectory, and it reached a speed of about 10 km/sec before shattering the Solwind satellite.[41]

In October 1985, the US Congress issued, in the form of an amendment to the FY 1986 funding bill, a moratorium on any further live-fire tests of the MHV against targets in space, provided the Soviet Union continues a similar ban. This moratorium was extended through FY 1987. The US ASAT weapon is described by both US and Soviet sources, as being in the testing stage.[42] In 1985, the US Secretary of Defense wrote that the test and evaluation phase of the ASAT programme was scheduled for completion in 1987; in 1986 he stated that the funds requested for FY 1987 would be used to continue research, development, testing and evaluation of the ASAT programme and to begin long lead-time material procurement.

For FY 1988, the Department of Defense unveiled a plan to restructure the ASAT programme, including continued testing of the MHV. For the mid-1990s, the DoD also plans to develop an enhanced higher-altitude version of the system which would use a new booster, or a ground-based system using a Pershing-2 missile. A follow-on system could consist of ground-based excimer lasers. The DoD also asked Congress to lift its ban on tests against a target satellite.[43]

EXISTING ABM CAPABILITIES

This subsection seeks to describe the capabilities of the ABM systems (systems to counter strategic ballistic missiles or their elements in flight trajectory) that are *deployed* at present or have been deployed in the past, as well as those which have been *tested* (without being deployed). ABM (or BMD) systems that are the subject of *research* will

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[41] Bhupendra Jasani: "The military use of outer space". In: *World Armaments and Disarmament, SIPRI Yearbook 1986*. Oxford: Oxford University Press. pp. 133-134. C. Marshall (1985): "Working solar monitor shot down by ASAT". In: *Science*, Vol. 230, No. 4721, 4 October 1985. pp. 44-45.

[42] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987 - FY 1991 Defense Programs, February 5, 1986. Washington, DC: US Government Printing Office. pp. 222-223. *"Star Wars" - Delusions and Dangers*. Moscow: Military Publishing House, 1985. p. 18.

[43] *Aviation Week & Space Technology,* 16 March 1987. pp. 19-21.

be discussed in the next chapter, "Conceptual and Technological Challenges".

The description of ABM systems at this place does not imply that *all* ABM systems should be regarded as space weapons. However, the more recent discussion of ABM/BMD does largely involve weapons that would either be based in space or destroy targets in space (or both). Thus they fall under the most likely definitions of space weapons. A full understanding of this discussion is possible only against the background of all current ABM capabilities.

Non-dedicated ABM capabilities

Incidental ABM capabilities apply to all objects that can enter outer space, especially those that can do so at great speed, including earth-, sea- and air-launched missiles of appropriate range. But these non-dedicated ABM capabilities have to be seen against the background of the current inability, on all sides, to track and target ballistic missiles (or their warheads) adequately, especially in large numbers. They are probably less significant than existing non-dedicated ASAT capabilities.

Dedicated ABM capabilities

The only weapons systems to counter strategic ballistic missiles in existence at the present time are those not prohibited by the ABM Treaty of 1972 as amended in 1974. Under the amended Treaty, the United States and the Soviet Union are entitled to nominate one site each to be defended by one hundred fixed land-based launchers. The two sites chosen are: Moscow for the Soviet Union; Grand Forks (North Dakota) for the United States. The United States decided to mothball its ABM system, but the physical possibility and legal entitlement to reactivate it at any time remains open.

Radars are a vital component of ABM systems. Mutual allegations of treaty violations regarding capabilities and functions of radars will be described later in the report, even though they at least partially refer to systems already tested and/or deployed.

<u>United States of America</u>

In the first half of the 1960s, the United States developed two nuclear-armed ABM missiles. Guided by ground-based radars, the nuclear warhead would explode near the incoming re-entry vehicles (RVs) and destroy them. The *Spartan* missile was designed to destroy RVs before and the *Sprint* missile after they had entered the atmosphere.

Over the next two years, the debate whether to deploy an ABM system was intense. In September 1967, Robert McNamara, then Secretary of Defense, announced the US decision to deploy a partial ABM system. While pursuing development, testing and evaluation of an ABM system (eventually called *Sentinel)*, the Secretary of Defense argued that the USA should initiate negotiations with the Soviet Union to limit the deployment of ABM systems. In 1968 the two sides agreed, in principle, to begin negotiations on the limitation of their ABM systems. The Sentinel programme was reviewed by the Nixon administration and cancelled, to be replaced by a different system called *Safeguard*. Some 28 Sprint and 8 Spartan missiles were deployed at Grand Forks, North Dakota. Although Safeguard was declared operational in October 1975, it was deactivated in the same month. The perimeter acquisition radar was retained. Since that time the USA has not deployed any ABM system and the radar is used for early warning.

The US Army has tested the *Homing Overlay Experiment* (HOE), for non-nuclear intercept above the atmosphere. On 10 June 1984, an ICBM with a dummy warhead was launched from Vandenberg AFB (California) and a missile carrying a non-nuclear interceptor was launched twenty minutes later from the Kwajalein missile test range. With the aid of a long-wavelength infra-red sensor, the interceptor homed in on the target and destroyed it on impact.[44]

In the *Delta 180* experiment on kinetic-energy weapons, carried out on 5 September 1986, a satellite and the second stage of a Delta rocket were brought to a collision. The satellite was separated from the second stage. As the two vehicles approached the Kwajalein missile test range, they were manoeuvered on a collision trajectory. While the Delta second stage was guided on a stabilized path, the satellite did actively manoeuver to achieve impact at about 3 km/sec.[45]

In another programme, the *flexible lightweight agide guided experiment* (FLAGE), the US Army on 27 June 1986 successfully intercepted a target simulating a reentry vehicle. The target, together with a booster that accelerated it to hypersonic velocity, was launched from an aircraft. It was released at about 14,000 metres above ground. The intercept took

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44 "HOE Experiment- further details". In: *Interavia Newsletter*, No. 10523, 13 June 1984. p. 1. *Aviation Week & Space Technology,* 18 November 1985. p. 21. *Aviation Week & Space Technology,* 15 September 1986. pp. 18-19. Before the impact at an altitude of about 160 km, at a closing speed of about 6 km/sec, an umbrella-shaped aluminium and steel device studded with weights opened up to a diameter of about 4.5 metres to improve the probability of interception. The successful intercept was achieved with the fourth attempt.

45 *Aviation Week & Space Technology,* 15 September 1986. pp. 18-19.

place at about 4,000 metres altitude, approximately seven seconds after launch of the interceptor equipped with a millimeter-wave radar homing device.[46]

Based on the concept tested in the HOE and the FLAGE, the US Army initiated in late 1985 or early 1986 development of two ground-based kinetic-energy ABM systems, the *exo-atmospheric re-entry vehicle interceptor subsystem* (ERIS) and the *high endoatmospheric defense interceptor* (HEDI). The ERIS interceptor is expected to have a length of about 50 cm, one-fourth the size of the HOE, and its targets are assumed to be non-manoeuvring RVs. ERIS in in development; test flights are not expected until "some time after" 1989.[47] The HEDI missile will be about the same size as the Spartan but will have higher velocity. Flight tests of HEDI are to begin in 1989. Testing of both systems is to be conducted within the US missile test ranges agreed with the USSR according to the provisions of the ABM Treaty.[48] It is to be noted that ERIS and HEDI are in the stage of *development* and have not been tested; they are mentioned here because of their relationship to the HOE which has been tested.

Union of Soviet Socialist Republics

In accordance with the provisions of the ABM Treaty, the Soviet Union has deployed an ABM system around Moscow. The ABM Treaty allows the system deployment area to have a radius of 150 km;100 launchers are allowed. According to Soviet official information the purpose of the Moscow ABM system is defense against accidental ballistic missile launches and a certain amount of protection against decapitation attack on the Soviet Union.

According to official US sources, the Soviet ABM system consisted up to 1979 of four ABM complexes with a total of 64 (4x16) above-ground launchers with ABM-1b/Galosh (US designation) nuclear-armed interceptors designed to intercept warheads in space shortly before re-entry into the atmosphere. Battle management radars of the "dog house" and "cat house" types (US designation) were based separately from the launch complexes. Tracking and guidance radars were located at the launch complexes.[49]

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[46] *Aviation Week & Space Technology,* 7 July 1986. pp. 24-25; 14 July 1986. p. 119.

[47] *Aviation Week & Space Technology,* 18 November 1985. p. 21; 10 March 1986: 39; 9 March 1987: 41.

[48] *Aviation Week & Space Technology,* 10 March 1986: 37-38; 24 March 1986: 28-29.

[49] *Soviet Strategic Defense Programs.* Released by the Department of Defense and Department of State, October 1985. pp. 7-12.

In late 1979, 32 of the launchers were dismantled.[50] According to US officials, in 1980 the Soviet Union started to upgrade and expand its ABM system to the limit allowed by the ABM Treaty.[51]

The modernized Moscow ABM system which, according to US sources, may be fully operational by 1987, will have two layers, instead of the one layer it consisted of before. The old Galosh launchers (based above the ground) are, according to US officials, being replaced with hardened in-ground silos with a modernized Galosh interceptor. In addition, a new high-acceleration ABM interceptor (code-named Gazelle), also nuclear-armed, but designed to engage targets in the atmosphere, is said to complement the Galosh. The "dog house" radar is said to serve battle-management functions, and a new phased-array engagement radar (the Pushkino PAR) would command and control the actual interception of RVs.[52]

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[50] *United States Military Posture for FY 1983.* Prepared by the Organization of the Joint Chiefs of Staff. Washington, DC. US Government Printing Office. p. 110.

[51] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1986 Budget, FY 1987 Authorization Request and FY 1986-90 Defense Programs, February 4, 1985. Washington, DC: US Government Printing Office. p. 56. Frank Gaffney (US Deputy Assistant Secretary of Defense for Theater Nuclear Force Affairs): "The strategic context of SDI: a US assessment of Soviet attitudes towards mutual vulnerability". In: Bhupendra Jasani (Ed.): *Space Weapons and International Security.* Oxford: Oxford University Press 1987. p. 289.

[52] Frank Gaffney (US Deputy Assistant Secretary of Defense for Theater Nuclear Force Affairs): "The strategic context of SDI: a US assessment of Soviet attitudes towards mutual vulnerability". In: Bhupendra Jasani (Ed.): *Space Weapons and International Security.* Oxford: Oxford University Press 1987. pp. 289-290. *Soviet Strategic Defense Programs*; Released by the Department of Defense and Department of State, October 1985. pp. 7-12.

Part II
Technological and Conceptual Challenges

The current utilization of outer space for military purposes, and in particular the existing capabilities in the field of space weapons (ASAT and ABM), have been described. A major part of this utilization, through *satellites* and *fixed ground-based kinetic and nuclear energy ABM systems*, has been carried out by the two major nuclear-weapons States since the late 1950s or early 1960s. Technological progress in these areas continued, but it did not introduce major conceptual challenges as long as the assumption remained essentially undisputed that the offense dominates over the defense in strategic nuclear weapons.

The inability to effectively defend large areas against a co-ordinated attack of ICBMs, SLBMs, strategic bomber aircraft, and cruise missiles led to a situation that is described by the United States as nuclear deterrence and by the Soviet Union as equality and equal security. There were disagreements on the desirability of such a strategic environment, but this was widely regarded not as a matter of choice.

The concept of nuclear deterrence derives from the existence of a large number of strategic offensive nuclear weapons systems, coupled with the absence of any significant capability of defense against most of these weapons systems. Knowing that there exist no means to prevent that the other side will respond in kind, each side will refrain from nuclear attack. According to this line of strategic thinking, it is important that both sides are vulnerable to a nuclear response. The fear of a second or retaliatory strike would prevent either of them from contemplating a first strike.

The Soviet Union rejects the concept of deterrence. In its view, it does not only create unpredictability and uncertainty, but leads inexorably to a balancing act on the edge of war. Instead of this concept, the Soviet Union proposes that of "reasonable sufficiency". Reasonable sufficiency of military capabilities finds its expression in quantity and quality of armaments of defensive character as well as in their structure and deployment pattern. Both of these elements should be convincing with regard to lack of aggressive aspirations. Sufficiency means also that concrete levels of military capabilities should practically confirm the defensive character of military forces and at the same time provide necessary security.

The emergence of *ASAT weapons* did incorporate some conceptual challenges, but they remain limited as long as neither the United States nor the Soviet Union have a capability to destroy within a short time frame a large proportion of the other side's satellites, in particular those in higher orbits. At present such a capability is not believed to exist. But if ASAT weapons were perceived as endangering the capability of either side to retaliate after the other side had launched a nuclear attack, they would challenge the prevailing strategic concepts.

Basically, technological advances that are now reflected in the *current* utilization of outer space for military purposes did not fundamentally challenge these strategic concepts. It was rather improvements in targeting accuracy, developments in the field of tactical nuclear weapons, modifications of targeting doctrines (counterforce) and, more generally, uncertainties revolving around the concept of limited nuclear war that challenged the prevailing concepts.[53]

While developments in satellite and space weapons technology did thus for a certain time not vitally challenge the basic strategic concepts, new developments which in themselves are technological challenges may also constitute conceptual challenges, either because they would effectively open up an alternative to the present nuclear situation or because they might lead one or more governments to believe in the existence of such an alternative.

This need not necessary be true to the same degree for all nuclear Powers. The Soviet Union, in particular, does not perceive technological sophistication as a way out of the present nuclear situation. According to its own statements, it is rather proceeding in its policy from the understanding of the unacceptability of nuclear war and the necessity to renounce the use of nuclear weapons and military force as a means of ensuring security in general. The United States considers it necessary to evaluate whether strategic defenses could offer a viable alternative to the present situation.

4. Contemplated space weapons

This chapter treats space weapons which are reported to be in various stages of *research* and perhaps *early development*, as well as those that

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[53] US Secretary of Defense Weinberger explains that every US President and every US Secretary of defense since the early 1960s has maintained the capability to respond to a range of possible Soviet attacks with a range of appropriate options. He says it is misguided critics which have sometimes confused US efforts to create credible options for the purpose of deterring Soviet aggression with a malign intention to fight limited nuclear wars. Regarding counterforce targeting, Weinberger states that it was never the case that the US based its deterrent on retaliating against Soviet cities. He describes the actual targets as 1. the Soviet leadership, 2. its military power and political control capabilities, and 3. its industrial ability to wage war. (Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987 - FY 1991 Defense Programs, February 5, 1986. Washington, DC: US Government Printing Office. pp. 74-75.)

are merely the subject of *discussion*, being possible future options in the light of scientific and technological capabilities. These space weapons fall into two main categories: BMD systems[54] and ASAT weapons.[55] At present, public discussion tends to focus on BMD systems. One reason is that BMD systems are more encompassing. They would also have ASAT implications while ASAT systems would most likely have only marginal BMD capabilities. A second reason is that territorial BMD is perceived to pose a more direct challenge to strategic concepts than ASAT weapons. A third reason is that the United States of America has announced an initiative in the field of BMD.

The utilization of space-based weapons for the destruction of targets on the surface of the earth is not an acknowledged subject of research by any State, even though some types of contemplated space-based weapons could, according to some observers,[56] in principle also be used for that purpose. Others argue that the power needed to destroy hardened targets will be much greater than can be transmitted from space to ground; and that this could be done more effectively with nuclear weapons. However, some non-hardened targets (for example aircraft, command and control centers) could be destroyed by certain kinds of space-based weapons.

4.1. HISTORICAL BACKGROUND

The historical background of the present technological and conceptual challenges posed by space weapons consists of quantitative and qualitative developments in nuclear weapons and their delivery systems on the one hand, and weapons designed to intercept them (and satellites) on the other hand. It spans by now about three decades. It is not possible to retrace all these developments here, and some of them (for the second component, ABM and ASAT systems) have been briefly presented in the first part of this report. The history of space weapons-related research can be traced only imperfectly because part of such programmes may not have become known to the public.

ASAT WEAPONS

The utilization of *satellites* for military purposes is widely assumed to have started soon after the first satellites had been launched, and the development of *ASAT weapons* was taken up soon afterwards. The US

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[54] Ground to space, air to space, sea to space, space to space, and space to air.

[55] Ground to space, air to space, space to space.

[56] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p. 69.

Air Force began testing ASAT missiles in 1959. The early US ASAT weapons - *Zeus* and *Nike-X* missiles based at Kwajalein from 1963 to 1967, and *Thor* missiles based at Johnston Island from 1964 to 1975 - were based on the use of nuclear weapons which would be indiscriminate in their destructive effect. Soviet ASAT weapons, tested 1968-1971 and 1976-1982, while slower because they were not direct-ascent weapons, would destroy by kinetic energy the intended targets only. In the past years, the United States has tested a direct-ascent kinetic-energy ASAT weapon that would combine the advantages of being fast and having a destructive effect on targeted satellites only. All these systems, dealt with as *current* ASAT capabilities, are limited in their range; they pose a risk mainly for low-orbit satellites. Research is now also being planned or carried out on ground- or air-based lasers in an ASAT role. Many countries are of the opinion that it is a matter of urgent necessity to negotiate a treaty banning ASAT weapons so as to safeguard the normal functioning of satellites.

One class of space weapons, ASAT weapons, was thus introduced shortly after the launch of the first satellite in 1957. While some elements of an arms race are detectable (action - reaction - counter-reaction), there is also some evidence of unilateral restraint in this area largely unregulated by treaties and agreements. (The PTBT and the Outer Space Treaty would prohibit testing and orbiting nuclear-armed ASAT weapons in space.)

DEFENSES AGAINST NUCLEAR WEAPONS

In the early days of strategic nuclear weapons, both the United States and the Soviet Union gave consideration to developing passive and active defenses against nuclear attack. *Passive defenses*, in the form of hardened and radiation-proof silos for launchers, and hardened launch control and other command centres have been implemented. But these passive defenses, including shelters for part of the population built by some States, are thought to have little significance with regard to the survival of a State subjected to major nuclear attack, except in so far as it may facilitate, for nuclear-weapons States, the continued functioning of command centres at least long enough to execute a retaliatory nuclear strike.

Active defenses designed to destroy incoming missiles, *ABM systems,* were envisaged early in the nuclear arms race, as a means to limit destruction in the event of nuclear war. Air defenses, against the third delivery system of nuclear weapons, bomber aircraft, were also deployed. Both the Soviet Union and the United States conducted research on ABM weapons in the 1960s. The Soviet Union developed and deployed a ground-based kinetic and nuclear energy ABM system for a limited area, the *Galosh* (US designation). The United States developed the *Nike-Zeus* and *Nike-X* missiles from which the *Sprint* was derived (endoatmospheric intercept, nuclear-armed). In addition the *Spartan* missile (exoatmospheric intercept, nuclear-armed) was developed. In September 1967, the decision to deploy the *Sentinel*, an ABM system designed to cope with a limited attack (attack from a third nuclear country, or accidental attack) was announced. This system was afterwards, by the Nixon administration, modified to the *Safeguard* system designed for the defense of missile sites.

Towards the end of the decade, when a debate was taking place in the United States on the wisdom of ABM weapons, the Soviet Union agreed to a US proposal to start negotiations towards the limitation of ABM systems, within the framework of an overall limitation on strategic armaments. At the end of discussions between the United States and the Soviet Union, and within the United States, it was agreed that the technology was inadequate for creating an effective territorial ABM system. In addition, the two Powers felt that a limitation of ABM systems was essential for agreements limiting strategic nuclear weapons. In 1972, the US-USSR negotiations resulted in the ABM Treaty and the SALT I Interim Agreement on Strategic Offensive Arms.

The ABM Treaty prohibits the deployment of ABM systems for a defense of the territory (except for two, later one, specified limited areas), and the development, testing, or deployment of ABM systems or components which are sea-based, air-based, space-based or mobile land-based.[57] It does not prohibit research on such systems, nor did it prohibit development and testing of fixed land-based ABM systems on agreed test ranges, and the modernization of the permitted ABM complexes. The United States mothballed the ABM launchers while keeping the radars of its ABM system. The Soviet Union maintained the ABM system deployed around Moscow and is modernizing it by introducing a second type of ABM interceptor missile and by building new radar installations, stating that the modernization is in accordance with the ABM Treaty provisions. Research on technologies potentially utilizable for ABM/BMD purposes (lasers, particle beams, sensors, kinetic-energy interceptors, etc.) went on in both the United States and the Soviet Union.

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[57] Article V, para. 1. According to agreed interpretation (D) 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.

American sources repeatedly reported on technological advances in ABM-related research conducted in the United States. In July and August 1980, and in May 1981, *Aviation Week & Space Technology* carried technical surveys on particle-beam and high-energy laser weapons, based on material obtained in interviews with the official agencies concerned.[58] Official documents of the US government did also report research efforts in ballistic missile defense and directed-energy technologies.[59]

According to information from official US sources, the Soviet Union initiated in the late 1960s a substantial research programme into advanced technologies for BMD, covering many of the same technologies that would later be investigated in the US Strategic Defense Initiative (laser, particle-beam, radio-frequency, and kinetic-energy weapons; computer and sensor technology).[60]

In 1981 the Soviet Union proposed that all "strike weapons" should be prohibited in the space environment,[61] not only weapons of mass destruction, as provided by the Outer Space Treaty of 1967.

NUCLEAR WEAPONS AND DELIVERY SYSTEMS

Developments in nuclear weapons and their delivery systems provide an essential background to BMD programmes. At this place, only some major elements can be briefly mentioned.

On the US side, the perceived or alleged *vulnerability of land-based ballistic missiles* to surprise missile attack was one element that gave an impetus to research on BMD weapons. The vulnerability - whether perceived or real - came about mainly as the result of two developments: an increase in the accuracy of ICBMs (and, at a lower level, also of SLBMs) and the progressive shift towards multi-warhead (MIRVed) missiles. Perceived counterforce capabilities gave rise to doubts about the effective functioning of nuclear deterrence, even though the sea-based strategic nuclear weapons were not considered

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58 *Aviation Week & Space Technology,* 28 July 1980, pp. 33-66; 4 August 1980, pp. 44-68; and 25 May 1981, pp. 40-71.

59 See, for example, in the *Arms Control Impact Statements*. The Fiscal Year 1984 Arms Control Impact Statements, dated April 1983, but not influenced by the March 23 address of President Reagan, there are 16 pages on BMD programmes (pp. 122-137) and 24 pages on directed energy programmes (pp. 249-272).

60 US Department of Defense and Department of State: *Soviet Strategic Defense Programs.* Washington, DC: US Government Printing Office, October 1985. pp. 12-16.

61 Document CD/274 of 1981. In general, proposals for the limitation or prohibition of space weapons are covered in part IV of this study.

vulnerable for the foreseeable future. The strong concern of the US government about the vulnerability of fixed land-based ICBMs manifested itself in the *hardening* of existing ICBM silos and in the search for a *basing mode* for the MX missile. At different stages, the "racetrack", "dense-pack" and "deep basing" modes were considered, and now the US government plans to deploy 50 MX as rail-mobile system. (The first 50 MX missiles are deployed in Minuteman silos.) The development by the United States of the *land-mobile small single-warhead ICBM* (Midgetman) is also a response to the perceived vulnerability. The perception that the land-based retaliatory forces are vulnerable to a surprise attack (after the accuracy of Soviet ICBMs had increased), coupled with the promise of ongoing research on ABM/BMD technology, led to a reconsideration of the merits of point-defense ABM systems, at least in the United States.

In the view of the US government, the main *arms limitation treaties* on strategic nuclear weapons, SALT I and II, did not present a satisfactory remedy against the vulnerability of retaliatory nuclear forces. The negotiations had failed to bring about a clear quantitative reduction in nuclear weaponry. The link between the limitation of ABM systems and the limitation of strategic offensive weapons is mentioned several times in the ABM Treaty and the agreed interpretations and unilateral statements regarding this treaty. On the one hand, limits on defenses are seen as conducive to the limitation of offensive arms. On the other hand, further limits on strategic offensive arms are seen as a precondition for the viability of the ABM Treaty. In a statement of May 9, 1972, Ambassador Smith stated that US supreme interests could be jeopardized if an agreement providing for more complete strategic offensive arms limitations were not achieved within five years.[62] SALT II was signed in 1979, but in the view of the United States it did not sufficiently address the concern of ICBM vulnerability and the desire for numerical reductions.

According to the Soviet Union, it was the United States themselves that initiated the destabilizing deployment of MIRVed missiles and a missile improvement programme (ABRES) in the 1970s, at least five years before the USSR. The USSR also says that at the same time the concept of "flexible" nuclear attacks against hard targets was introduced in the US nuclear strategy and that the Soviet Union has always underlined the fallacy of the US nuclear counterforce strategy and pointed out that options of this kind would be indistiguishable from general nuclear war. In the Soviet view, these developments threaten to make nuclear

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[62] Jozef Goldblat: *Agreements for Arms Control: A critical survey.* London: Taylor & Francis, 1982. pp. 202-205.

catastrophy more probable. The Soviet Union also states that in spite of the US decision not to abide any longer by the provisions of the unratified SALT II Treaty, the USSR continues to strictly observe it. The USSR also considers necessary to strengthen the ABM Treaty which it regards as the cornerstone of the arms limitation regime.

4.2. THE US STRATEGIC DEFENSE INITIATIVE

THE PRESIDENTIAL ADDRESS OF 23 MARCH 1983

The announcement, by President Reagan, of the US Strategic Defense Initiative (SDI) on 23 March 1983 changed the nature of the debate on nuclear deterrence and ABM/BMD systems. It set a large part of the ground for the discussion that ensued. Regardless of their position towards the desirability and feasibility of ballistic missile defense, observers agree that the announcement of SDI was an extremely significant event. It was intended as such. President Reagan said that "tonight we are launching an effort which holds the promise of changing the course of human history".[63]

The announcement of SDI came at the end of a larger address on national security issues. The part on SDI contained several elements:

- *Deterrence works:* In President Reagan view, deterrence of aggression through the threat of retaliation had worked for three decades.
- *Strategic stability must be enhanced:* President Reagan said it was necessary to examine every opportunity for reducing tensions and introducing greater stability into the strategic calculus on both sides. As one of the most important contributions towards these goals he mentioned ongoing efforts to reduce, in negotiations with the Soviet Union, the level of nuclear arms.
- *Dissatisfaction with the prospect of continued reliance on deterrence:* Even a drastic reduction of nuclear arms would leave the strategy of deterrence in place. President Reagan said that his advisers had underscored the necessity to break out of a future in which security relied solely upon the threat of retaliation. This reliance on deterrence, the President felt, was a sad commentary on the human condition, "the human spirit must be capable of rising above dealing with other nations and human beings by threatening their existence".

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[63] "President Reagan's National Security Address, March 23, 1983, Washington, D.C.". *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern, Supplement, No. 10, 24 March 1983.

- *Announcement of the SDI effort:* President Reagan said that after careful consultation with his advisers, he believed there was a way to achieve lasting stability other than by deterrence. The United States would embark on a comprehensive and intensive effort to define a long-term research and development program to begin to achieve the ultimate goal of eliminating the threat posed by strategic nuclear missiles.
- *Feasibility of effective defense against ballistic missiles:* President Reagan acknowledged that intercepting and destroying ballistic missiles was a formidable technical task which might not be accomplished before the end of this century. In the President's view, technology had attained a level where it was reasonable to begin an effort towards the stated goal. He called upon the scientific community "who gave us nuclear weapons to turn their great talents to the cause of mankind and world peace; to give us the means of rendering these nuclear weapons impotent and obsolete".
- *Offensive use of defensive systems:* President Reagan recognized that defensive systems have limitations and raise problems and ambiguities: "If paired with offensive systems, they can be viewed as fostering an aggressive policy and no one wants that." The United States would seek neither military superiority nor political advantage.
- *International obligations:* The President said that this first step was consistent with US obligations under the ABM Treaty. He also recognized the need for close consultation with the US allies.
- *The immediate future:* In the meantime, the United States would preserve the nuclear deterrent and maintain a capability for flexible response. However, the US would also pursue reductions in nuclear arms. In order to be able to negotiate from a position of strength, the strategic forces would have to be modernized, the President said. The conventional forces would also have to be improved.

THE FOLLOW-UP

Following the United States President's announcement, two study teams were established to analyse the possibility of strategic defense and to make recommendations. The *Defensive Technologies Study* Team concluded that powerful new technologies were becoming available that justified a major technology development effort offering future technical options to implement a defensive strategy. The most effective systems would have multiple layers, or tiers. Survivability of system components would be a critical issue the resolution of which would require a combination of technologies and tactics that remained to be worked out. The study called for the structuring of a broad-based research and technology development effort focused on establishing technical feasibility. The recommended effort was structured to permit a decision in the early 1990s on whether to proceed to system-level development.[64] The second study team prepared the *Future Security Strategy Study*. It concluded that it was essential that options for the deployment of advanced defenses against ballistic missiles be established and maintained. If feasible, such defenses would offer a new concept of deterring nuclear war by defense instead of retaliation.

In January 1984, the Strategic Defense Initiative was established as a research programme based on the Defense Technologies Study. At about the same time the Strategic Defense Initiative Organization (SDIO) was created as a defense agency to manage the SDI-related efforts by the Department of Defense. A comprehensive program was defined to explore key technologies in the field of defense against ballistic missiles, with principal emphasis on non-nuclear BMD systems. Specific research efforts were organised in five areas:

- Surveillance, acquisition, tracking, and kill assessment (SATKA);
- Directed-energy weapons technologies (DEW);
- Kinetic-energy weapons technologies (KEW);
- Systems analysis/battle management (SA/BM);
- Survivability; lethality; and key technologies (SLKT)[65]

As stated in official US documents, SDI was established as a programme of vigorous *research* to investigate the feasibility of advanced defensive technologies, seeking to reduce and possibly eliminate, the threat posed by ballistic missiles, strengthening stability and increasing the security of the United States and its allies. Technologies with potential against shorter-range ballistic missiles are also investigated. The research programme is intended to provide a future President and the Congress the *technical knowledge* necessary to support a potential decision in the 1990s on whether to develop and later deploy advanced defensive systems. Any future decision to move from research to development and deployment of advanced defensive weapons would be preceded by extensive discussions with the allies of

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[64] Defensive Technologies Study, March 1984. United States Department of Defense, Strategic Defense Initiative. Washington, DC: US Government Printing Office. pp. 4-5. Report to the Congress on the Strategic Defense Initiative, June 1986. Department of Defense, Strategic Defense Initiative. Washington, DC: US Government Printing Office. pp. I-1 to I-2.

[65] Report to the Congress on the Strategic Defense Initiative, June 1986. Strategic Defense Initiative, Department of Defense. Washington, DC: US Government Printing Office. p. I-2.

the United States; it would also be a matter for discussion and negotiation with the Soviet Union.[66]

The US Secretary of Defense declared that SDI is *not a weapons development programme*, that it is carried out in full compliance with the ABM Treaty, and that it is not based on preconceived notions of what a potential defensive systems against ballistic missiles should entail. Regarding the use of BMD systems for point defense on the one hand or defense of the whole territory on the other hand, the Secretary stated that defenses that might evolve from the research programme will not be intended to defend strategic weapons systems, rather the US was considering ways to defend its territory and that of its allies against the threat posed by ballistic missiles.[67]

The Soviet Union claims that SDI is not merely a programme of research but a crucial stage in the development of space weapons. The size of the project budget is quoted in support of this view. The Soviet Union does not believe that the US may renounce deployment of a nationwide BMD system at the end of the research programme. As for US statements that SDI is to be conducted in full compliance with the ABM Treaty, the Soviet Union considers them to be unconvincing and meant to conceal the true meaning of US actions eroding the ABM Treaty.[68]

Actual funding for the Strategic Defense Initiative was $ 50 million in FY 1984, in FY 1985 $ 1397.3 million, in FY 1986 $ 2963.1 million. For FY 1987 the US Congress appropriated $ 3753 million, and for FY 1988 and 1989, the SDIO has requested $ 5914.8 million and $ 6690 million, respectively. (These figures include, besides the five areas mentioned

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[66] US Department of Defense and Department of State: Soviet Strategic Defense Programs. Washington, DC: US Government Printing Office, October 1985. pp. 22-23.

[67] Foreword to *The President's Strategic Initiative*. White House Document of January 1985. Washington, DC: US Government Printing Office. Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987 - FY 1991 Defense Programs, February 5, 1986. Washington, DC: US Government Printing Office. p. 287.

[68] *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. pp. 35-36. In the hearings of the US Senate Armed Services Committee concerning ratification of the ABM Treaty, on 18 July 1972, Ambassador Gerard Smith clarified the meaning of "development" in the context of the ABM Treaty: "The obligation not to develop such systems, devices or warheads would be applicable only to that stage of development which follows laboratory development and testing. The prohibitions on development contained in the ABM Treaty would start at that part of the development process where field testing is initiated on either a prototype or breadboard model."

above, military construction linked to the SDI, and the SDI programme of the Department of Energy.)[69]

In the view of the US government, SDI is not a unilateral initiative by the United States, but a response to efforts by the Soviet Union in the same fields, serving as a hedge against a unilateral Soviet breakout out of the regime established by the ABM Treaty. The US Secretary of Defense claims that the Soviet Union has now ground-based prototype lasers that could interfere with satellites. He further claims that the Soviet Union is continuing full-scale strategic defense research in space- and ground-based laser weapons as well as particle beam, radio frequency, and kinetic energy weapons and could field selected prototypes of these weapons by the mid-to-late 1990s. He also claims that the aggregate of current Soviet BMD-related activities suggests that the Soviet Union may be preparing a ballistic-missile defense of their national territory.[70] The Director of the US Arms Control and Disarmament Agency said, in April 1986, that the Soviet Union has a large strategic defense programme "going well beyond research".[71]

The Soviet Union acknowledges carrying out various research programmes, including some with military applications. Soviet sources describe them as aimed at improving early warning, intelligence, communications and navigations systems based in space. The Soviet Union denies, however, that it is developing space weapons or ABM systems for the whole territory. In addition, it is said, the USSR is not engaged in any preparations for developing a territorial ABM system on the basis of air defences. The activities are described as being conducted in accordance with the ABM Treaty and not constituting a Soviet version of SDI. Soviet authors also point out that US accusations of Soviet violations of the ABM Treaty escalated in 1984 and 1985,

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[69] Figures for FY 1984 and 1985 from the Reports of the Secretary of Defense, Caspar W. Weinberger, to the Congress on the FY 1986 Budget, FY 1987 Authorization Request and FY 1986-90 Defense Programs, February 4, 1985 (p. 216); and on the FY 1987 Budget, FY 1988 Authorization Request and FY 1987-1981 Defense Programs, February 5, 1986 (p. 223). Figures for FY 1986-1989 from *Aviation Week & Space Technology,* 2 March 1987, pp. 18-19.

[70] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. pp. 28/52.

[71] "Geneva arms control talks: prospects and problems". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 70, 24 April 1986. p. 10.

after the address of President Reagan and the establishment of the SDI programme.[72]

4.3. Features of Contemplated BMD Weapons

Phases of an ICBM Trajectory

The trajectory of an intercontinental ballistic missile is commonly divided into four phases: boost, post-boost, midcourse, and terminal. An ICBM takes about 25-35 minutes to travel the distance between the two major nuclear Powers, depending on the exact location of launch site and target and the shape of its ballistic trajectory. Ballistic missile defenses which seek to destroy missiles or warheads at several phases are called *multi-layered* defenses. They are considered the most promising approach to BMD.

Boost phase

Two parameters of the boost phase are very important, burn-out time and burn-out altitude. The burn-out time sets time constraints for detection and intercept at this phase. The burn-out altitude largely determines what technologies can be utilized for the destruction of the ICBMs at this stage. Short burn-out times and low burn-out altitudes make it more difficult to successfully detect and destroy ICBMs or SLBMs during the boost phase.

The boost phase, in which the missile is accelerated to its required velocity, lasts for about 200-300 seconds for the current generation of ICBMs, and about 200 seconds for SLBMs.[73] During this phase one or

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[72] See Alexey G. Arbatov and Boris G. Mayorsky: "Preventing the militarization of space: is it necessary or possible?" In: Bhupendra Jasani (Ed.): *Space Weapons and International Security.* Oxford: Oxford University Press, 1987; pp. 188-189.

In July 1985, Vitaly Zhourkin, Deputy Director of the Institute for US and Canada Studies of the USSR Academy of Sciences, was asked whether the Soviet Union had its own SDI research programme. He replied that the Soviet Union did not have its version of SDI. This would not mean that it did not carry out any research because research was allowed by the ABM Treaty, and the Soviet Union did carry out research. But it did not, as Zhourkin said, plan any strategic defensive system situated in space, and it did not do anything to instal a territorial ABM system prohibited by the ABM Treaty. (Vitaly Zhourkin: Statement during the Video Conference between some participants of the SIPRI conference on Space Weapons and International Security, July 1985, Stockholm).

In the Soviet publication "Star Wars" Delusions and Dangers (Moscow: Military Publishing House, 1985, p. 39) it is stated that the "claim that the same sort of work as in America is being conducted in the Soviet Union is nothing but a lie".

[73] According to Soviet scientists, typical burn-out times for current ICBMs are about 200 seconds. (Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space:*

several warheads (depending on whether the missile has a single warhead or is MIRVed), inertial guidance systems, a computer with target data, as well as decoys and penetration aids are all in one vehicle, called the *bus*. Depending on the trajectory, the altitude of the missile at the end of the boost phase can vary considerably. Some experts indicate that the upper limit of the earth atmosphere is reached after 100-150 seconds, and that at the end of the boost phase (i.e. at burn-out), after about 200 seconds, the missile has reached an altitude of 200-350 km.[74] Another description says that at the end of the boost phase, after 200-300 seconds, the missile has only reached the upper limit of the earth's atmosphere, at about 100 km altitude.[75]

The ascending missile makes a relatively easy target. It is highly visible because of the bright plume produced by the burning boosters. It can therefore be easily detected. The missile is much larger than warheads, which again makes for easy detection. It is also more vulnerable than the individual warheads because its skin, in particular the walls of fuel compartments are more difficult to protect than warheads. The number of targets is smaller during the boost phase than in the following phases. Since the bus at the top of the missile carries all nuclear warheads, decoys and penetration aids, destruction of the missile would destroy all of them at once. However, during all or most of the boost phase, the missile is within the atmosphere, ruling out the utilization in this phase of some of the technologies contemplated for BMD.

Detection of ICBMs and SLBMs in their boost phase has almost by necessity to rely on satellites. Due to the curvature of the earth's surface, a missile at an altitude of 200 km is detectable by ground-based sensors only within a range of 1,600 km, and within a range of 2,000 km from an altitude of 15 km (aircraft).[76]

Post Boost Phase

During the post-boost phase, lasting for 300 to 500 seconds,[77] sometimes also called the bus deployment or busing phase, the warheads are released along with decoys and penetration aids. Thus

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space: The dilemma of security. Moscow: Mir Publishers, 1986. p. 18.) The US Department of Defense indicated that the boost phase lasts 150 to 300 seconds. (United States Department of Defense, Strategic Defense Initiative: Report to the Congress on the Strategic Defense Initiative, June 1986. p. V-5.)

[74] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: The dilemma of security.* Moscow: Mir Publishers, 1986. pp. 18-21.

[75] Bhupendra Jasani (unpublished manuscript for UNIDIR).

[76] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: The dilemma of security.* Moscow: Mir Publishers, 1986. p. 19.

[77] United States Department of Defense, Strategic Defense Initiative: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. V-5.

during the post-boost phase the number of targets multiplies. RVs are harder to detect than ICBMs and less vulnerable. (They are hardened to withstand the heat during re-entry into the atmosphere.) On the other hand, they are no longer shielded by the atmosphere. Short-range SLBM and IRBM trajectories have similar boost and terminal phases but less extensive post-boost and midcourse phases.[78]

Midcourse phase

The third phase is the midcourse phase. According to one source it lasts for about 10-15 minutes for ICBMs and 7-10 minutes for SLBMs.[79] Other sources indicate duration times for the midcourse phase of ICBMs of 1000 seconds (16-17 minutes)[80] and 1500 seconds (25 minutes).[81] The duration depends on the range of the trajectory, but it can also be influenced by deliberate choice of depressed or lofted trajectories. During this time, warheads and decoys travel in ballistic trajectories above the atmosphere. The apogee of the elliptical path is about 1000 km, but it can be much lower in the case of depressed trajectories.

Midcourse interception allows more time for identification and destruction of the RVs than the boost phase, and the RVs are no longer be shielded by the atmosphere. Moreover, the trajectories of RVs travelling beyond the atmosphere can be computed fairly accurately if local gravity anomalies are nown. But such an operation would have to deal with more "real targets" (RVs) and, above all, also have to discriminate between these "real targets" and "false targets", i.e. decoys and penetration aids. The total number of targets would have increased tenfold to several hundredfold, compared to the boost phase.[82] Decoys would closely resemble RVs. Penetration aids could be balloons made from metal or metallized film.

Terminal phase

The terminal phase starts when the RVs enter the atmosphere (altitude about 100 km) and it lasts according to one source about 20-50

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[78] United States Department of Defense, Strategic Defense Initiative: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. V-3.

[79] Bhupendra Jasani (unpublished manuscript for UNIDIR).

[80] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: The dilemma of security.* Moscow: Mir Publishers, 1986. p. 21.

[81] United States Department of Defense, Strategic Defense Initiative: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. V-4.

[82] United States Department of Defense, Strategic Defense Initiative: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. V-5.

seconds, according to another source about 100 seconds.[83] The lighter decoys are slowed down by atmospheric drag, providing an easy means of discriminating between real warheads and decoys. Thus the number of targets for BMD sharply decreases, compared to the mid-course phase. However, the time available is also· much shorter, in particular because the RVs could be salvage-fused (programmed to detonate at intercept) and the intercept would hence have to take place at high altitude. Incoming RVs might also be manoeuvrable which would complicate the task of BMD.

POINT DEFENSE AND TERRITORIAL DEFENSE

The term *territorial defense* refers to the defense of large areas, typically the entire national territory, and is used in contrast to *point defense* for the preservation of specific weapons sites, command posts or industrial centres. Disregarding at this moment the questions of feasibility - effective territorial defense is more difficult to achieve than point defense, and many experts doubt its feasibility - an interrelationship exists between the choice of point or territorial defense on the one hand, and the phase at which missiles and warheads would be intercepted, on the other hand. Territorial defense would most likely employ BMD at several of the four phases, in the expectation that the number of missiles/RVs could be drastically reduced in each successive layer of such a multi-layered defense. In principle, territorial defense could also be attempted by relying solely on single-layer BMD, but this would require an efficacy of the system that is at present not considered achievable.

Point defense would rely on BMD in the terminal phase. During the boost and post-boost phases the trajectory of the RVs, and in particular their points of impact, cannot be accurately computed. For manoeuvrable RVs, uncertainty about the point of impact would prevail until late in the terminal phase. The requirements of point defense BMD would depend very much on the type of "point" that had to be protected or, more exactly, on the degree to which the site would be hardened against nuclear attack.

The provisions of the ABM Treaty, as amended by the protocol of 1974, allow point defense for one site each in the Soviet Union and the United States. The deployment area is limited to a radius of 150 km. The Soviet Union has selected the area of Moscow to be defended by a fixed ground-

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[83] United States Department of Defense, Strategic Defense Initiative: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. V-5. Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: The dilemma of security.* Moscow: Mir Publishers, 1986. p. 21.

based ABM system while the United States selected Grand Forks, an Air Force Base in North Dakota where ICBMs are based. (The US ABM system, Safeguard, has been inactivated more than ten years ago, with the exception of the perimeter acquisition radar.)

The strategic implications of point and territorial defense are different. Point defense of ICBM sites could strengthen a strategy of nuclear deterrence by increasing the certainty that these weapons would be available for a retaliatory second strike. It would thus counteract vulnerability, whether perceived or real. *Effective* territorial defense (or the mere *belief* that a deployed territorial defense would be effective), on the other hand, would entail an at least partial departure from the strategy of deterrence by threat of retaliation. While a development from point to territorial defense might be a continuum on a technological level (from the easy to the more difficult task), it is not generally considered to be a continuum regarding strategic thinking. The advocacy of a *jointly managed, gradually phased transition* from a situation of offense to one of defense domination in strategic nuclear weapons is an indication that discontinuities and difficulties of such a transition have been recognized.

BASIC TECHNOLOGIES

The following overview is not an analysis of the likely efficiency of the weapons under contemplation, or even of the feasibility of constructing mere models. Some of the most obvious problem areas are simply noted. This should not be interpreted to imply any judgment as to the feasibility or otherwise of the weapons currently under discussion.

The relationship of ABM/BMD and ASAT weapons

As indicated in the previous chapter, ASAT and BMD weapons have some basic principles in common, even though some operational requirements are different. The destruction of satellites would require lesser standards of technological prowess than the destruction of a host of speeding missiles.

Kinetic-energy weapons

Kinetic-energy weapons (KEWs) cause destruction with the force of motion of a solid object, such as a bullet fired from a rifle. A target can be destroyed not only by directly hitting it with a projectile but also by exploding a missile (with a conventional or a nuclear warhead) close to the target.

Electromagnetic guns

The new generation of KEWs are called hypervelocity projectiles. Their concept is old. The basic idea is to propel a projectile with a great speed using electromagnetic forces. Impetus to the development of electromagnetic guns has largely come from the research on impact fusion, dealing with the properties of matter under extremely high temperatures and pressures.

Although the *electromagnetic railgun* has been under investigation since World War I, high performance was achieved only in 1978. A voltage is applied to two parallel (or co-axial) current-carrying rails. If the circuit it completed by placing a conducting movable bogey (armature) between and perpendicular to the rails, the current flowing through the circuit generates a magnetic field. This field in turn generates a force, which tends to push the conductors. The rails are fixed, and the only moving element is the armature. The force accelerates the armature along the rail axis. In front of the armature and between the rails is the projectile. In order to achieve high accelerations, the magnetic field has to be very high or the rails very long. For velocities of 10 m/sec or 20 m/sec, electromagnetic accelerators may have to be as long as 125 metres and 500 metres. The magnetic field cannot be increased without limit, it is limited by mechanical and thermal strength of the rail gun structure.[84]

The SDIO plans to carry out experiments in 1988 using an electromagnetic launcher designed to demonstrate high velocities and high repetition rate of fire (experiment *Thunderbolt)*. Scientists are interested in achieving hypervelocity (in excess of 10 km/sec) with projectiles weighing up to a kilogram, repetition rates of one shot per second and energy conversion efficiencies of 50 per cent.[85] An electromagnetic launcher facility called *Checmate* (compact high-energy capacitor module, advanced technology experiment) of the US Defense Nuclear Agency is capable of firing two shots per day. Earlier launchers had the capacity of only one shot per month, due to the required replacement of the rails after each firing because of erosion. The Checmate launcher is designed to launch 100-g plastic cubes at velocities up to 4 km/sec. A pre-accelerator using a helium gas injector is employed. It gives the projectile an initial velocity of 0.5 km/sec before it is passed through the main accelerator. The overall efficiency

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[84] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. pp. 47-50.

[85] *Aviation Week & Space Technology,* 27 January 1986. p. 21.

of the conversion of stored energy into kinetic energy is about 20 per cent; a goal of 50 per cent is set by the SDIO.[86]

According to the US government, the Soviet Union has a variety of research programmes underway in the area of KEW; this source claims that in the 1960s the Soviet Union developed an experimental "gun" that could shoot "streams of particles" of a heavy metal such as tungsten or molybdenum at speeds of nearly 25 km/sec in air and over 60 km/sec in a vacuum.[87]

If electromagnetic guns would be deployed on the ground - and they might have to be, given the need for large power sources - the projectiles would have to travel through the atmosphere, which puts constraints on the performance of such a system. Very high velocities are required not only in order to provide a large amount of kinetic energy to the projectiles, but also to allow them to reach their targets in time.

Chemically propelled missiles

Chemically propelled missiles are the traditional type of ABM weapons. The ABM systems that are, or have been, deployed (Galosh, Safeguard) utilize homing interceptors (infra-red or radar) propelled by chemical missiles. The development of such ABM weapons, as far as they are ground-based and fixed, is permitted by the ABM Treaty. US ABM/BMD systems which have been tested or are to be tested in the coming years all belong to this class of weapons, chemically propelled missiles.[88] To ensure a large range, the velocity of chemical rockets would have to be increased. A problem of ground basing is that in the atmosphere the interceptor velocity decreases and homing sensors cease to operate when the interceptor surface is heated and ionized. One possible solution to the latter problem is to cool the sensors.

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86 *Aviation Week & Space Technology,* 27 January 1986. pp. 92-93.

87 US Department of Defense and Department of State: *Soviet Strategic Defense Programs.* Washington, DC: US Government Printing Office, October 1985. pp. 15-16.

88 They are described in section 3.3. of the first part of this report under the heading "dedicated ABM capabilities" and include the low altitude defense system, LoADS; the homing overlay experiment, HOE; the flexible lightweight agile guided experiment, FLAGE; the exo-atmospheric re-entry vehicle interceptor system, ERIS; and the high endoatmospheric defense interceptor, HEDI. LoADS, FLAGE and HEDI operate within the atmosphere, they would belong to ABM weapons but, at least in the configuration tested or at present envisaged, not to space weapons.

Directed-energy weapons

Basically three types of directed-energy weapons (DEWs) are considered for space weapons: high-energy lasers, particle-beam weapons, and high-power radio-frequency weapons (microwave weapons). Besides the DEW technologies in the more narrow sense, acquisition, tracking and pointing with the precision necessary for DEW is a main challenge. High angular resolution is required for target description and high pointing and tracking accuracies are needed for efficient target interception over ranges of more than 1,000 kilometres. Homing kinetic-energy systems would require less accurate tracking than non-homing kinetic-energy weapons and beam weapons, since the rocket or guided projectile could home in on the target when it comes within short range.

High-energy lasers

Laser light is special in two respects: its frequency is precise, since all the light comes from the same transition in all the molecules; and the light waves from all molecules emerge with crests and troughs aligned, since the waves are produced co-operatively. It is possible to focus the laser energy (except for the very short wavelengths of the X-ray laser) with mirrors into narrow beams characterized by small divergence angles.

A convenient parameter for a laser is the beam brightness which is defined as the ratio of the power emitted from the laser to the size of the cone in which the laser energy is contained. The cone size depends on how well the beam is focussed. When a laser beam travels through the atmosphere, it spreads owing to scattering by particles as well as by absorption and heating effects of the air through which it passes (thermal blooming). In space, however, the size of the spot is limited practically only by the laws of optics. Any optical system emitting, focussing or reflecting a laser beam produces diffraction increasing the size of the spot focussed on the target. The divergence angle can be no smaller than about 1.22 times the wavelength of the light divided by the diameter of the mirror.[89] Small divergence angles are desired for BMD purposes. The diameter of mirrors that can be produced and orbited is limited. In consequence, there is a strong interest to utilize short-wavelength lasers.

Lasers could damage missiles (or RVs) at all phases but could be employed most effectively for boost-phase interception. With moderate

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[89] Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984). p. 16.

intensities and relatively long exposure, a continuous wave laser could burn through the missile skin. The exposure time could be reduced by a higher intensity of the laser. Pulsed lasers could cause an explosion on and near the missile skin, and the shock wave from the explosion would injure the missile. The latter mechanism is called *impulse kill*, while the former is referred to as *thermal kill.*

A space-based laser would require the creation of laser light beams in outer space and the supply of the required energy in that environment. Another concept is to have ground-based lasers with space-based mirrors reflecting the beam towards the targets.

Chemical laser: Chemical lasers are relatively well developed. In such devices, energy is transferred from excited molecules produced by a chemical reaction. A molecule stores energy in vibrations of its constituent atoms with respect to one another, in rotation of the molecule, and in the motions of the atomic electrons. The molecule sheds energy in the form of emitted light when it makes transitions from a higher-energy (excited) state to a lower-energy state. Lasing takes place when many molecules are in an upper state and few are in a lower state: one downward transition then stimulates others, which in turn stimulate yet more, and a cascade begins. The result is a powerful beam of light. Energy must be supplied to the molecules to raise most of them to the upper state. This process is called pumping. In the case of chemical lasers, the pumping energy comes from the chemical reaction that makes the lasant molecules. For example, hydrogen and fluorine react to form excited hydrogen fluoride (HF) molecules. The other requirement for lasing - few molecules in the lower state - is satisfied by removing the molecules from the reaction chamber after the have made their transitions to the lower state and replacing them with freshly made upper state molecules.[90]

A chemical laser with a shorter wavelength than the hydrogen fluoride laser is the oxygen iodine laser; another, with a longer wavelength, the deuterium fluoride laser. A HF chemical laser (designated MIRACL) was used in an SDI experiment on 6 September 1985 at White Sands Missile Test Range to destroy the second stage of a Titan I missile placed on the ground about 1 km away from the laser.[91] The brightness of the MIRACL was about 10^{17} Watt/steradian. It has been estimated that to

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[90] Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984). p. 16.

[91] *Aviation Week & Space Technology,* 23 September 1985. pp. 16-17.

destroy a missile 3000 km away, a laser would have to have a brightness of 10^{21} Watt/steradian.[92]

Excimer and free-electron laser: The term *excimer* is a contraction of the words "excited dimer". A dimer is a molecule consisting of two atoms. The dimers considered for these lasers contain an atom of a noble gas and a halogen atom, such as xenon fluoride, xenon chloride and krypton fluoride. Laser light comes from dimers in an excited upper state decaying to a lower state, just as in the hydrogen fluoride laser. The high-energy molecules are provided by pumping with electric discharges. It has been estimated that hundreds of gigawatts per station would be required, with a repetition rate of about 10 Hz. It is difficult to envisage how these energy requirements could be met in space; thus excimer lasers would likely be ground-based. The total efficiency of a excimer laser system is estimated at 5-10 per cent. The heat produced might prevent a high pulse-repetition rate. Modular design, with each module being actuated in succession (so that they have time to cool) is one solution to this problem.[93]

A *free-electron laser* (FEL) depends on the conversion of kinetic energy of a beam of electrons into laser radiation. A FEL is called a free-electron laser because the electrons are not bound to the atoms or molecules of a lasing medium as in a chemical or excimer laser. In a FEL, a beam of electrons is accelerated to a high velocity in an accelerator and then passed through a magnetic field. The magnets are so arranged that their polarities alternate along the path of the electron beams. In one device, the changing magnetic field causes a change in the velocity of the electrons, causing emission of laser light. This light is bounced back and forward by a pair of mirrors placed at the opposite end of the device. The light then stimulates the electrons to release more radiation which is coherent. The wavelength can, in theory, be selected from a range between microwave and ultraviolet. Like the excimer laser, the FEL needs a large power source, in this case for the accelerator. (This is in contrast to the chemical laser, where two elements start the reaction when they are brought together.)

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[92] *Scientific American,* February 1986. p. 46. Soviet experts write that the powers needed for space-based laser weapons would have to be nearly three orders of magnitude higher than those of today's HF lasers. (Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin [Eds.]: *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p. 29.)

[93] *Space-Strike Arms and International Security.* Report of the Committee of Soviet Scientists for Peace, Against the Nuclear Threat. Moscow, October 1985, abridged edition. p. 17. Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p.33.

Because of their vast energy requirements, excimer and free-electron lasers would most likely have to be ground-based. Relay mirrors at high altitudes could carry the laser beam around the curve of the earth, and intercept mirrors could focus the beams on individual targets. With ground-based lasers there would have to be compensation for atmospheric turbulence. This could be achieved, in principle, with a sensor on the ground observing the distortion of a beacon beam as it passes through the atmosphere. The beam from the ground-based laser would then pre-distorted in just such a way that its passage through the same column of air re-formed it into an undistorted beam. However, recent discoveries seem to indicate potentially serious obstacles to propagation of a high-energy FEL beam through the atmosphere due to the interactive effects of atmospheric turbulence and thermal blooming.[94]

X-ray laser: Another contemplated laser weapon is the *X-ray laser*, pumped by a nuclear explosion. It delivers all its energy in one pulse. The pumping source would be a nuclear bomb. The radiant heat of the bomb raises electrons to upper energy levels in atoms of lasant material positioned near the detonation. As the electrons fall back again to lower levels, it can happen that for a moment many atoms are in a given upper level and few in a lower level. This is the necessary condition for lasing from the upper level to the lower level.[95]

Since X-rays are not reflected by any kind of mirror, there is no way to direct the X-rays into a beam with optics as in the case of visible and infra-red lasers. Nonetheless, some direction can be given to the laser energy by forming the lasant material into a long rod. The result is that most of the laser energy emerges as a beam aligned along the rod axis.

Both space-based systems and pop-up systems of X-ray lasers have been contemplated. The small size and weight would make it possible to consider basing the weapon on the surface of the Earth and launching the whole system into space upon warning of enemy launch. However, the weapon, if used at the boost phase, would have to be launched from a base (or submarine) relatively close to enemy launch sites in order to avoid the obstacle posed by the curvature of the earth.

Particle beam weapons

There appears to be less confidence about the feasibility of particle-beam weapons in space than about the possible use of laser beams for

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[94] *Aviation Week & Space Technology,* 4 May 1987. p. 28.

[95] Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984). p. 25.

defense against ballistic missiles, except perhaps for the use of *neutral particles* for discrimination between warheads and decoys or penetration aids. The method is based on the fact that when high-energy nuclear particles hit an object, nuclear reactions take place and produce several different types of secondary radiation. By measuring the characteristics of the secondary radiations it might be possible to discriminate warheads from decoys during the post-boost and midcourse phases.

Only charged particles can be accelerated to form high-energy beams, but a charged beam would bend uncontrollably in the earth's magnetic field. The key element of this technology is the pre-accelerator device in which negatively charged particles or ions (for example negatively charged hydrogen atoms) are efficiently accelerated using a device called radio-frequency quadropole. After the charged particles have been accelerated, electrons have to be stripped off the beam so that it becomes neutral. Neutral-hydrogen atoms, if they were to be used for a particle beam, would easily lose their electrons, thus turning into protons and becoming sensitive to, and distorted by, the geomagnetic field. For this reason, neutral-hydrogen beams would be effective only at high altitudes (about 250 km), and a countermeasure against them would consist of creating a gas shield.[96]

Under certain circumstances, an *electron beam* (a negatively charged particle, as opposed to neutral particles) might be able to propagate through the extremely thin air of near-earth space without bending. In accordance with this scheme, a laser beam would first remove electrons from air molecules in a thin channel stretching from the battle station to the target, leaving a tube of free electrons and positive ions. A high-energy, high-current electron beam would then be injected into the channel and would propagate down the positively charged tube. The result would be straight-line propagation to the target, where the effect would be similar in most respects to the action of a neutral particle beam. If feasible, the concept would generally resemble the neutral particle beam, with the added requirement for the channel-boring laser.

Microwave weapons

Microwaves are short-wavelength radio waves. They could propagate through the atmosphere unattenuated at all but the highest power levels. At high power levels, microwaves cause heating in many materials. One problem with BMD application of microwaves is the large

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[96] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p.42.

divergence angle, producing a spot many kilometres wide at a few hundred kilometres range. For this reason, even a large amount of energy emitted from a generator would lead to small energy deposition per square centimeter on the target, much less than lasers. But even weak microwaves could upset sensitive circuitry if they reach it. Prime targets of such weapons would be the control and guidance systems of missiles. The metal skin of a booster would stop the microwave pulse from reaching internal electronics, but the microwaves could reach sensitive electronic circuitry through antennae or apertures in the booster, causing overloading and damage if the electronic circuitry is not made resistant to disruption or burnout. Two of the main technical problems of microwave weapons are the generator technology and their uncertain effect on the target.[97]

Other system elements

Apart from the destructive mechanism, there would be many other requirements for the effective functioning of space weapons. Among them, three are of particular importance: surveillance, acquisition, tracking and kill assessment (SATKA), battle management, and survivability.

Surveillance, acquisition, tracking and kill assessment would rely on sensors based on satellites (perhaps also on ground, for midcourse and terminal phase acquisition and tracking), on radars and on imaging laser radars. It would also include on-board signal processing systems. The United States and the Soviet Union have deployed a range of satellite-based sensors. Both countries have also deployed radars for ballistic missile early warning. In the ABM Treaty, both States undertook 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 outwards (article VI, para. b).[98]

Possibly the main difficulty in setting up an operational large-scale BMD system is *battle management.* It would have to integrate the operation of all the separate components: sensors, weapons, and SATKA

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[97] Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984); pp. 35-36. Yevgeny Velikhov, Roald Sagdeev and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p. 53.

[98] Mutual accusations of treaty violations have centered on the construction or modernization of ballistic-missile early-warning radars. In the case of the Soviet Union it is the construction of a large phased-array radar near Krasnoyarsk, in the case of the United States the upgrading of the radar facilities, including replacement of rotating dish antennas by phased-array ones, at Thule (Greenland) and Fylingdales Moor (United Kingdom).

systems. Even if each single component would work as planned, it would be a major task to track thousands of targets, assign them to individual battle stations, and to reassign them to other battle stations (or having the same battle station repeating the "shot") if the kill assessment had been negative. Centralized and decentralized battle management systems are conceivable. Due to the time pressure, human involvement in decision-making would by necessity be limited. Therefore some believe that computers would have to be used. However, experts disagree on the feasibility of developing adequate computer programmes which could involve scores of millions of software code lines.

4.4. COUNTERMEASURES TO SPACE WEAPONS

Passive and active countermeasures against space weapons are conceivable (as is the case also for other types of weapons). The discussion on countermeasures to space weapons has focussed on means to counter potential BMD systems partially or wholly based in space, but there are also some potential countermeasures against ASAT weapons.

COUNTERMEASURES TO ASAT WEAPONS

Passive countermeasures against ASAT include hardening of satellites, placing them in high orbits, providing them with a capability to manoeuver, and setting up redundant capabilities. These countermeasures have shortcomings in efficacy, cost, and satellite capabilities. Hardening and making satellites manoeuvrable increases their weight. Putting satellites in higher orbits would, at least in part, degrade some capabilities such as photoreconnaissance. Redundant satellites are deployed as a hedge against technical problems, but to do that on a larger scale would be costly. One *active* countermeasure against ASAT weapons would be to equip satellites with interceptors. This would again increase their weight.

COUNTERMEASURES TO BMD SYSTEMS

Passive countermeasures to BMD systems refer to buildup, modification, and diversification of strategic offensive nuclear forces. Active countermeasures would destroy or otherwise neutralize one or several components of BMD systems.

Passive countermeasures

Many of the countermeasures against BMD would make ballistic missiles heavier. They would require technological innovation and financial re-sources. It is however, not clear that effective countermeasures would present a greater technological challenge and cost more than the development and deployment of a large-scale BMD system.

Saturation of the ballistic-missile defense by increasing the number of missiles, warheads and decoys is one main countermeasure against BMD. There is no certainty that a buildup of the ballistic missile force would still be constrained after a deployment of a BMD system by one or several States. Vulnerability of ballistic missiles might also lead to a buildup of delivery systems against which BMD would not be effective, among them SLBMs with depressed trajectories and cruise missiles.

Against boost-phase intercept of ballistic missiles, several possible countermeasures have been suggested.[99]

- According to some experts, the deployment of unarmed "fake ICBMs" or booster decoys (ICBM boosters without warheads and precision guidance system) would be a simple and cost-effective countermeasure against boost-phase intercept. Reportedly such "fake ICBMs" would be not nearly as expensive as true ICBMs and could not be reliably identified by today's means.[100]
- The booster plume could be shielded, making it more difficult for infra-red sensors to detect it. This might be costly and could be overcome by BMD systems relying on several types of sensors.
- The brightness and configuration of the booster plume could be made unstable by using additives to the propellant. This would make it more difficult to accurately aim a directed-energy weapon on the booster, and holding the beam stable for the time that is necessary to deposit the required amount of energy. However, this effect is limited to BMD systems relying on infra-red sensors.
- The missile could be rotated, reducing the effectiveness of laser weapons. A counter-countermeasure against this would consist of increasing the power level of the laser or operate it in a pulse rather

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[99] Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984); pp. 45-52. Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986.

[100] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in space: the dilemma of security.* Moscow: Mir Publishers, 1986. p.101.

According to a US report, it would be necessary to use true ICBM boosters as (unarmed) decoys since only they would have the same booster plume as the true (armed) ICBMs. Such decoys might not need to be highly reliable and could be deployed above ground next to the ICBM silos. (Ashton B. Carter: *Directed Energy Missile Defense in Space* - A Background Paper. Washington, DC: US Congress, Office of Technology Assessment, 1984 (OTA-BP-ISC 26, April 1984); p. 50.

than in a continuous mode. But there are limitations to increasing the power level of weapons based in space.

- The booster could also be coated with a reflective surface or an ablative shield which would evaporate when heated and dissipate the heat from a laser. Or it could be hardened, so that directed-energy weapons would have to dwell longer on a spot to achieve the same effect.
- To degrade the efficacy of directed-energy weapons, aerosols could be dispersed along the flight path of missiles, absorbing laser beams.
- Fast-burn boosters could be used. The boost phase of missiles with a burn-out time of about 40-50 seconds would be over by the time they reached an altitude of 60-80 km, making boost-phase intercept very difficult. According to an estimate, fast-burn booster would increase total missile weight by about 15 per cent, with unchanged payload and range.[101]

Against post-boost and midcourse phase intercept, the following countermeasures could be envisaged:

- The use of a larger number of decoys, simulating RVs, is an obvious countermeasure. RVs could be hidden within balloons made from a metallized reflecting film. While the majority of balloons would be empty (decoys), the other would contain RVs. Both types would have to have the same laser, radar and optical signature, and the same ballistic characteristics in space. Radar-reflecting chaff or infrared-emitting aerosols could further increase the number of "targets" a BMD system would have to deal with or mask the real targets.

  However, discrimination between RVs and decoys might become possible by utilizing neutral particle beams. Another method of discrimination would consist of measuring the speed of the bus during the deployment of RVs and decoys. The changes in the velocity of the bus as it deploys each object could, in theory, give a clue to the mass of the object deployed and thus the nature of the object.
- Hardening of RVs beyond the present level could perhaps offer some protection against directed-energy weapons. But it would increase the weight of the RVs and thus likely reduce the number that could be launched by a given missile.
- Depressed trajectories would reduce the time available for intercept.

Manoeuvrability of RVs is a countermeasure against terminal-phase intercept. Warheads could also be salvage-fused, so that they would

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[101] *L'IDS: Eventuelles contre-mesures* (Avis de savants soviétiques). Moscow: Novosti Press Agency, October 1986. p. 7.

detonate at intercept. This would make low-atmosphere intercept useless for the defense of soft targets.

Recognizing the possibility of countermeasures, Paul Nitze, special advisor to President Reagan on arms control matters, said that the criteria by which the United States will judge the feasibility of new BMD technologies will be demanding. New defensive systems must be cost-effective at the margin, i.e. it must be no more expensive to add additional defensive capability than it is for the other side to add the offensive capability necessary to overcome the defense.[102] The same point was reiterated by the US Secretary of Defense: Any defensive system the US might employ must not allow an adversary to degrade its effectiveness less expensively than the US can restore it.[103]

Active countermeasures

Space-based BMD components might be vulnerable if they are for long periods of time in orbits with known parameters. Active countermeasures against BMD would first of all consist of attacking space-based components with ASAT weapons. Examples include space mines deployed in the vicinity of battle stations, to be exploded on command from the ground; ground- or air-launched missiles, and ground-based lasers. The deployment of clouds of small fragments in space, orbiting in the opposite direction of battle stations or mirrors, could cause damage that would render the battle station inoperable or produce defects on the surface of mirrors that would make accurate (re-)focussing of laser beams impossible. The propagation of laser light in space could also be impeded by the deployment of materials that absorb such radiation.

A simple method of causing non-selective destruction and disablement of sensitive controls in outer space would be to explode nuclear-armed missiles or satellite-borne nuclear weapons at high altitudes.

Ground-based components could also be attacked, in particular radar and laser facilities, but also launch sites of ground-based terminal-phase interceptor missiles.

Lastly, the links between the different components of a BMD system could be jammed. The sensors that would be used in a BMD system operate at known frequencies. They could be temporarily or permanently blinded by directing a strong beam of electromagnetic radiation of the

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[102] Paul Nitze: "Strategic Defense Initiative Offers Hope of Greater Security". 12 April 1985.

[103] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. p. 282.

wavelength at which the sensor is most sensitive. Hardening of the sensors might partially alleviate this risk.

To sum it up, it would make little sense to deploy strategic defence capabilities in space unless they are cost-effective and survivable. Some proposed countermeasures may be relatively cheap and easy to engineer; others may be much more difficult to procure. At present, the debate is somewhat conjectural. Several studies argue that elements of space-based systems would not be survivable.

5. Anticipated implications and consequences

The setting of the debate

The prospect of intensified military exploitation of outer space, including the possibility of its becoming a fourth environment of actual warfare (in addition to land, sea, and air), calls for analysis of the implications and possible consequences of such a development. It must be said at the outset of such an analysis that the views on this subject are contradictory.

As has been pointed out in the first part of this report, the utilization of outer space for military purposes has by now a history of more than twenty years. Advances in space technology have contributed to enhancing force, accuracy and sophistication of the weapons systems of nuclear-weapon States. Research and development, testing and deployment of some types of space weapons took place already in the 1960s. It is a renewed vigour (whether in public perception or in reality) of developments in this field that has given rise to new and increased discussion on the implications of such activities.

A major event and project that fueled this discussion was the announcement and subsequent implementation of the US Strategic Defense Initiative. For parts of the public, the debate on space weapons has become one on ballistic missile defense (leaving out other categories of military use of space, in particular ASAT weapons). And a large part of the debate is conducted with explicit or implicit reference to the US Strategic Defense Initiative alone, neglecting what the US government maintains (and the Soviet government denies) to be an ongoing research effort by the Soviet Union in the same type of technologies and systems.

This chapter deals essentially with the implications of one type of space weapons, namely systems designed for destroying ballistic missiles.[104] A balanced approach to the implications of space-related BMD systems (i.e. BMD systems based in space or operating in space) cannot deal with the US Strategic Defense Initiative alone; it has to cover the larger question of the strategic implications of space-related BMD in general, regardless of which State and government may conduct research on such systems or contemplate their deployment.

The use of satellites as military support systems can be seen as a first stage in the militarization of outer space. Research on and development

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[104] The conceptual challenges embodied by ASAT weapons have briefly been mentioned at the beginning of this second part of the Study. They are not covered in this section.

of strategic defenses and anti-satellite weapons is widely regarded as a qualitative step into a new stage.

5.1. POLITICO-MILITARY IMPLICATIONS

Notwithstanding their designation as defensive systems, even a cursory analysis of the implications of BMD systems cannot be confined to the reasoning that such systems would be intended to destroy weapons, and be unambiguously defensive. It must also be considered how such systems could be used as an aid in an offensive strategy. In a related distinction, a consideration of the likely implications of BMD systems cannot be based exclusively on the professed intentions of governments, as opposed to the capabilities that the deployment of a BMD system would confer on the deploying State. There is a long-standing tendency to base decisions on strategic offensive weapons systems on the capabilities of potential adversaries, and not on their publicly announced intentions. There is no reason why this should not be equally valid for BMD. Thus the point that contemplated BMD systems would be intended for defensive use only is not likely to carry great weight if such systems would also have capabilities for offensive use.

As has been noted earlier in this report, the strategic implications are quite different for point-defense BMD systems and systems with wider (in particular nationwide) coverage. The following remarks apply essentially to the latter type, i.e. BMD systems designed for territorial defense.

The ABM Treaty, as amended by the Protocol of 1974, limits the deployment of ABM systems to 100 fixed land-based launchers and interceptors (plus radar systems) for the defense of one particular area. Point defense of an ICBM base would thus be possible under the provisions of the treaty. In spite of this possibility, neither the United States nor the Soviet Union do at present employ ABM systems for the defense of an ICBM base. On a theoretical level, disregarding for a moment the limits set by the ABM Treaty, even the deployment of several point defense systems for the protection of the land-based retaliatory potential would not amount to abandoning nuclear deterrence. In the present situation, strategic implications of point defense are thus not as far-reaching as those of territorial defense. It is mainly for this reason that this section will concentrate on the implications and consequences of territorial defense.[105]

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[105] A secondary reason is that point defense is much less likely to require space-based components than territorial defense.

A large number of possible implications of BMD systems concern, not surprisingly, their relationship to weapons based in terrestrial space and targeted to that environment, in particular nuclear-armed ballistic missiles. At the outset of the ongoing negotations between the United States and the Soviet Union on nuclear and space arms the two sides agreed that the subject of the negotiations would be a complex of questions concerning space and nuclear arms (strategic and intermediate-range), with all these questions to be considered and resolved in their relationship. The objective of the negotiations is to work out effective agreements aimed at preventing an arms race in space and terminating it on earth, at limiting and reducing nuclear arms, and at strengthening strategic stability.[106]

STRATEGIC STABILITY

A main controversy on space-related BMD, and SDI in particular, concerns its defensive or offensive nature. To put it briefly, the United States says that any system that might be developed and deployed after (and if) the SDI research programme would show this to be feasible and desirable, would be defensive. Such defenses, it is argued, could increase an aggressor's uncertainties regarding the ability of his weapons to destroy the intended targets. The US Secretary of Defense stated that deployment of strategic defenses would "restrict the level of confidence Soviet leaders could have in the ability of a first strike to inflict damage on the free world".[107] The Soviet Union says that a large-scale space-related BMD system would be offensive by providing the deployer country the capability to launch a first strike with impunity because the system would at least degrade if not altogether negate the other side's capability of retaliation. Moreover the Soviet Union points to its self-assumed obligation not to be the first to use nuclear weapons, announced by Foreign Minister Gromyko at the Second Special Session of the UN General Assembly devoted to Disarmament, on 12 June 1982.[108] In the view of the Soviet Union this commitment rules out a nuclear first strike by the USSR, and hence there would be no need for a defense against such a strike. The United States does not think that this assurance alone is sufficient to allay fears of a first strike. It has been said by other observers that such a commitment might be more effective if strategic weapon systems of both States would be reduced quantitatively and qualitatively in a balanced manner so as to minimise the risks of first strikes.

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106 Joint US-Soviet Statement of January 8, 1985.

107 *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 15, 26 January 1987; p. 3.

108 UN Document A/S-12/PV.12; p. 22.

The ambiguities, as far as offense and defense are concerned, were recognized by President Reagan in his announcement of 23 March, 1983: "If paired with offensive systems, they can be viewed as fostering an aggressive policy and no one wants that." The President said that the US would seek neither military superiority nor political advantage.

Thus strategic defenses have an ambiguous effect on the credibility of the Soviet and US nuclear deterrents. Strategic defenses can be seen as a means to reduce the vulnerability of deterrent forces, but at the same time they can also be perceived as a means to make such forces ineffective.

According to traditional strategic thinking, if deployment of a territorial BMD system would lead to a belief by the deployer country or its adversary that it resulted in a first-strike capability, what is called strategic stability would be degraded if not altogether lost. In a crisis, a first strike might become tempting for both parties if it would be more likely to (partially) penetrate the BMD system than a numerically inferior and perhaps less well co-ordinated retaliatory strike. Instability would likely be particularly acute during the stage at which strategic defenses would be perceived as being able to cope with a second strike, but not in the case of a first strike. It seems probable that strategic defenses would, if they were to be developed and deployed, first achieve this stage before they might eventually be further improved to give confidence against a first strike. In this situation, the nuclear Powers would have to continue to base their security on the same premise which exists today, that is the availability of offensive capabilities to threaten the potential aggressor with retaliation.

One may imagine a situation of acute political crisis between two States, both of which would have strong offensive forces but *only one* of which would have deployed (imperfect) strategic defenses. What emerges is that a side which strikes first obtains an advantage, especially if it also happens to have deployed strategic defenses. By waiting, both would be penalized in the extreme. It is so because the side possessing a defensive system might to a large extent feel immune (or be perceived to feel immune) from retaliation by an already degraded force. The side having no or only nascent strategic defenses may be tempted to simultaneously attack the adversary's defense system and offensive forces to get a fraction of its warheads through, rather than wait and having part of its arsenal destroyed, the remainder being insufficient for retaliation in face of even partially effective strategic defenses. Although it would be exposed to a subsequent retaliation, the outcome of such a hypothetical exchange would be more tolerable than being exposed to a first strike. Thus the existence of a defensive system is prone to lead to pre-emption. At least it might cause the side with inferior or no strategic defenses to go to a launch-on-warning condition in order to have confidence that its entire nuclear force could be used for a retaliatory second strike. Recognizing the first-strike incentives for the side without strategic defenses, the side having deployed strategic defenses might find it prudent to launch a first strike of its own in order to limit the damage of nuclear attack by trying to reduce the number of nuclear weapons the defense would have to cope with. In short: there would be an incentive for both sides to strike first, the exact opposite of strategic stability. Even if *both sides* had deployed imperfect strategic defenses, the logic would remain similar. Each of them might feel forced to consider a first strike to pre-empt the other side doing the same if strategic defenses would be perceived to offer considerable protection against a second but not against a first strike.

If strategic defenses, in particular imperfect ones, would result in both capabilities and incentives for conducting a first strike in crisis situations, a means to defuse such situations would be a declaration that a first strike will not be carried out. However, knowing that strategic decision-making takes rather capabilities than intentions as its point of departure, it is difficult to envisage that mere assurances would stabilize the situation.

It is important to note, in this context, that only few conditions have to be met for strategic stability to be jeopardized. It could occur even in the absence not only of a real first strike capability but also of a perception of a first strike capability. For strategic instability to occur it would suffice if one side had the mistaken*perception that the other side believed* it had a first strike capability. The first side might, erroneously, assume that the second side would be prepared to launch a first strike and feel pressure to pre-empt. Hence to preserve strategic stability three conditions must be met, a *real* first strike capability must not exist, no side must *perceive* that first strike capabilities exist on either side, and no side must *perceive* that the other side *believes* it has a first strike capability. At present these conditions seem to be met, but there is no certainty that this situation will prevail. Both, developments in ballistic missile defense and in strategic offensive weapons could jeopardize one or several of the necessary conditions.

The above scenarios consider exclusively the relationship between the USSR and the United States. Relationships between the two major nuclear Powers and other nuclear Powers are not covered.

The Soviet Union views SDI as a tool which would give the United States the means of blackmail and aggression, first by negating the

Soviet Union's capability of retaliation, and secondly by providing space-based systems which could be utilized against targets in terrestrial space. Coupled with the modernization programmes of offensive nuclear weapons, the true purpose of a large-scale US BMD system, in a Soviet view, would be to frustrate the Soviet Union's retaliatory potential.[109] The Soviet Union holds that the SDI leads to destabilization and will escalate the war danger.

The US position is that strategic defense is a means to deny the Soviet Union a first-strike capability. The United States perceive the land-based Soviet ICBM force as posing a first-strike threat. Even partially effective strategic defense would introduce uncertainty about the success of a Soviet first strike, according to this line of thought, and hence reduce the likelihood of this happening. What is less often addressed in detail in US statements is the likely impact of US strategic defenses on a Soviet *second-strike capability,* i.e. the Soviet Union's ability to respond to a hypothetical US first strike. The basis of this omission is that proponents of US strategic defenses do not envisage, in their statements, that the US side might be the one to strike first.[110] However, referring to the Soviet claim that the US aims to achieve, by way of strategic defense, a first strike capability by depriving the Soviet Union of its retaliatory deterrent, the US Secretary of defense points to the US offer to eliminate on both sides all offensive ballistic missiles while going forward toward strategic defenses.[111]

As has been noted, because of time constraints the human involvement in *decision-making* would have to be very limited for a large-scale BMD system to be effective. The Soviet Union considers this to make such systems especially dangerous, in contrast to existing weapons systems which allow some time for evaluating the situation before deciding on

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109 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. pp. 27-31.

110 Cf. George A. Keyworth III (Science Advisor to the US President): "Today's Big Stick: Technology" (Address to the Air Force Association National Convention, Washington,DC, September 17, 1984). Without wanting to offer any judgment on the merits of the US and Soviet argumentation, it must be said here that professed *intentions* (US will not be the side striking first) are an uncertain basis for strategic decision-making, compared to *capabilities.* In a hypothetical situation where only one side would have deployed strategic defenses, the stabilizing effect of such defenses is linked to the assumption that this side would under no circumstances resort to a first strike. This assumption may not be universally shared.

111 Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. p. 53.

their use.[112] The risk of an accidental nuclear war would in this view be increased.

In conclusion, it can be said that the positions of the United States and the Soviet Union are divergent. The United States considers the present situation in strategic offensive weapons as not sufficiently stable and fears that advances in technology may render the delivery systems even more vulnerable, thus increasing instability. Strategic defenses, if feasible, are believed to strengthen strategic stability. There is some ambiguity as to whether the US government considers the transition stage to entail major instabilities. The US Secretary of Defense stated in early 1985 that based on a realistic view of Soviet military planning, the transition to strategic defense would not be destabilizing.[113] In his report two years later he wrote that the United States seeks to convince the Soviet Union to join in working out a stable transition toward what it sees as a safer world, a transition in a phased manner that provides increasing stability in each stage of the process.[114] The Soviet Union considers that movement towards, and deployment of, strategic defenses would entail major instabilities. It refuses the US proposal for a co-operative and jointly managed and gradually-phased transition first to a offense-defense mix and ultimately to a defense-dominated strategic situation.[115] The Soviet Union thinks such a move would open new channels for the arms race and make it nonmanageable.

There is profound skepticism on the part of many non-nuclear States whether a world in which two States have deployed huge numbers of nuclear weapons and one concerned about a hypothetical first strike is conducting research into a new strategic defense system the other

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112 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 9.

113 Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1986 Budget, FY 1987 Authorization Request and FY 1986-90 Defense Programs, February 5, 1985. Washington, DC: US Government Printing Office. p. 55.

114 Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. pp. 54/282.

115 The US advanced ideas on how to ensure a stable transition to strategic defenses at the Geneva Nuclear and Space Talks in 1986 ("Reagan sees 'real chance' for nuclear arms reductions". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 168, 18 September 1986; p. 3). The implications of a jointly managed and gradually-phased transition to a defense-dominated strategic situation would be difficult to describe at this time. The main reasons are that such a transition is of a very hypothetical nature, and that implications for strategic stability would depend on the way it would be implemented. A number of different ways might be envisaged, with different implications. Given the Soviet refulsal to join in such a managed transition and the large number of unknown elements, an evaluation would be too conjectural at present.

views as having first strike potential and requiring countermeasures should really be referred to as stable. Strategic stability is a concept not universally accepted. The view is also expressed that the concept of strategic stability is inherently subjective and becomes the justification for engaging in an arms race and for interfering and intervening in the affairs of various regions of the world. According to this view, in the present-day world the security of each country can be ensured only when the collective security of all nations is also taken care of at the same time.

ACCIDENTAL LAUNCHES OF NUCLEAR WEAPONS

The United States points out that strategic defense would provide a protection against accidental launches of strategic ballistic missiles. The Soviet Union does not deny this but argues that for this purpose it would be more cost-effective for both sides to invest in self-destruct mechanisms for ballistic missiles. It is also the view of the Soviet Union that BMD might increase the risk of accidental nuclear war, either through a proliferation of strategic offensive weapons by one side to offset the deployment of BMD by the other side, or by increased risk of miscalculation. Soviet authors also stress that it is necessary to weigh the risks of a self-activation of the BMD system as a result of an error in the detection and identification system or in the battle-management system.[116]

US spokesmen have explained that a defensive system would be needed even if the major nuclear Powers had eliminated their nuclear weapons, to guard against blackmail or an actual attack by a "madman" who had obtained a nuclear-tipped missile.[117]

ARMS RACE IN OUTER SPACE

In the opinion of the Soviet government, the appearance of space weapons (space-to-space, space-to-earth, and earth-to-space) could be the beginning of an arms race in space.[118] The Soviet view is that the United States, by starting to develop space weapons capable of offensive missions, has made militarization of outer space a top priority of US policy and put the question on the agenda whether outer

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[116] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. p. 118.

[117] "Reagan encouraged by Soviet arms proposal". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 247, 17 January 1986. p. 7.

[118] *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 8.

space is to be or not to be peaceful.[119] The US view is that outer space has for long time already been utilized for military purposes, that SDI is a research programme and that it was initiated as a response to Soviet research efforts in the same fields since 1969. The Soviet Union is seen by the US Secretary of Defense as wanting to keep a monopoly after having made great progress in anti-missile space weapons technology.[120]

Regarding the direct utilization of space weapons as strategic offensive systems, no State acknowledges research or development on space-based weapons designed for attacking targets on ground, on the seas, or in the atmosphere, with the exception of ballistic missiles in flight. The Soviet Union, however, accuses the United States of attempting to provide itself with protection against ballistic missiles and simultaneously deploying space-based weapons targeted to terrestrial space.[121] However, there exists skepticism regarding the efficacy of most types of possible space-based weapons against ground targets. According to Soviet scientists, only laser and microwave weapons (the latter through an electromagnetic pulse, EMP) would be able to destroy ground and air targets from space. Lasers could, in favourable weather conditions, ignite inflammable matter, and an EMP could disrupt or destroy electronic equipment. Neither weapon would, however, be effective against hardened targets. It is rather aircraft at high altitudes (strategic bombers on patrol and airborne command posts) that would be vulnerable to laser weapons.[122]

ARMS RACE IN GENERAL

Two worries expressed by some experts concern the impact of space weapons research and development on arms technology in general, and the question whether a large-scale research programme, once started, can be stopped at any time.

Regarding the first point, these observers think that a large R&D effort directed towards space weapons would accelerate, through spin-offs, the across-the-board qualitative arms race. New technologies might be infused, as a by-product of an effort directed towards space weapons,

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119 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. pp. 10/22.

120 "Weinberger says Soviets want space defense monopoly". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 197, 30 October 1986. p. 6.

121 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 23.

122 Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. pp. 69-77.

into the entire spectrum of military systems, from nuclear to conventional, from strategic to tactical and battlefield weapons, from weapons themselves to various support systems. Research and development for space weapons encompasses virtually all areas of modern science and engineering. Research on directed-energy weapons, in particular lasers, may help the development of tactical laser systems. The same could be said of electromagnetic launchers and high-velocity missiles. Advances in new materials, propulsion, computer technology, and communications could be exploited in a similar way. It is admitted that progress in overall military technology does not exclusively depend on the existence of space-oriented R&D. But rapid expansion of military R&D, in connection with space weapons programmes, is likely to accelerate the overall pace of military technology, especially at the early, less specific stage of the programmes. The apparent contradiction of some opponents of SDI in arguing at the same time that effective strategic defense will not be possible and that the programme would be destabilizing can be explained by their worries that even an unsuccessful strategic defense programme would fuel the arms race in other military areas.

Even what is announced merely as a research programme, like the US Strategic Defense Initiative, is by these observers considered to develop a strong momentum of its own. They think that the sheer size - in terms of money, institutions involved and scope - of SDI cannot but generate strong bureaucratic and political momentum leading to deployment. In this view, the claim that the research stage is being approached with an open mind, to determine the feasibility of large-scale BMD, is misleading. The US position is that such a large-scale research effort is necessary, that SDI is limited to research, and that the government is in full control of this programme. According to a study by the Federation of American Scientists, SDI is rapidly gaining momentum among defense contractors. The Federation says that corporate pressure for its deployment has, however, not become irreversibly entrenched (March 1987). The industry retains some skepticism because of the high costs involved in competing for contracts, poor odds of winning a profitable contract, the uncertain business environment caused by programme restructuring, and the risk of programme cancellation due to technical problems. Other areas of concern are changing priorities or the possibility of an arms control agreement with the Soviet Union.[123]

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[123] "Scientists Find Corporate Support Building for Deployment of SDI". In: *Aviation Week & Space Technology,* 27 April 1987. p. 81.

A risk involved in all military R&D projects, and hence also in such directed towards space weapons, is that they lead to arms races based on mutual *worst-case assumptions*. If the purpose and capabilities of weapons in research or development are ambiguous, the other side may feel compelled to prepare a complete spectrum of responses to cover all possibilities. Possible options for a response to space weapons programmes include a further numerical expansion of strategic offensive forces, improvements of their penetration abilities, the development of space weapons to counter the other side's space-based components (all described in the section on countermeasures) and the initiation or acceleration of equivalent programmes. The possibility of such responses is likely to be taken into account by the first State, and hence it will do R&D on countermeasures (against an analogous system by the other side) and counter-countermeasures (against countermeasures by the other side) at the same time as it is carrying out R&D on the weapons system itself. In principle the action-reaction cycle, based in part on anticipated reactions, could be managed by negotiated or tacit mutual accomodation. However, there is great uncertainty in assessing future capabilities of space weapons, making accomodation difficult.

MILITARY BALANCE

According to the Soviet Union, the present global military-strategic situation between the USSR and the United States is characterized by the existence of rough parity which provides strategic stability and serves as an important fact of international security. The Soviet Union does not regard this parity as something permanent. But to move away from it in search of superiority would be, in its view, a dangerous attempt to reverse the course of history. On the other hand, a movement setting out from parity toward reduction and then complete elimination of nuclear arms would contribute to the realization of the idea of comprehensive and equal security. The Soviet Union holds that it is necessary to move from the formula of mutual assured destruction through radical reduction of armaments towards the formula of mutual assured survival.

The Soviet government claims that the United States, through SDI, aims at upsetting the existing strategic parity between the two major nuclear Powers and securing decisive military superiority over the Soviet Union. This would be done by reducing the value of the retaliatory capability of the USSR and at the same time building up the US strategic offensive capability. At the same time the Soviet government says that it would produce weapons to maintain the balance, and that there would in consequence be an escalation of the arms race in all fields.[124] In the perception of Soviet observers the United States may hope to exhaust the Soviet Union economically by engaging it in an arms race in defensive as well as offensive weapons systems. They think that such a plan would be futile because effective countermeasures to space-based and/or space-related BMD might be cheaper than its development and deployment.[125]

The United States denies the accusation that it is seeking superiority through SDI. The President has repeatedly stated (for example at the Reykjavik sumit meeting) that if the SDI programme should prove strategic defenses to be feasible, the United States would be willing to share this technology with the Soviet Union. The Soviet Union does not believe this offer to be serious. SDI is presented and justified as a response to both a Soviet buildup of strategic offensive forces (in number of warheads, and accuracy of land-based missiles) and Soviet research into the same technologies that are researched within the framework of SDI. It is, in this view, a programme to prevent Soviet strategic superiority and pre-emptive capabilities.

An objective estimate of the military balance is very difficult to arrive at, and it would become even more difficult to determine if one side would decide to deploy a large-scale BMD system and the other side would take asymmetric countermeasures (i.e. not deploying a large-scale BMD system on its own, but rather enhancing its strategic offensive potential).

5.2. IMPLICATIONS FOR ARMS LIMITATION AND DISARMAMENT

LIMITATION OF STRATEGIC OFFENSIVE NUCLEAR SYSTEMS

In the preamble of the ABM Treaty the United States and the Soviet Union stated that effective measures to limit anti-ballistic missile systems would be a substantial factor in curbing the race in strategic offensive arms. They accepted the premise that the limitation of anti-ballistic missile systems, as well as certain agreed measures with respect to the limitation of strategic offensive arms, would contribute to the creation of more favourable conditions for further negotiations on limiting strategic arms.

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124 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. pp. 8-9/25-26.

125 *The Large-Scale Anti-Missile System and International Security.* Report of the Committee of Soviet Scientists for Peace, against the Nuclear Threat; abridged version. Moscow: Novosti Press Agency Publishing House, 1986. p.68.

The United States thinks that new technologies for strategic defense might hold the promise to change this relationship, and that these technologies should be researched. Moreover, the US government is not satisfied with the record of arms control in strategic offensive systems since the signing of the ABM Treaty. The Soviet Union thinks that the relationship between strategic offensive and defensive systems stated in the preamble of the ABM Treaty remains valid as long as perfect strategic defense is not feasible. Hence only mutual restraint in the field of ABM/BMD systems would allow progress in limiting and reducing strategic offensive arms. There exists, in this view an organic relationship between strategic offensive and defensive systems which is of an unchangeable nature.[126]

US officials argue that once strategic defenses would be deployed, strategic offensive weapons for the purpose of retaliation would not have to be very numerous, "not nearly as large as the arsenals we now require to survive pre-emptive strikes". The logic behind this argument is that at present both major nuclear Powers have large arsenals in order to retain a retaliatory capacity after having suffered a first strike, and that strategic defenses would foreclose the option of a successful first strike and hence no longer necessitate such large arsenals. Hence, in this view, strategic defenses would be conducive to a reduction of offensive strategic nuclear arms.[127]

Regarding the aim of reducing the number of strategic ballistic missiles (or even all strategic nuclear arms) to a very low level or even zero, the US position is that this would be feasible only in connection with a deployment of strategic defenses. At very low or zero levels, already the acquisition of a very small number of (additional) strategic offensive weapons by one party, in violation of an agreement, would have a strong military impact. Strategic defenses would, according to this point of view, be necessary as an insurance against potential violations, hence a necessary condition for reducing the level of offensive armaments to a very low level or to zero.[128]

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126 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 42.

127 George A. Keyworth, II Science Advisor to the US President): "The Case for Strategic Defense: An Option for a World Disarmed". In: *Issues in Science and Technology,* Fall 1984. p. 42. The argument that strategic defenses might be more effective in coping with a second strike than with a first strike (and hence serve to weaken the retaliatory capabilities more than first-strike capabilities), raised by some experts, is not effectively addressed in this article.

128 George A. Keyworth, II (Director of the White House Office of Science and Technology): "The Case for Strategic Defense: An Option for a World Disarmed". In: *Issues in Science and Technology,* Fall 1984. p. 43.

The United States argues that SDI created opportunities for negotiations toward drastic reductions of strategic offensive arms because BMD, once deployed, would lower the value of ballistic missiles. In particular, the US believes that SDI is a key reason why sweeping potential agreements on cuts or the complete elimination of ballistic missiles are presented. SDI is not seen (and was at Reykjavik not used) as a "bargaining chip".

The Soviet Union is linking reductions of strategic offensive arms to a negotiated limit on strategic defense (for example in the form of strengthening the ABM Treaty). It says that the USSR must not be expected to agree to reduce its retaliatory nuclear weapons while the US carries on with "its program of reducing the value of Soviet nuclear arms in the hope of being able to engage in aggression with impunity". The side that announced its intention of making the armaments of the other side meaningless and outdated must not expect the latter to help it in this undertaking, the same source says.[129] Not only would the Soviet Union decline to enter into reductions of strategic offensive weapons if the US should deploy strategic defenses, but it might build up this arsenal, particularly the elements against which BMD would be ineffective. At the same time Soviet experts say that there are no grounds to believe that the dominance of the offense over defense in strategic weapons could be overcome by new types of BMD, as they are researched in the framework of SDI.[130]

At the Reykjavik meeting (October 11-12, 1986), the Soviet Union linked agreement to the elimination of strategic offensive weapons over a ten-year period to a mutual commitment not to abandon the ABM Treaty for this ten-year period and to strictly observe all its provisions. All testing on the space elements of ABM systems in outer space would be prohibited except for research and testing conducted in laboratories. The Soviet Union argued that this commitment was necessary to prevent unexpected developments that might upset the equality of both sides in the process of strategic nuclear disarmament.[131] The United States proposed a commitment not to withdraw from the ABM Treaty for a period of ten years, coupled with the complete elimination of all strategic ballistic missiles and intermediate-range nuclear

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129 *"Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p. 52.

130 Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. pp. 106/113.

131 Mikhail Gorbachev: *The Results and Lessons of Reykjavik.* Moscow: Novosti Press Agency Publishing House, 1986. pp. 13/30/37. The Soviet disarmament proposals of 15 January 1986 are covered in Part IV of this Study.

missiles in Europe.[132] In the view of the US Secretary of Defense, accepting severe limitations on research, development and testing would amount to abandoning SDI, and it would make it more, not less, difficult to attain major reductions in strategic offensive arms.[133] The US believes that the continuation of research on strategic defenses would be necessary to insure that agreements for the elimination of offensive systems would be carried out.

IMPLICATIONS FOR THE ABM TREATY

The Soviet Union sees the US *Strategic Defense Initiative* as going beyond research and eroding the ABM Treaty prohibiting the development, testing and deployment of sea-based, air-based, space-based and mobile land-based ABM systems or components (article V, para. 1). In this view, prototypes of space weapons are going to be developed (lasers, electromagnetic guns) in contravention of the ABM Treaty. This treaty in particular is seen as a crucial document for strategic arms limitation. Soviet observers also think that the existence on a limited scale of tested and perhaps also deployed components of a space-based ABM system would complicate future negotiations on the limitation of BMD.[134]

The United States position is that it is engaging in research allowed under the terms of the ABM Treaty, and that what the USSR considers as tests of components of a nationwide ABM system are demonstrations of and experiments with subcomponents. In 1983 (before the announcement of SDI by President Reagan) the US government stated that the ABM Treaty prohibition on development, testing and deployment of space-based ABM systems, or components for such systems, applies to directed energy technology (or any other technology) used for this purpose; thus when such programmes enter the field testing phase they would become constrained by these ABM Treaty obligations.[135] It is no longer certain that this will remain the official US position. The controversy surrounding the "narrow" and "broad" interpretation of the

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[132] "Reagan: Soviets insisted on blocking SDI program". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 185, 14 October 1986. pp. 2-3.

[133] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. p. 54.

[134] *The Large-Scale Anti-Missile System and International Security.* Report of the Committee of Soviet Scientists for Peace, against the Nuclear Threat; abridged version. Moscow: Novosti Press Agency Publishing House, 1986. pp. 57-58.

[135] Fiscal Year 1984 Arms Control Impact Statements. Statements Submitted to the Congress by the President Pursuant to Section 36 of the Arms Control and Disarmament Act. Washington, DC: US Government Printing Office, April 1983. pp. 266-267.

ABM Treaty by the United States will be taken up in part III of this report.

The United States claims that the Soviet Union has violated the provisions of the ABM Treaty by constructing a *large phased-array radar* near Krasnoyarsk. In the US view, the Krasnoyarsk radar is designed for detecting and tracking ballistic missiles. Article VI, para. b prohibits deployment of radars for early warning of strategic ballistic missile attack except at locations along the periphery of the national territory and oriented outwards. The basic rationale was to prevent tracking of warheads near their potential re-entry and impact points which could improve the accuracy of engagement radars and increase the probability of effective interception. US official sources point out that the Krasnoyarsk radar is some 750 kilometres from the nearest border and that it is moreover not oriented toward that border but across approximately 4,000 kilometres of Soviet territory to the northeast.[136] The Soviet Union claims that the radar in question does not violate the ABM Treaty because it is designed for observation of space objects. In response the United States says that the design of the Krasnoyarsk radar is not optimized for space tracking and that it is essentially identical in design to other radars acknowledged by the Soviet Union to be for ballistic missile detection and tracking (and placed at the periphery of the Soviet Union).[137]

The Soviet Union accuses the United States of violating the ABM Treaty by building large phased-array radars at Thule (Greenland) and Fylingdales Moor (United Kingdom). The United States responds that it is only upgrading existing facilities in accordance with the terms of the ABM Treaty. The Thule facility will be completed in 1987, the Fylingdales Moor facility in FY 1990. Further Soviet accusations of treaty violations concern the performance characteristics of four *Pave Paws* large phased-array radars built at the periphery of the continental United States for warning of SLBM attack. This accusations are refuted by the United States. There are further mutual accusations, but compared to those described above they are given less publicity by both Powers.

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[136] *Soviet Strategic Defense Programs.* Released by the Department of Defense and Department of State, October 1985. Washington, DC: US Government Printing Office. p. 10. Frank Gaffney (US Deputy Assistant Secretary of Defense for Theater Nuclear Force Affairs): "The strategic context of SDI: a US assessment of Soviet attitudes towards mutual vulnerability". In: Bhupendra Jasani (Ed.): *Space Weapons and International Security.* Oxford: Oxford University Press, 1987. pp. 286-288.

[137] On their request, a group of US Congressmen and experts visited the Krasnoyarsk radar on 5 September 1987.

CONTROL OF ASAT WEAPONS

Because the satellites are soft targets and less in number, compared to nuclear missiles and warheads, and because of their stable, predictable orbits, making them easy targets, particularly those in low orbits, even a rudimentary system of space-related BMD would probably have a powerful ASAT capability. Even a ground-based laser can damage a satellite. The prospects for agreement on any measure aimed at the proscription of specialized ASAT weapons would thus likely disappear if space-based BMD should be deployed.

OTHER ARMS LIMITATION AND DISARMAMENT TREATIES

Pushing forward towards development and deployment of large-scale space-related BMD systems would, in the view of the Soviet Union, destroy a number of treaties which in some way regulate relations between the two major nuclear Powers, among them the bilateral ABM Treaty, and (if nuclear weapons tests or placing nuclear weapons and other weapons of mass destruction in orbit should be involved) the multilateral Partial Test Ban Treaty and Outer Space Treaty, affecting not only the United States and the Soviet Union but also other States. Opponents of development and deployment of space weapons argue that the breakdown of the existing principal arms limitation agreements would exert pressure on the Non-Proliferation Treaty and nullify the prospects for additional arms limitation agreements, in particular a comprehensive test ban treaty. This interpretation is shared by many of the neutral and non-aligned countries, and particularly by those who have developed their own nuclear technology for peaceful purposes. Some of them claim that in view of the disarmament record of the nuclear Powers, the NPT has been transformed into a discriminatory instrument which serves interests not strictly related to disarmament as such. They also consider that an arms race in space would further diminish the credibility of the recently announced guidelines for the control of missile technology transfers, a multilateral initiative by Western countries (Canada, France, Federal Republic of Germany, Italy, Japan, United Kingdom and the United States of America).[138]

Moreover they also think that the growing sophistication of arms technology makes the task of verification more difficult by providing dual capabilities or blurring the operational characteristics of weapons. In this view, development and deployment of space weapons might lead to a total breakdown of arms limitation. The US view is that strategic defenses would provide the possibility of total abolishment

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[138] This line of thought has been repeatedly advanced by Argentina in different fora related to disarmament and the peaceful use of nuclear technology.

of strategic ballistic missiles by easing the verification requirements: with defenses in place, small-scale violations of a prohibition of strategic ballistic missiles could more easily be temporarily tolerated.

5.3. GENERAL CONSIDERATIONS

One of the motivations for the United States to contemplate strategic defenses is to get out of a situation in which the major nuclear Powers are holding one another hostage, or engaging in a "mutual suicide pact". In this view, all parties concerned would be better off if they could destroy incoming missiles, should deterrence fail, rather than killing people. The US Secretary of Defense explains that President Reagan's vision of SDI seeks to move all mankind away from "the unsettling state of total vulnerability". In his view democratic publics crave a nonoffensive, nonnuclear way of helping maintain the peace, and he refers to the present situation as being hostage to the terrors of mutual assured destruction.[139]

The Soviet Union is not in favour of the presently existing situation of deterrence by threat of retaliation. However, it does not believe that technological sophistication of weapons systems, in this case ballistic missile defence, is a promising alternative. It is concerned that deployment of strategic defences would lead to instabilities, providing incentives for a nuclear first strike. In the Soviet view, nuclear disarmament is the way out of the situation existing at present.

5.4. COLLATERAL IMPLICATIONS

IMPLICATIONS FOR THE PEACEFUL USES OF OUTER SPACE

There is no full unanimity on the implications of space weapons for the peaceful use of outer space. But it is less the nature than the *magnitude* of the implications that is subject to debate - desirable implications are generally not predicted. Soviet authors in particular argue that a (hypothetical) deployment by the United States of a space-based BMD system would block US-Soviet cooperation as well as broad international cooperation in the uses of space for peaceful purposes.[140] Space technology is a tool of immense versality and great power. Its

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[139] Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1988/FY 1989 Budget and FY 1988-92 Defense Programs, January 12, 1987. Washington, DC: US Government Printing Office. p. 52/287.

[140] Yevgeni Velikhov, Roald Sagdeev, and Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. p. 111.

elements can be put together to help improve life on earth or to devastate the planet.

The following paragraphs present the case of those who feel that there will be negative implications. The opposite point of view would deny the stated implications, thus it can also be inferred from this description.

From the outset of the exploration of outer space it has been widely hoped that this new dimension of human endeavour could be a unifying element for the international community. Any kind of exploration and utilization of outer space is likely to have international consequences. Two evident reasons for this are on the one hand that outer space is an international environment, without State sovereignty over particular areas, and on the other hand that from outer space there is access to all territories on earth (for example for remote sensing). The Outer Space Treaty of 1967 stated 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 and scientific development.

Progress in the exploration of outer space added momentum to the creation of elements of an outer space legal system and to the establishment of international organizations and institutions for the promotion and regulation of international co-operation in space. The process of development of a positive international legal and organizational framework is, however, not concluded, and the proliferation and progress of space technology is certain to raise a number of new and complex problems which the international community will have to tackle. The chances of its suceeding will depend on the international climate, on the spirit of co-operation, mutual confidence, and willingness to compromise. A trend towards an arms race in outer space could severely impair these chances.

Though outer space is vast, there is the problem of access by all interested parties to the most useful orbits, in particular the geosynchronous orbit which might get congested. If present trends in the utilization of this orbit - including the military use - continue, the availability of slots on this orbit will not suffice to accomodate the growing number of users.

Another issue is a tendency to commercialize the use of outer space. Commercial activities in outer space have to be in accordance with the obligations stemming from the recognized space law. An increase of such commercial utilization of space could raise new questions and cause new conflicts which may require an international effort to find mutually satisfactory solutions. The dissemination of radio and television broadcast by satellite, as well as economically important remote sensing of earth resources are among the major issues to be solved in an international framework, and other problems are certain to follow.[141]

The risks associated with a turn towards increased use of outer space not only through military support satellites but in addition through space weapons derive from the assumption that such a development may make it doubtful whether international accord on the peaceful exploration and use of outer space can be reached. If major programmes towards the use of outer space as deployment and operation area for weapons should be implemented, military considerations would likely overshadow all other motives for space exploration and use. Civilian space research and activities might suffer for two reasons; first because civilian budgets would come into strong competition with military budgets for States engaging in increased military use of outer space, and second because military competition might make it impossible to work out an international framework for space activities, resulting in the absence of predictability which would be an important condition for the willingness to invest in space activities.

Economic Implications

Analysts of some neutral and non-aligned countries oppose the development of space weapons, in particular space related BDM systems, on the grounds that such programmes would deeply affect the *world economy* as a whole, subjecting global growth and trade to great strains. They foresee, in the first place, a concentration of financial, material and human resources on activities related to the military sector, whose multiplier effects tends to be low compared to that of non-military investments. So, they expect such policies to contribute significantly to a slowing down of some of the main industrialized countries' growth rate and to a deterioration of world trade and productivity resulting from the former.

Opponents of the development of space weapons, in particular space-related BMD systems, think that such programmes would have negative effects on the *political relations* between the Soviet Union and the United States, and more generally between States parties to the Warsaw Treaty Organization and States parties to NATO. This would, in their view, have a negative impact on the *economic links* between the countries involved; trade would be restricted and diminish. Some observers think that the United States hopes to weaken and to create sectoral disparities in the Soviet economy by imposing an accelerated

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141 The principles on direct broadcasting satellites and remote sensing of the earth, worked out by COPUOS, have been briefly touched upon in Part I.

arms race while continuing to deny access to advanced technology of US origin, in particular that with military implications. In that sense they profess to recognize elements of "economic warfare". On its part, the United States does not envisage that R&D and even potential deployment of strategic defenses need have a negative impact on the political relationship; the US thinks that the opposite is possible.[142]

Regarding the economic relations between *North and South*, some observers anticipate a negative impact on the social and economic conditions of the developing countries, should programmes on space weapons go ahead. This assertion is based in part on the fact that the latter's demand for resources would tend to channel investments towards States that carry out such programmes. Thus, the current fall in the financial flows would be emphasized an prejudice growth expectations. The argument goes on saying that arms acquisitions by developing countrieswould be encouraged by the spin-offs of R&D on space weapons since newer military technology would become available. Againt, much needed resources would be used for non-productive or only marginally productive activities. This analysis also expects a reduction of economic assistance programmes under the competition of space weapons programmes. As a limitation of this point, it must be recognized that there is no certainty that resources saved by foregoing strategic defenses would even partially be channeled into economic assistance programmes.

The view is also presented that a heightened arms race, due to space weapons programmes, would reduce the willingness of developed States to engage in *technology transfers* to developing countries. The latter are seen as being technologically dependent upon the former. More than 90 per cent of all scientists and engineers are employed in industrialized countries, and in R&D expenditures the distribution is even more lopsided. While the economic and social prospects of the developing States depend on a number of historical, social, political and economic factors, technology transfer has become important for the intensification of their development. The improvement of conditions of technology transfer could alleviate their dependence. A boost for military R&D in developed States, coupled with restrictive technology transfer, might not only impede the possibility of narrowing the technology gap but rather widen it. However, other observers think that the technology most useful for promoting economic development in

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142 A jointly managed, gradually phased transition to a defense-dominated strategic situation would involve a certain amount of politico-military co-operation between the two major nuclear Powers. Moreover, the US view is that a situation where both countries could feel safe of nuclear attack (due to strategic defenses) would be more conducive to a positive political relationship than deterrence by threat of retaliation.

developing countries is not high technology (which tends to substitute capital, i.e. machines, for manpower) but rather intermediate technology making more efficient use of resources available to developing countries. The transfer of such intermediate technology would be less likely to suffer under an intensification of military R&D.

SOCIAL IMPLICATIONS

The argument is put forward that an economy expected to sustain a major technological effort to create a comprehensive space-related BMD system would be hard pressed by competing demands for resources coming from the military and civilian sectors. Regarding human resources, a "brain drain" from civilian to military sectors is anticipated.

Proponents of strategic defenses do not usually argue that strategic defenses are cheaper than continued exclusive reliance on deterrence by threat of nuclear retaliation. They make their case on other than cost grounds. They would, however, point out that strategic defenses would be conducive to drastic reductions, if not total elimination, of strategic ballistic missiles, possibly paving the way for further progress in disarmament, thus offsetting at least part of the resources needed for R&D, deployment and maintenance of strategic defenses.

IMPLICATIONS FOR SCIENCE AND TECHNOLOGY

Sometimes the argument is made in favour of research into strategic defenses that it would give a major impulse to a large segment of technology and stimulate scientific discoveries of great value not only for military but also for civilian purposes. These so-called spin-offs would benefit science and the economy in general. It is probably fair to say that spin-offs can be used only as a supportive, but not as a central argument, since the application of the same amount of resources for research directly targeted to civilian purposes would be more likely to bring about technological progress in this domain.

Other observers say that military R&D is predominantly mission-oriented, stretching one aspect of general knowledge but contributing less than civilian research to the development of basic science, engineering and manufacturing. Moreover, it is said, the results of military-related R&D, even if applicable and useful in the civilian economy, are under stricter control, preventing or at least delaying the diffusion of spin-offs into the civilian economy. There exists also some apprehension that military space missions may be to the detriment of the further development of industrial uses of this environment, in particular research on materials science that would require further efforts to reach the stage of practical application.

5.5. POSITIONS OF WEST EUROPEAN STATES

Whether effective large-scale BMD will be feasible is debatable. (The US Strategic Defense Initiative is presented as a research programme to answer exactly this question.) Vigorous research into the relevant technologies has caused an evaluation of its impact on the military alliance systems, in particular NATO. Even in the absence of development and deployment, strategic defense programmes have important implications for arms limitation efforts, technologies utilizable for military purposes, policies for industry and technology, and the general political climate in the East-West relationship. And if strategic defenses should be deployed, major questions would arise about its effects on intra-alliance and inter-alliance relationships, and on the NATO strategy of flexible response. Against this background, the position of the West European NATO members towards space weapons, especially BMD, is of particular interest. Even though it was known that research on the relevant technologies was continued by the United States and the Soviet Union after the ABM Treaty was signed in 1972, it was the announcement of SDI in March 1983 that elicited official statements on space weapons.

THE RESPONSE TO SDI

The immediate reaction to the announcement of SDI by President Reagan on March 23, 1983, and subsequent statements by US officials, was mainly one of confusion, concern, and disbelief. The US allies had not been consulted or informed in advance of the Presidential address, although if implemented the new system would result in a fundamental change in nuclear strategy. For the United Kingdom and France, an important consideration concerned the efficacy of their independent nuclear deterrents in a potential defense-dominated world. There was also skepticism on the European side of NATO whether a defensive strategy could in the future replace the strategy of deterrence based on the threat of nuclear retaliation, and concern that strategic defenses might result in different regions of the alliance being defended less effectively than others (even though President Reagan had made explicit reference to the defense of US allies in his address). A briefing by US Secretary of Defense, Caspar W. Weinberger, to NATO defense ministers at a Nuclear Planning Group meeting in early April 1983 did not result in overall retrospective acceptance of the plan by all allies.

While European supporters of strategic defense argue that an effective defense would render the US nuclear guarantee to Europe much more credible, opponents have expressed concern that the overall effect would be "decoupling". Their argument has been that, either the Europeans would remain vulnerable and so expose themselves to becoming hostage to the Soviet Union, or else that the United States, when safe behind its protective shield, might be tempted to withdraw from its international commitments.

The Prime Minister of the *United Kingdom*, during her visit to the United States in December 1984, stated that strategic defenses should not be deployed before negotiating with the Soviet Union. They should enhance deterrence and not undermine it, and security should be achieved through reduced levels of offensive weapons on both sides.[143] In a speech on 15 March 1985, the British Foreign Secretary professed some skepticism regarding strategic defenses, saying that there would be no advantage to creating a new Maginot line of the 21st century, liable to be out-flanked by relatively simpler and cheaper countermeasures. He also stressed the need to be certain that the US nuclear guarantee to Europe would indeed be enhanced not at the end of the process but from its very inception.[144]

Describing the general attitude of the government of the *Federal Republic of Germany*, Chancellor Helmut Kohl, addressing the International Military Science Symposium in Munich, on 9 February 1985, said that it would not only look into the arms control and military strategy aspects of SDI but also take into account its implications for the alliance and its economic and technological aspects. In his view, it was too early to make a final assessment of strategic defense. Referring to the bilateral Soviet-US negotiations on nuclear and space weapons, the Chancellor stressed the importance of consultations both bilaterally and within the alliance. The government of the Federal Republic of Germany subsequently issued a statement on 18 April 1985 that the US research programme is militarily justified (because of Soviet research on antimissile capabilities), politically necessary (because the currently available instruments of security policy had not prevented an increase of strategic nuclear offensive capabilities) and in the interest of the security of the West as a whole.[145]

The West German Minister of Defense stated in Winter 1986 that it is in the interest of the Federal Republic, and of Western Europe, that the SDI research programme be pressed forward, to determine whether a defense system is technically feasible and financially practicable and whether there is a possible relationship between offensive and

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143 "Strategic Defense Initiative: British-United States agreement on research". In: *Survey of Current Affairs,* Vol. 16, No. 1; January 1986. p. 9.

144 Sir Geoffrey Howe: Speech given on 15 March 1985 at the Royal United Services Institute, London.

145 *Bulletin der Bundesregierung,* No. 40, 19 Apri l985. p. 342.

defensive weapons that could lead to greater stability and favour the reduction of offensive arms. But he also said that the participants in the debate on strategic defenses should guard against the danger of denigrating and undermining a strategy of deterrence based on offensive weapons that would have to continue to be valid until an alternative would be available.[146] Chancellor Kohl has made known to the US government that the government of the Federal Republic of Germany favours continued adherence by the United States (and the Soviet Union) to the narrow (restrictive) interpretation of the ABM Treaty.[147]

The Foreign Minister of *France*, before the Commission on foreign affairs, defense and armed forces of the French Senate, on 12 June 1986 explained the French position towards SDI. This long-term US research programme, he said, could have implications for the military balance. He considered it important that a new arms race be prevented in the US-Soviet negotiations at Geneva. For France, it would continue to be of utmost importance that nuclear deterrence (by threat of retaliation) not be put in doubt. In its present formulation, the Foreign Minister said, the SDI programme seems to respond more to US than to European needs. Regarding the technological significance of SDI, the Foreign Minister estimated the benefits for Europe of the US offer of participation as very limited, perhaps 1 per cent of the total SDI budget.[148]

Several Western States, including Norway, Greece and Australia, have expressed strong concern regarding the consequences of space weapons.

ALLIED PARTICIPATION IN SDI

On 26 March 1985, at a NATO Nuclear Planning Group meeting in Luxembourg, the United States formally invited all the European allies, including France, and Japan, Australia and Israel, to participate in the SDI programme. In a communiqué the NATO defense ministers stated that they supported the US research programme into these technologies, with the aim of enhancing stability and deterrence at reduced levels of offensive nuclear forces. This research, consistent with the ABM

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146 Manfred Wörner: "A Missile Defense for NATO Europe". In: *Strategic Review,* Vol. 14, No. 1; Winter 1986. pp. 13-20.

147 This was conveyed during Chancellor Kohl's visit to Washington in October 1986; see "Reagan says SDI 'can open new doors to peace'". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 191, 22 October 1986. pp. 4-5.

148 Audition de M. Jean-Bernard Raimond par la Commission senatoriale des affaires étrangères, de la défense et des forces armées, 12 juin 1986.

Treaty, was recognized as being in the interest of NATO security and should continue.[149]

Memoranda of understanding (MOUs) concerning participation in the SDI research programme were signed on 6 December 1985 with the *United Kingdom*, on 27 March 1986 with the the *Federal Republic of Germany*, in May 1986 with *Israel*, and on 19 September 1986 with *Italy*. All these MOUs were classified and their contents not made public. With the Federal Republic of Germany, a joint understanding of general principles and guidelines for the cooperation between the two countries on SDI was also signed. On 21 July 1987 an unclassified agreement was signed with Japan. According to the DoD, the agreements signed by the five countries are substantially equivalent.[150]

Canada, Denmark, France, Greece, Norway and Australia have explicitly declined governmental participation in the SDI programme. This does not necessarily prevent their industrial establishment from participation.

According to the Federation of American Scientists, 17 foreign government agencies, universities and corporations were involved in SDI projects from 1983 to March 1987. From the contract figures given it can be inferred that their share was not more than about $ 100 million, about 1 per cent of all SDI contracts.[151] The United States will own the right to technology developed under contract for SDI.

DEFENSE AGAINST TACTICAL MISSILES

Regarding defenses against nuclear short- and medium-range ballistic missiles, the Minister of Defense of the Federal Republic of Germany, Manfred Wörner, said that a positive assessment of SDI became easier when it became clear that European interests would be equitably taken into account. He also said that the inclusion of the nuclear threat to Western Europe in SDI had enabled the government of the Federal Republic of Germany to reject suggestions to embark on a European

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149 J. Cartwright: "The Strategic Defense Initiative and the Atlantic alliance". In: *North Atlantic Assembly, Special Committee on Nuclear Strategy and Arms Control, Interim Report* AC 139, CS/AN(85)4, October 1985. p. 12.

150 "U.S. and West Germany sign SDI research agreement". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 52, 1 April 1986. pp. 6-7. "Italy and United States sign SDI agreement". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 170, 22 September 1986. pp. 5-6. "U.S., Japan sign SDI research agreement". In: *Daily Bulletin,* US Mission, Geneva/US Embassy, Bern; No. 134, 22 July 1987. pp. 5-6.

151 "Scientists Find Corporate Support Building for Deployment of SDI". In: *Aviation Week & Space Technology,* 27 April 1987. p. 81.

Defense Initiative.[152] Wörner also expressed, in 1985 and 1986, an urgent need for means to cope with Soviet ballistic missiles (SS-21, SS-22, SS-23) armed with *conventional* warheads that might be used for surprise attack of military targets. In his view, the only politically and strategically acceptable response for NATO is a non-nuclear point defense of priority targets against Soviet missiles, an extended air defense system. This is described as consistent with "the defensive cast of the NATO alliance" and contributing to the stability of the military relationship between the opposing blocs in Europe. The Minister sees no requirement for stationing weapons systems or components in space for such an extended air defense.[153]

More than 50 US and European defense companies have formed 12 contractor teams to compete in the SDI effort to define the architecture for a defense system against tactical ballistic and cruise missiles, and contracts have been awarded to European institutions. Israel has also expressed interest in this field of research.[154] Independently of SDI, the French company Aerospatiale is conducting preliminary studies on an anti-tactical ballistic missile system (with ground-based interceptor missiles) that could be used for point defense of French land-based nuclear missiles.[155]

Because of the shorter flight times and lower trajectories of short- and intermediate-range ballistic missiles, defenses against them would probably have to rely to a greater degree than strategic defenses on terminal-phase interception. Terminal-phase interception seems to hold much more promise for point defense of military targets than for population defense.

EUREKA

France proposed in April 1985 to the Western European States the establishment of a European research co-ordination agency, *Eureka*. This step was motivated by a desire to remain competitive in high technology, to prevent a brain drain of European scientists and engineers to the United States, and to emphasize European autonomy. The first Eureka conference was held at Hannover on 6 November 1985,

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152 "German Minister Discusses NATO's Defense Options". In: *Aviation Week & Space Technology,* 17 November 1986. pp. 77-79.

153 Manfred Wörner: "A Missile Defense for NATO Europe". In: *Strategic Review,* Vol. 14, No. 1; Winter 1986. pp. 13-20.

154 *Aviation Week & Space Technology,* 12 May 1986. p. 27. 30 June 1986. p. 24. 29 September 1986. pp. 22-23. 15 December 1986. p. 26.

155 "Aerospatiale Studies Missile System to Counter Tactical Soviet Threat". In: *Aviation Week & Space Technology,* 21 April 1986. pp. 75-77.

with the participation of the twelve member States of the enlarged EC, plus Austria, Finland, Norway, Sweden, Switzerland, and Turkey.[156] Eureka is a civilian research programme directed to high technology fields such as artificial intelligence, large-scale computing, telecommunications, robotics, materials science, lasers and biotechnology.

5.6. POSITIONS OF NEUTRAL AND NON-ALIGNED STATES

Debate on the advisability of ballistic missile defense, especially development of space-based defenses, has become intense throughout the world, because of the assumption that the resulting implications have universal relevance to international security. The debate has been conducted at the United Nations and in varous regional forums, between governments and within national borders at all levels. Numerous non-aligned States have made statements at the United Nations and elsewhere concerning the anticipated implications and consequences of space weapons. The following summaries aim to provide a sample of the views that have been presented.

Argentina

Argentina has said that there is more than adequate evidence to show that the militarization of outer space has already begun in a big way. In its view, advances in space technology since its inception in the 1950s have contributed to enhancing force, accuracy and sophistication of the weapons systems of the nuclear-weapon Powers, and the last few years have seen the development of directly and clearly identifiable military activities born out of space technology. What is more, this increasing military orientation of space technology has led, as Argentina states, to the development of the war machines of the major nuclear Powers containing some of the following weapons: the thermo-nuclear warheads, the strategic and intermediate-range missiles and bombers and the space-based means to manipulate a total planetary war. The latest to enter in the field are the anti-satellite weapons and the space-based ABM systems. Weapons like space-based ABM systems are no longer confined to science fiction, they are fast becoming a reality. Sizeable amounts of resources running into billions of dollars have been allocated for the purposes of research and development of these weapons. It is difficult to believe, for Argentina, that once a programme is launched it will remain confined to the stage of research and development.

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156 Jean-Baptiste Main de Bossière: "Le programme Eureka". In: *Défense Nationale,* December 1986. pp. 133-148.

India

In the matter of the use of space for peaceful purposes, India's interest is both specific and general. The first Indian satellite was launched in 1975, and since then eight more satellites have been put into space for performing several peaceful functions of benefit to the people of India. The government has plans to expand the Indian space programme soon so as to include remote sensing and other peaceful activities. India has thus an abiding interest in the protection of civilian satellites and in keeping space free of weapons. However, 75 per cent of the satellites now in space, numbering over 3,200, are performing a variety of military roles, according to an Indian estimate. They are designed to enhance the effectiveness of the use of nuclear and other weapons on earth. In the event of war, these military satellites will be among the first targets of attack, and as a consequences all civilian satellites will also be simultaneously incapacitated.

India deplores the development of anti-satellite weapons and is in favour of multilateral negotiations for banning them. Some experts are of the opinion that a ban would be unverifiable, while others consider that adequate verficiation is feasible. Insistence, therefore, on 100 per cent verification could be construed as a pretext for not banning ASAT weapons.

The other grave danger perceived by India is research and development of space-based weapons, including anti-ballistic missile defence systems. The US interest in these weapons is reportedly the result of its perception of a credible threat from the USSR land-based missiles to US ICBM silos. In order to meet this perceived threat and under the compulsions of science and technology, the United States is carrying out research into space-based weapons of various types for destroying Soviet missiles in flight before they reach their targets. It has been claimed by the United States that such weapons are intended to be defensive, and that they would not have the role of striking targets on the ground. But their capability to do so is unquestionable and the Soviet Union apprehends that US research into space-based weapons would pose a threat of a first strike against it, and it would therefore have to consider effective countermeasures. India is of the opinion that the arms race could thus extend into outer space with unforeseeable consequences, unless space-based weapons are prohibited.

The objective of the current bilateral negotiations between the United States and the USSR is said to be to reduce their strategic arsenals initially by 50 per cent, and eventually to lower their levels until there is nuclear disarmament by the end of this century. India sees no reason why an expensive space defence system should be developed against nuclear arsenals that are expected to be reduced progressively through negotiations.

India is concerned also over another aspect of the current research into space weapons based on new physical principles, such as lasers, particle beams, kinetic energy, electro-magnetic forces and microwaves. India fears that there is every possibility that the fruits of this wide-ranging research may be applied sooner or later to conventional weapons with disastrous consequences for the future of international peace and security.

Indonesia

Indonesia thinks that current developments indicate that outer space is becoming a new arena of arms competition between the major Powers, and it has expressed concern about this prospect. Outer space is regarded as the common heritage of mankind and must be reserved exclusively for peaceful purposes and uses that are beneficial to all mankind. Because of its geographical composition, Indonesia relies for telecommunications largely on a space-based telecommunications satellite, and it is hence in particular concerned at the way a militarization of outer space would impinge on peaceful satellite communications. As an equatorial country, Indonesia is also worried about the use satellites in the geostationary orbit might be put to. The position of Indonesia is that the geostationary orbit is a limited natural resource that must be used exclusively for peaceful purposes. The existing legal regime of outer space is perceived as being insufficient for preventing an arms race, and Indonesia considers it necessary to urgently remedy this situation before such a task would become more difficult, or even impossible, due to advances in space weapons technology. In this context, Indonesia attaches first priority to a ban of ASAT weapons.[157]

Morocco

Morocco noted that the arms race, which in its view has spread to outer space, has become a source of great concern for all the international community. Morocco's position is that this process began by the use of satellites for military surveillance, early warning and spying missions, and it does not support the view that the devices used for these activities are not strictly speaking weapons. Advances in technology have enabled offensive and defensive weapons to be developed and deployed in space. These weapons, in Morocco's view, are designed to destroy not only devices in space but also targets on Earth. Morocco

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[157] See the Indonesian statement made in the Conference on Disarmament on 5 August 1986 (CD/PV.376).

also said that research conducted by the two major Powers has enabled the initiators of a spiralling arms race to acquire ASAT weapons considered to confirm beyond any doubt that outer space is indeed militarized. It expressed its worry that the Earth may become hostage as result of an increase in space weapons systems "which a simple computer error may trigger off".

Recognizing the futility of seeking superiority in an arms race, Morocco believes in the necessity and virtues of negotiation, and stressed that the international community expects the Powers responsible for the arms race in outer space to display a sincere political will to bring their negotiations to a successful outcome. In Morocco's view, these bilateral negotiations must be supplemented by a broader forum. The Conference on Disarmament should identify, clarify and correct ambiguities that surround the current legal regime governing outer space. The existing instruments, designed to protect space from the military threat, have in Morocco's view, through their vagueness, the general nature of their terms, and the modesty of their scope given rise to so many differences of interpretation that they have not so much governed the activities of States in space as opened up gaps for the militarization of space. Morocco urges a constantly updated codification with respect to all space activities, which should keep up with the development of technology. The major Powers, and the Conference on Disarmament, are called upon to draw up "space disarmament" treaties, prohibiting the development, testing, manufacture, stockpiling and use of all space weapons, and the destruction of such weapons. Space weapons would include, according to Morocco, any system capable of launching attacks against spacecraft from outer space or from land, sea or sky, as well as any weapon system capable of attacking targets on land, at sea or in the sky from outer space.[158]

Nigeria

Nigeria holds the view that research for superiority has taken the nuclear arms race to outer space, that it has further complicated disarmament negotiations and reduced the chances of nuclear disarmament. Regarding the utility of weapons in outer space, Nigeria declared that the vision of any such superiority in a high-tech age can only be illusive. Extending the arms race to outer space is, in Nigeria's view, too dangerous and costly to be condoned, and it would lead to

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158 See the Moroccan statement made in the Conference on Disarmament on 3 July 1986 (CD/PV.367).

greater insecurity and misery for mankind. Therefore it should be stopped through negotiations.[159]

Pakistan

Pakistan has expressed the opinion that there is merit in the link between substantial reductions of offensive nuclear weapons and a commitment not to develop, test or deploy space-based weapons. If deterrence were to be based on defense or on a mix of offense and defense, the results would be highly destabilizing. Further, Pakistan thinks that operational and effective BMD could make possible a nuclear first strike by a side possessing a defensive screen which could then be used to protect the attack from the feeble retaliation of its adversary. In the view of Pakistan, an offense-defense mix would take the arms race to higher and more dangerous levels. Pakistan stated that it was no admirer of the concept of strategic deterrence, that it was, however, gravely concerned at the attempts to replace this concept with an even more dangerous one.

Pakistan is also concerned that new technologies developed in connection with space weapons, such as lasers and particle beams, could be applied to conventional weapons deployed by countries parties to the military alliances, amplifying the existing military asymmetries between them and the non-aligned and neutral States. Weaponization of space could, in the view of Pakistan, also further entrench the inequitable use of outer space to the detriment of developing States.[160]

Sweden

Sweden called for multilateral negotiations to prohibit ASAT weapons. An ASAT ban not adhered to by all States with a future ASAT capacity would make many important satellites potential objects of attacks. Existing ASAT systems should be destroyed.

On the question of ballistic missile defence, Sweden said that it does not believe that security can be achieved through such defences. BMD systems in outer space, if technically feasible, might be vulnerable to attack and could be overcome by an increase in the number of nuclear weapons. Sweden also said that it is difficult to see how destabilization, and an increase in the risk of nuclear war, could be avoided in the process to establish advanced BMD systems. Sweden holds that the reasons that prompted the conclusion of the ABM Treaty

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[159] See the Nigerian statement made in the Conference on Disarmament on 18 February 1986 (CD/PV.340).

[160] See the Pakistani statements made in the Conference on Disarmament on 6 February 1986 (CD/PV.337), 22 April 1986 (CD/PV.358), and 3 July 1986 (CD/PV. 367).

continue to be valid and that the strict observance of its provisions is necessary. Sweden said that the deployment of space-based strategic defence systems would also affect the security of other countries than the two major nuclear Powers. The deployment of such systems might alter the strategic relationship and have consequences for overall stability, and possible defence systems could, at least in theory, be provided with an additional capacity to be used against targets other than strategic weapons, in space or on Earth, Sweden stated. For this reason, the deployment of space weapons is a source of concern for the whole international community. Sweden thinks there is a strong case for multilateral involvement.

The Swedish position is that "advanced BMD systems" are subject to obligations undertaken multilaterally and not only to the bilateral treaties between the Soviet Union and the United States. Recognizing that those obligations may not be as precise as they could be, Sweden said that even if this insufficient multilateral legal framework does not explicitly prohibit weapons in orbit around the Earth (or on Earth, in the atmosphere, at sea or below) their development, testing and deployment would run counter to the spirit of the Outer Space Treaty.[161]

Venezuela

In the opinion of Venezuela, the idea that it is possible to design defense systems capable of protecting a country against a nuclear attack is even more dangerous than the one that "had been keeping us living under a system based on collective terror", namely mutually assured destruction. The outbreak of nuclear war is perceived as becoming more likely if strategic defenses are introduced. If two years ago the idea of a space-based defense system seemed fantastic, Venezuela stated, today it has ceased to be a hypothesis and is becoming a terrifying probability, given the fast advancement of science. Venezuela is against any initiative which would make outer space a new dimension for the arms race, and it remains unconvinced by the arguments put forward in its justification. A system of strategic defense is considered not to make nuclear weapons obsolete, but to accelerate their vertical proliferation in the quantitative and qualitative dimensions. Venezuela also considers it indefensible to devote enormous amounts of money to strategic defense while there are more urgent problems of hunger, health, poverty and education to be solved in the developing countries.

In the view of Venezuela, the fact that the Outer Space Treaty of 1967 prohibits the stationing in space only of weapon of mass destruction

[161] CD/PV.336 of 4 February 1986; pp. 32-33. CD/PV.411 of 9 June 1987; pp. 14-15.

does not mean that the stationing of other types of weapons is legitimate. In the view of Venezuela, deployment of any weapon in space should be prohibited.[162]

The Delhi and Mexico Declarations

In the Delhi Declaration (28 January 1985) and the Mexico Declaration (7 August 1986) the Presidents of Argentina, Mexico and Tanzania, and the Prime Ministers of Greece, India and Sweden expressed their view towards space weapons. Referring to the buildup of strategic offensive nuclear weapons, they stated that over the course of the last four decades, every nation and every human being has lost ultimate control over their own life and death. The six political leaders called for an end to all nuclear tests, and a halt to the nuclear arms race, followed immediately by substantial reductions in nuclear forces. Regarding outer space the Delhi Declaration stated that outer space must be used for the benefit of mankind as a whole, not as a battleground of the future. The six political leaders called for the prohibition of the development, testing, production, deployment and use of all space weapons. In their view, an arms race in space would be enormously costly, and have great destabilizing effects; it would also endanger a number of arms limitation and disarmament agreements. In the *Mexico Declaration*, the six political leaders urged the Soviet Union and the United States to agree on a halt to further tests of ASAT weapons, in order to facilitate the conclusion of an international treaty on their prohibition. Furthermore, they stressed that the Outer Space Treaty and the ABM Treaty should be fully honoured, strengthened and extended as necessary in the light of more recent technological advances.

The Declaration of Harare

The Non-aligned countries stated their position regarding space weapons in the Declaration of Harare, at the Eight Conference of Heads of State or Government of non-aligned Countries, held in August-September 1986. Since this declaration reflects the views of a great number of countries, it relevant articles will be quoted extensively:

> "The Heads of State or Government expressed deep concern at the preparations under way for the extension of the arms race in all its aspects into outer space. They strongly reaffirmed the principle that outer space, which is the common heritage of mankind, should be used exclusively for peaceful purposes and for the benefit and in the interest of all countries, regardless of their level of economic or scientific development, and that it should be open to all States.

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[162] See the Venezuelan statements made in the Conference on Disarmament on 12 June 1986 (CD/PV. 361), 1 July 1986 (CD/PV.366), 10 July 1986 (CD/PV.369), and 7 August 1986 (CD/PV.377).

They recalled the obligation of all States to refrain from the threat or use of force in their outer space activities. They reiterated their view that the universally accepted objective of general and complete disarmament under effective international control demands that outer space should not be transformed into an arena for pursuing the arms race. They therefore called on the Conference on Disarmament to commence negotiations urgently to conclude an agreement or agreements, as appropriate, to prevent the extension of the arms race in all its aspects into outer space and thus enhance the prospects of co-operation in the peaceful uses of outer space. In particular, they stressed the urgency of halting the development of anti-satellite weapons, the dismantling of the existing systems, the prohibition of the introduction of new weapon systems into outer space and of ensuring that the existing treaties safeguarding the peaceful uses of outer space, as well as the 1972 Treaty on the Limitation of Antiballistic Missile Systems are fully honoured, strengthened and extended as necessary in the light of recent technological advances. The Heads of State or Government invited the United Nations General and the Conference on Disarmament to explore the ways and means of bringing satellites for military purposes under international control, particularly when it puts at stake the security of non-aligned countries.

The Heads of State or Government called upon all States, in particular those with major space capabilities, to adhere strictly to the existing legal restrictions and limitations on space weapons, including those contained in the Outer Space Treaty and the 1972 Soviet Union - United States Treaty on Antiballistic Missiles, and to refrain from taking any measures aimed at developing, testing or deploying, weapons and weapons-systems in outer space. Simultaneously, negotiations should be undertaken urgently with a view to concluding an agreement or agreements preventing the extension of the arms race into this area. Measures aimed at developing, testing or deploying weapons and weapons-systems in outer space could, through a constant chain of action and reaction, lead to an escalation of the arms race in both "offensive" and "defensive" weapons, thus making the outbreak of nuclear conflict more likely. Such a situation would not only result in a quantum leap in the level of resources expended on armaments, but would also frustrate the efforts currently under way to achieve disarmament."[163]

5.7. THE POSITION OF THE PEOPLE'S REPUBLIC OF CHINA

Regarding the promise of advanced anti-ballistic missile systems, China declared that it is impossible to eliminate weapons by developing a new type of weaponry. The development of space weapons could only further aggravate and escalate the arms race, create greater instability and increase the danger of war. In the view of China, the militarization of outer space involves not only space weapons but also the satellite systems established for military purposes.[164]

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163 NAC/Conf.8/Doc.1/Rev.1, articles 35-37.

164 CD/PV. 302 of 26 March 1985, pp. 14-17.

In the view of China, outer space should be used exclusively for peaceful purposes. The Outer Space Treaty is seen as inadequate for the prevention of an arms race in outer space. The scope of prohibition should be extended from "nuclear weapons and other weapons of mass destruction" to include all space weapons, i.e. all devices or installations either space-, land-, sea-, or atmosphere-based, which are designed to attack or damage space vehicles in outer space, or disrupt their normal functioning, or change their orbits, and all devices or installations based in space which are designed to attack or damage objects in the atmosphere, or on land, or at sea, or disrupt their normal functioning. Other agreements concerning outer space, such as the Convention on International Liability for Damage Caused by Space Objects and the Convention on Registration of Objects Launched into Outer Space also are considered to be inadequate.[165]

In China's view, the primary objective in the efforts to prevent an arms race in outer space should be the de-weaponization of outer space. All countries with a space capability should refrain from developing, testing or deploying outer space weaponry. China proposes to focus efforts on the conclusion, as soon as possible, of an international agreement prohibiting research, testing, development, production, deployment and use of all outer space weapons and providing for the destruction of outer space weaponry.[166]

The de-weaponization of space would only be a first step on the way to the "non-militarization of outer space". It should be followed, in China's opinion, by the de-militarization of space, which would also cover the satellites with military purposes. For practical purposes, this second issue would have to be considered and resolved at an appropriate time in the future.[167]

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[165] CD/PV.372 of 22 July 1986, pp. 5-8.

[166] CD/PV. 292 of 19 February 1985, pp. 32-33; CD/PV.339 of 13 February 1986, pp. 32-33.

[167] CD/PV. 302 of 26 March 1985, pp. 14-17.

Part III:

Legal Aspects of an Arms Race in Outer Space and of the Means for its Prevention

The purpose of this part, relating to the legal aspects of the prevention of an arms race in outer space, is to analyse the value and scope of legal provisions in this area. In what way do the existing provisions contribute to the objective of the prevention of an arms race in outer space, and with what results? What may be expected of the establishment of rules of law, and under what conditions could these rules be effective? Although no definitive answer can be given to these questions in this research report, they will provide a focus for the observations made below.

What we have to do is: first of all to present positive law relating to outer space and its relationship with a prevention of an arms race in outer space, secondly to specify the main characteristics of the law in force, and thirdly to confront unilateral acts, behaviour and claims with the provisions applicable to them.

6. International law relating to outer space

There already exists a considerable body of international law applicable to outer space. Nevertheless the provisions relevant to the use of weapons in space are both of a general and specific nature. Current developments in space science and technology, coupled with ongoing military space programmes, underscored the inadequacy of existing legal instruments to prevent an arms race in outer space. The rules in this domain are scarcely distinguishable, in their origin, method of formulation, substance and legal authority, from the body of public international law as a whole. They are fundamentally inter-State and composite in nature. They concern only indirectly, or by implication, the prevention of an arms race in space. It is necessary to study them, to juxtapose them, in order to arrive at observations which are often more in the nature of rational consequences than consciously sought results. Moreover, either because of their abstract nature or conversely because of their precision and technical nature, they comprise numerous ambiguities as to their scope.

This will be clearly shown by a brief review of the principal applicable instruments.

6.1. POSITIVE TREATY LAW

The most visible and, as it were, most solid portion of legal regulation, is made up of treaties. But it should immediately be emphasized that they do not constitute the only element to be taken into consideration; the role of custom and unilateral acts may also be examined. It is nevertheless around treaty rules that the most important controversies in this area develop, and particular attention may justifiably be paid to them. We shall recapitulate, in chronological order, the main provisions of the relevant conventions, before dealing systematically with the characteristics of applicable law.

CHARTER OF THE UNITED NATIONS

The first instrument to be taken into consideration is the Charter of the United Nations (1945), despite the fact that, having been adopted before the utilization of outer space started, it could only concern space in a potential way. The obligations which the Charter contains and the principles which it establishes are nevertheless valid for outer space for various reasons: first of all because the Charter does not comprise any limitation *ratione loci;* but then also because Article 103 of the Charter stipulates that it shall prevail over any other obligation of Member States; and furthermore because the 1967 Outer Space Treaty explicitly refers to it and provides that activities in outer space shall be conducted in accordance with the Charter (Art. 3).

As to the relevant provisions of the Charter, several may be taken into consideration. They concern:

the *purposes* of the United Nations Organization, in Article 1 (paragraph 1. "To maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal of threats to peace...");

its *principles*, with, in particular, Article 2, paragraph 4 ("All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations");

the *guarantees of security* of States, as provided for in Article 51 ("Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain international peace and security...").

The application, and interpretation, of these provisions raise a number of unresolved problems, to which reference will be made below.

THE PARTIAL TEST-BAN TREATY

The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, signed on 5 August 1963, constitutes one of the first examples of a new approach to disarmament, which has become known as arms limitation and arms control. It is at the same time one of the first treaties that explicitly concerns outer space, and it approaches this question from the standpoint of the limitation of testing of certain types of weapons. Article I of the Treaty, in particular, stipulates:

> 1. Each 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; or
>
> (b) in any other environment if such explosion causes radioactive debris to be present outside the territorial limits of the State under whose jurisdiction or control such explosion is conducted. It is understood in this connection that the provisions of this subparagraph are without prejudice to the conclusion of a treaty resulting in the permanent banning of all nuclear test explosions, including all such explosions underground, the conclusion of which, as the Parties have stated in the Preamble to this Treaty, they seek to achieve.
>
> 2. Each of the Parties to this Treaty undertakes furthermore to refrain from causing, encouraging, or in any way participating in, the carrying out of any nuclear weapon test explosion, or any other nuclear explosion, anywhere which would take place in any of the environments described, or have the effect referred to, in paragraph 1 of this Article.

THE OUTER SPACE TREATY

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies , signed on 27 January 1967, which was formulated within the framework of the United Nations, still constitutes, some twenty years later, the main basis of law applicable to outer space. Its preamble recognizes, in particular, "the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes". Its articles I and III contain essential rules:

> Article I:
>
> The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.
>
> Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

> There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.
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> Article III:
>
> States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

Article IV sets forth the main restrictions on military activities in outer space:

> 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 manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

Its article IX provided the basis for co-operation between parties, founded on the respect of interest of all parties as well as on the necessity to preserve the environments of space and Earth:

> Article IX:
>
> In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. 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.

Articles X and XII provide bases for verification of these activities, albeit in restricted conditions.

Article X

In order to promote international co-operation in the exploration and use of outer space, including the moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by these States.

The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XII

All 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 intereference with normal operations in the facility to be visited.

Without engaging in a more detailed discussion, the following observations may be made immediately:

The concept of *use for peaceful purposes* is not clearly spelled out and has given rise to controversy. In this context, suffice it to say that the term "peaceful" has been interpreted by some as mening "non-military", while others have equated it to "non-aggressive".

Different rules are established for outer space proper, on the one hand, and for the moon and other celestial bodies, on the other. In the first case, what is involved is only a limited prohibition which, for example, does not prohibit the placing in orbit of non-nuclear ASAT or antimissile weapons. In the second case, exclusive use for peaceful purposes entails more substantial restrictions, without necessarily going as far as total demilitarization. Because of its limited scope, the Outer Space Treaty left open the possibility of the introduction of weapons in space, other than nuclear weapons or other weapons of mass destruction, in particular ASAT weapons and space-based ABM systems.

The verification provisions are not of a binding nature and are largely dependent on the goodwill of the Parties.

THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT), signed on 1 July 1968 (entry into force 5 March 1970) is a multilateral instrument whose role in the prevention of an arms race in space must not be overlooked. It concerns nuclear weapons or other nuclear explosive devices (Art. I) and seeks to limit the number of States which may possess such weapons and hence also the number of States which may be able to use nuclear weapons in space. Its role in the prevention of an arms race in space does not extend to non-nuclear weapons. In reciprocation of the undertaking by non-nuclear weapon States party to the Treaty not to acquire nuclear weapons the nuclear weapon States party to the Treaty undertake under Article VI to negotiate to bring the arms race to an end. Critics of the Treaty however argue that it is discriminatory towards non-nuclear weapon States.

THE BILATERAL AGREEMENTS BETWEEN THE UNITED STATES AND THE SOVIET UNION OF 30 SEPTEMBER 1971

In a quite different spirit are two bilateral agreements which were concluded on 30 September 1971 between the United States and the Soviet Union.

Agreement on measures to reduce the risk of outbreak of nuclear war

The agreement on reduction of the risk of outbreak of nuclear war is aimed, *inter alia,* at protecting early warning satellites and preventing their accidental destruction or disablement from leading to the outbreak of a nuclear conflict between the two parties. Article 3 of the agreement stipulates:

> The Parties undertake to notify each other immediately in the event of detection by missile warning systems of unidentified objects, or in the event of signs of interference with these systems or with related communications facilities, if such occurences could create a risk of outbreak of nuclear war between the two countries.

Agreement on measures to improve the direct communications link[168]

The agreement on measures to improve direct communications between the two States, provides in Article 1(1a), *inter alia,* for the establishment by each party of "a satellite communications system, with each Party selecting a satellite communications system of its own choice". Article 2 provides that "Each Party confirms its intention to take all possible measures to assure the continuous and reliable operation of the communications circuits and the system of terminals of the Direct Communications Link...".

The agreement represents an application of the principle of non-interference with certain satellites of the other party, leading to a partial limitation of the use of ASAT systems. It does not contribute to disarmament in the strict sense of the word. It does, for example, not prevent the creation of ASAT weapons and therefore does not prevent an

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[168] This agreement is an update of the agreement of June 1963 establishing the direct communications link between the United States and the Soviet Union. In July 1984 a further agreement was concluded to expand and improve the operation of the direct communications link.

arms race in space. All it does is to protect certain satellites by a non-interference commitment.

THE ABM AND SALT AGREEMENTS (1972 AND 1979)

The SALT negotiations were conducted in direct connection with the development of strategic weapons, but also with the prospect of the development of a defence system against ballistic missiles and the prospect of new military uses of space. Their results have been varied.

The ABM Treaty

The Treaty on the Limitation of Anti-Ballistic Missile (ABM) Systems between the United States and the Soviet Union was concluded on 26 May 1972 and entered into force on 3 October of the same year. This instrument is of great importance for the prevention of an arms race in space, and its interpretation has given rise to much controversy.

The treaty initially limits the number and possibility of deployment of ABM systems within specific areas. Article I, paragraph 2, thus provides that "Each Party undertakes not to deploy ABM systems for a defense of the territory of its country... except as provided for in article III of this Treaty". Article III provides for the possibility of deploying two ABM systems within a deployment area with a radius of 150 km, one around the capital and the other around an ICBM site. In 1974, it was agreed by protocol to reduce the number of authorized sites to one.

Article V, paragraph 1 of the ABM Treaty in fact stipulates that "Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based or mobile land-based".

Research is, however, not prohibited by the treaty since it was felt that it could not be subject to verification.

Verification measures by national means are expressly provided for in article XII, paragraph 1, which reads: "For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law". These means[169] are protected under article XII, paragraph 2: "Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article".

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[169] "National Technical Means" covers inter alia or mainly satellites.

The idea of non-interference with reconnaissance satellites is thus confirmed, and this provision constitutes a bilateral basis for the limitation of the use of ASAT systems.

SALT I (1972)

On the same day, an Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms was concluded. This agreement concerns space to the extent that it provides for verification by national technical means and, in the same terms as the ABM Treaty, establishes the principle of non-interference with such national technical means. (art. V, paras. 1 and 2).

SALT II (1979)

The Treaty on the Limitation of Strategic Offensive Arms was signed by the United States and the Soviet Union on 18 June 1979, but has not been ratified. It was to be in force until December 31, 1985 (Art. XIX).

Regarding outer space, it contains, firstly, a clause concerning verification by national technical means (art. XV, para. 1) and confirms the principle of non-interference (para. 2), secondly, it prohibits the development, testing or deployment of "systems for placing into Earth orbit nuclear weapons or any other kind of weapons of mass destruction, including fractional orbital missiles" (art. IX, para. 1). The common interpretation of this agreement nevertheless specifies that this provision does not entail any dismantling or destruction of launchers by either of the parties.

This treaty is not in force between the parties, but they both stated that they would comply with its provisions. However, the United States recently declared that it no longer regarded itself as being bound by the content of the treaty, and in particular by the strategic arms ceilings which it included.[170] The USSR declared on its part that it will continue to observe the terms of the SALT II Treaty in hope that the United States will reverse its position and abide by the Treaty.

THE CONVENTION ON THE REGISTRATION OF SPACE OBJECTS

The multilateral Convention on the Registration of Objects Launched into Outer Space was signed in 1975 and entered into force in 1976. It established mandatory registration with the Secretar-General of the

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[170] On 27 May 1986, the Reagan Administration announced that the United States would no longer be bound by this agreement, which had never been ratified. Reference was also made to violations by the Soviet Union. The number of US launchers of ICBMs and SLBMs equipped with MIRVs, and heavy bombers equipped for cruise missiles capable of a range in excess of 600 km rose beyond the established ceiling of 1,320 (Art. V, para. 1) on 20 November 1986.

United Nations of space objects launched into orbit and beyond. States party are to supply information on space objects, such as orbit and general function. This information is to be transmitted "as soon as practicable" which invariably results in *ex post facto* notification. Furthermore, only the "general function of the space object" is to be reported. Thus, it should be noted that up to this day no party has ever reported any space mission as serving military functions.

The registration has the potential of being useful in maintaining outer space for peaceful purposes and of lessening the growing uncertainty and suspicion as to the nature of all space activities. To achieve these results, however, more timely and precise information would have to be furnished by the launching State.

THE CONVENTION ON THE PROHIBITION OF MILITARY OR ANY OTHER HOSTILE USE OF ENVIRONMENTAL MODIFICATION TECHNIQUES

The multilateral Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), which was opened for signature in 1977 and entered into force in 1978, contains a provision which is relevant to outer space. Article II of the Convention states: "the term 'environmental modification techniques' refers to any technique for changing - through the deliberate manipulation of natural processes - the dynamics, composition or structure of the earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space".

The convention does not comprise specific verification procedures but may to a certain extent protect satellites against interference resulting from deliberate disturbance of the environment through which they travel.

THE AGREEMENT GOVERNING THE ACTIVITIES OF STATES ON THE MOON AND OTHER CELESTIAL BODIES

The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (known as the Moon Treaty) was signed in 1979 and entered into force in 1984. The number of parties is, however, still small and the principal space Powers have not acceded to it.

The treaty reiterates, but also defines more precisely and expands, the provisions of the Outer Space Treaty. Article 3, in particular, stipulates:

> 1. The moon shall be used by all States Parties exclusively for peaceful purposes.
>
> 2. Any threat or use of force or any other hostile act or threat of hostile act on the moon is prohibited...

The agreement also prohibits, in the same paragraph, the use of the moon as a base for threatening "the earth, the moon, spacecraft, the personnel of spacecraft or man-made space objects".

Paragraph 3 prohibits the placing in orbit "around or other trajectory to or around the moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the moon". This prohibition adds more precision to the provisions of the Outer Space Treaty. It should be noted that, under article 1 of the Moon Treaty, the prohibitions apply not only to the Moon but also to other celestial bodies within the solar system, other than the Earth. The question arises whether the fact that the agreement has not been ratified by the major space Powers means that this possibility is maintained *a contrario*. Probably not, if one bears in mind that article IV, first paragraph, of the Outer Space Treaty establishes this prohibition in a general fashion in stipulating that: "State Parties to the Treaty undertake not to ... station such [i.e., nuclear and mass destruction] weapons in outer space in any other manner".

THE INTERNATIONAL TELECOMMUNICATION CONVENTION

The multilateral International Telecommunication Convention, as formulated at the Nairobi Conference of 1982, entered into force in 1984. It succeeded a prior Convention of 1975 and concerns the allocation of radio frequencies in space. It is intended to ensure that frequencies are distributed in such a way as to avoid harmful interference. But article 38, paragraph 1, provides that "Members retain their entire freedom with regard to military radio installations of their army, naval and air forces", which at the very least demonstrates that one cannot speak of the demilitarization of space on the basis of existing positive law.

PROBLEMS OF DEFINITION

If one tries to draw some general conclusions with respect to these different treaties, regarding their relationship to the objective of the prevention of an arms race in outer space, several inadequacies appear. The legal regime is far from complete, even regarding the definition of basic concepts.

Outer space

First and foremost, there is outer space itself, which the Outer Space Treaty does not clearly distinguish from the Earth's atmosphere, on the one hand, and the celestial bodies, on the other. The lack of definition - or, to be more precise, in the case in point, a delimitation - does not prevent it from having a particular legal regime. As regards military uses, for example, the difference of principle with the atmosphere and the celestial bodies is clear. Outer space is less likely to be put to military use than the atmosphere and more likely than the celestial bodies.

This rudimentary approach sufficed for the needs of the time when the Outer Space Treaty was concluded in 1967. There is no certainty that it is still adequate for the purpose of preventing an arms race, whether in relation to activities on the border of space and the atmosphere or to activities which might concern the Moon.

Of course, the precise definitions and delimitations which exactitude would require are not always indispensable or indeed possible. It is not a bad thing to be sparing with rules, limiting them to perceptible requirements and avoiding a potentially artificial legal perfectionism. Space law is largely dependent on the development of technologies and cannot at the present stage derive from a single, authoritative source or be arranged into a comprehensive corpus. In practice it has been built up gradually, in step with the needs of the international community and in the light of changing perceptions of those needs as technology develops.

There may also be conflicting ideas about desirable definitions for, as we know, there are two rival concepts in this area: a territorial concept involving the establishment of fixed delimitations with reference to physical criteria, and a functional concept whereby the regulation of specific space activities is regarded as paramount.

The Outer Space Treaty hedges on this point and takes an approach drawing on elements from both concepts. It would seem, however, that the dominant tendency is to avoid any parcelling up of space, to consider it as a homogeneous whole and not to divide it into different parts, particularly not in relation to the Earth.[171] From this point of view, what is needed to safeguard freedom of use, and in this respect the development of space law is very different from that of contemporary maritime law. It is doubtful whether any further progress can be made until the major space Powers agree on a given principle.

Peaceful purposes

Mention has already been made of the problem of how to define the peaceful purposes for which space is supposed to be used. The civilian use and the exploitation of outer space are part of a much wider concept, "the common province of all mankind", that is to say that outer space should be preserved for peaceful purposes only and its exploitation should be carried out and regulated in accordance with this

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[171] However, proposals to establish separate legal régimes for low-orbit satellites and for high-orbit satellites might, if adopted, constitute a step in this direction.

objective. The debate about the relationship between such peaceful purposes and the militarization of space, a process already well under way, and whether these peaceful ends merely preclude aggressive activities or other types of military activities is for the time being controversial and appears not amenable to a positive conclusion.[172] From this standpoint, it is doubtless more important for the purpose of attaining the desired objective, to ensure positive international co-operation so that such co-operation can expand in the interests of mankind as a whole and with particular regard for the interests of the developing countries, reducing the prospects and desirability of military use. In other words, efforts at prevention must involve more than just prohibition, restriction and verification and must also be directed towards growing peaceful co-operation.

Space weapons

Lastly, mention should be made of the problem of defining space objects and more particularly, in this connection, of defining space weapons. There is also the problem of objects, such as certain satellites, which are under special protection.[173] Providing special protection for particular satellites carries a threefold risk: either they will be singled out as being of particular strategic importance and thus made more vulnerable, or the status of the other satellites left without such protection might be undermined, and such protection could legitimize certain military uses of space.

A definition in this area is a very delicate matter, since a number of satellites are multi-purpose; moreover, to take the example of ASAT weapons, in addition to weapons designed specifically for ASAT purposes there may be others which can have an ancillary or occasional military use as ASAT devices.

In formulating such a definition, there are two pitfalls to be avoided: on the one hand, making the definition so general and abstract that it can be of no practical use; and, on the other hand, making it so technical and descriptive that it rapidly becomes obsolete and is incapable of

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[172] For a summing up, see Hubert Thierry: "Aspects juridiques de la course aux armements dans l'espace". *AFDI*, 1985, pp. 7-22. See also V. S. Vereshchetin: *Prevention of the arms race in outer space.* Geneva: UNIDIR, 1986.

[173] Satellites intended for the maintenance of communication between the United States and the Soviet Union, and satellites used to verify certain bilateral agreements. However, this protection has an exclusively bilateral basis, which is apart from the general provisions concerning the prohibition of the use of force and the provisions on responsibility (art. 7 of the Outer Space Treaty, and the 1972 Convention on International Liability for Damage Caused by Space Objects). The problem of immunity of certain satellites will be examined later in this report.

preventing the emergence of new technological dangers. One can argue that it might be better to abandon ambitions of comprehensive and fully rational definitions and instead to adopt definitions specific to different agreements and commitments. Such an approach is probably all the more necessary in that definitions take on meaning in relation to prohibitions imposed and possibilities of verification. An operational definition is always related to a particular prohibition or limitation or to an available verification procedure.

One striking point in this connection is that it is not normally the practice to classify missiles passing through space as space weapons. A major argument for such exclusion would seem to be that it is not intended to prohibit them, which is altogether in line with the logic of the Outer Space Treaty. According to this view, the prevention of an arms race in outer space does not in itself entail limitation or prohibition of such weapons, even though they inevitably have to be routed through space.

In the final analysis, this problem of definition comes down to the reference system for the maintenance of peace and security. It is that system which enables authorized weapons to be distinguished from weapons which should be prohibited, and here it would doubtless be desirable for concepts to be clarified.

6.2. OTHER ELEMENTS OF POSITIVE LAW

Apart from the agreements, treaties and conventions to which we have just referred, one must not overlook the role of custom and also of certain unilateral acts.

INTERNATIONAL CUSTOM

That custom should be taken into consideration results, firstly, from the United Nations Charter, and the Statute of the International Court of Justice which forms an integral part of it, from the Vienna Convention on the Law of Treaties, and from the Outer Space Treaty.

In accordance with article 38 of the Statute of the International Court of Justice, custom is a source of law equivalent to treaties; and article 1, paragraph 1, of the Charter, which establishes as an essential purpose the maintenance of peace and security, refers to the "principles of ... international law", which are largely of a customary nature. In the Outer Space Treaty, both article I and article III state that the use of space and celestial bodies must be undertaken in accordance with international law, a wording which covers customary law.

The essential interest of taking customary law into consideration lies in its generality of principle: whereas treaties are strictly confined to the States parties, under the principle *"Res inter alios acta..."*,[174] custom is virtually applicable, in conditions of equality, to all States.[175] It is only in the context of customary law that one may find rules that are completely general. Caution should, however, be exercised in practice before postulating the concrete generality of the applicability of a customary rule. Custom is a matter not of usage alone, but usage which is regarded as legally binding. A State may, in fact, avoid such applicability in so far as it is concerned by expressing an objection at the time when the rule is formed.[176] The generality of custom is therefore presumed, as it were, once the existence of the rule is established, but it may be the subject to derogations in the light of the behaviour of States concerned.

Is there a customary law applicable to outer space, and more particularly to the prevention of an arms race in this environment? It would be difficult to demonstrate the existence of specific rules, but two categories of rules should be mentioned.

- First, customary rules which are formed and developed from treaties, which take up their provisions and extend them beyond the circle of the parties.[177] This is certainly the case with the Charter itself, whose provisions relating, for example, to the prevention of the use of force or to self-defence are of a customary character.[178] It is also the case with the Outer Space Treaty, whose principles may be regarded as now having been incorporated in general law applicable to outer space and to celestial bodies. But such an extension has its limits: it is not the treaty as a whole which is systematically extended, but only the provisions in respect of which the general

[174] As, for instance, defined by the Vienna Convention on the Law of Treaties of 23 May 1969 (hereinafter referred to as the "Vienna Convention"), which largely codifies customary law in this area. Art. 34: "A treaty does not create either obligations or rights for a third State without its consent."

[175] See, for instance, the ICJ judgement of 20 February 1969 in *North Sea Continental Shelf Cases,* para. 63: "general or customary law rules and obligations ... by their very nature, must have equal force for all members of the international community..." *ICJ Reports,1969,* p. 38.

[176] See, for instance, the ICJ judgement in *Fisheries Case (United Kingdom v. Norway),* 18 November 1951. *ICJ Reports 1951,* p. 131: "In any event the ... rule would appear to be inapplicable as against Norway inasmuch as she has always opposed any attempt to apply it to the Norwegian coast."

[177] The conditions in which such general customary rules can be formulated were dealt with systematically in the above-mentioned judgement on *North Sea Continental Shelf Cases,* especially paras. 61 ff.

[178] See, in particular, the ICJ judgement of 27 June 1986 in *Case Concerning Military and Paramilitary Activities in and Against Nicaragua.* ICJ Reports 1986, passim.

agreement of States has emerged, thereby creating the basic condition for the existence of an international custom.[179]

Less widely accepted treaties do not necessarily give rise to a general custom and remain confined to the circle of the States parties. This is the case, in particular, with the Partial Nuclear Test-Ban Treaty.[180]

There is nothing to prevent even bilateral treaties - such as the ABM or SALT agreements - from constituting the basis for a customary rule or to prevent their provisions, which have been generally accepted by States, from forming the basis for universal obligations. Establishing this, nevertheless, raises the whole problem of the demonstration of the existence of custom.[181]

It could be interesting to arrive at a conclusion that certain obligations resulting from a treaty have acquired a customary character which could be separated from the initial instrument and in consequence be binding even if the original treaty would no longer be in force. Such a demonstration would, however, be problematical.

- Second, general customary rules which form part of conventional international law and are of concern to outer space.

Regarding the prevention of an arms race, much attention has to be paid to all matters relating to the right to take countermeasures.[182] Countermeasures are an authorized reaction to unlawful behaviour, a reaction which would itself be unlawful if it was not justified by the initial behaviour. A State which considers that a treaty obligation has been violated may thus be moved to react with a corresponding disregard for its own obligations, in order to protect its situation and to inflict a sanction on the perpetrator of the initial violation. In the

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179 As stipulated by the ICJ in the aforementioned *North Sea Continental Shelf Cases.*

180 As demonstrated, in particular, by the repeated calls for the conclusion of a treaty providing for a more comprehensive ban on testing, the significant refusals to accede to the 1963 Treaty and the fact that the ICJ has never recognized the customary character of this norm (see, in particular, the ICJ judgement of 20 December 1974 in *Nuclear Tests Case.*

181 Among the wealth of literature on international custom, see, for instance: H. Thierry *et al.: Droit international public,* 5th edition. Paris: Montchrestien, 1986; pp. 107-131. T. Brownlie: *Principles of Public International Law.* Oxford: Oxford University Press, 1966; pp. 4-9. H.W.A. Thirlway: *International Customary Law and Codification.* Leiden: Sijthoff, 1972.

182 Concerning this concept, see the work of the International Law Commission on State Responsibility, and particularly the reports of Professor Ago (Eight report and commentary of the International Law Commission to draft article 30, *Yearbook of the International Law Commission, 1979,* Vol. II, Part Two, pp. 115-122.

sphere of concern to us, such a possibility has a twofold character: it guarantees States against the harmful consequences of a violation; but it also renders precarious the obligations which they have accepted, since it opens a way to disregard these obligations on a reciprocal basis.

More generally, the legal consequences of unilateral acts of States - unilateral acts which are important in the area of the arms race and its prevention - are governed by customary law.[183] It is customary law which determines the way in which such acts commit the States that have undertaken them and the extent to which they may create rights or obligations in respect of third parties.

It is thus international law as a whole and not a particular collection of specific rules which must be considered and is operative in this field. Unilateral acts and acts of international organizations nevertheless raise specific problems, not only through their relationship with a customary rule. They constitute a category of acts, particularly prolific and diverse, to be taken into consideration.

ACTS OF INTERNATIONAL ORGANIZATIONS

Resolutions of the General Assembly constitute a particularly pertinent example of the first type. As is well known, many of them relate to outer space and to the prevention of an arms race. Their role in the disarmament process is, generally speaking, a considerable one. They may have a preparatory character in relation to certain treaties (e.g. the Outer Space Treaty[184]); they may contribute to the interpretation of treaties or norms (see, for example, the definition of aggression, in 1974,[185] or resolution 2625 (XXV) on principles concerning friendly relations among States[186]); or they may constitute an element in the elaboration of customary rules and thus help to develop, albeit

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183 Concerning the principle, see in particular the above-mentioned ICJ judgement in *Fisheries Case (United Kingdom v. Norway).*

184 See, for instance, resolution 1962 (XVIII) of 13 December 1963 setting out the legal principles governing the activities of States in outer space; the text of the Treaty of 27 January 1967 was approved by resolution 2222 (XXI) of 19 December 1966. It should be noted that, as early as 14 November 1957, the General Assembly adopted resolution 1149 (XII) stressing the danger of military activities in outer space.

185 Resolution 3314 (XXIX) of 14 December 1974.

186 Resolution 2625 (XXV) of 24 October 1970: Declaration of Principles of International Law concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations.

indirectly, international law applicable to States.[187] Beyond their direct and restricted legal effects, they clearly constitute a political-legal environment which States must inevitably take into account.

Generally, the resolutions of the General Assembly of the United Nations supported by large majorities of Member States are entitled to adequate weight in a condition of relative legal void. The resolutions represent a unique form of moral authority in an evolutionary situation and they are not devoid of legal implications for responsibilities that concern the continued survival of mankind.

Mention can be made at this point of two types of resolutions more directly related to the prevention of an arms race in outer space: Firstly, resolution S-10/2, the Final Document of the Tenth Special Session of the General Assembly devoted to Disarmament, which contains a number of elements denouncing the arms race and stressing the need to halt it; and secondly, the General Assembly resolutions which deal specifically with the prevention of an arms race in outer space (the two most recent ones being resolution 40/87 of 12 December 1985 and resolution 41/53 of 3 December 1986), which refer to the principal treaties in force and call for the rapid conclusion of treaties, both multilateral and bilateral, to achieve this objective.

UNILATERAL ACTS OF STATES

Unilateral acts of States are a quite different matter, since they are in principle the work of States acting individually on their own account, and not the result of collective international action. They consist in a State adopting a specific position, either through a declaration or official statement or else implicitly, by a particular behaviour.

Such unilateral acts are legion and indeed constitute the bulk of the legal behaviour of States. Some of these acts relate to treaties: decisions on ratification, interpretations, reservations, or even withdrawal. Others relate to custom, and consist of the exercise by a State of a power recognized by international law. Thus, when a State decides voluntarily to observe the provisions of an unratified treaty to cease nuclear testing (although not bound to do so by any treaty obligation, for example by committing itself to respect a moratorium) it contributes to curbing the arms race, at least temporarily, and the

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[187] See, for instance, the arbitral award in *Texaco-Calasiatic v. Government of Libya,* 19 January 1977; ICJ judgement in the aforementioned *Case Concerning Military and Paramilitary Activities in and Against Nicaragua,* 27 June 1986.

implications of such an act should be assessed in terms of general international law.[188]

The foregoing example shows that the effect of unilateral acts of States is not necessarily negative, despite the tentativeness of such acts. The international community displays a definite preference for agreements, and appears to consider that treaty commitments provide a firmer foundation than the convergence of unilateral attitudes. This is the tenor of resolutions 40/87 and 41/53, even if they also call for the adoption of some unilateral measures.[189]

There can be no denying that such acts are a fundamental expression of the freedom of States, and that it is only imperfectly conducive to the overall objective of the prevention of an arms race. Specific difficulties connected with the dynamic aspects of unilateral attitudes of States will be discussed later.

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188 On the implications of such unilateral pledges, see the above-mentioned ICJ judgement in *Nuclear Tests Case.*

189 See, in particular, paras. 4 and 10 of resolution 41/53 calling upon "all States ... to take immediate measures to prevent an arms race in outer space" and "to refrain, in their activities relating to outer space, from actions contrary to ... the objective of preventing an arms race in outer space".

7. Main characteristics of applicable law

Following this review of the main instruments which more often relate indirectly to the prevention of an arms race in outer space, the next step should be to undertake a more systematic analysis of the main characteristics of the existing law. The legal authority of the rules, their scope, their permanence, and some aspects of their content, will successively be examined.

7.1. AUTHORITY

The interest of this problem lies in the possible coherence of an applicable body of rules, which would result from a clear ranking of such rules. But this is by no means the case; as the whole consists of a heterogeneous collection of rules of various origins and varying authority.

It is both difficult and of limited interest to consider the problems of the relationship between rules in an abstract manner, without relating them to any specific issue. We shall merely recall some basic aspects which must always be taken into account in the analysis of a set of treaty rules, whether in the case of a single treaty or, *a fortiori,* a set of independent agreements.

RELATIONSHIP BETWEEN CUSTOM AND TREATY

It should be noted that treaties are not in principle above customary rules. The latter can perfectly well modify the former and indeed annul them. The principle here is that of the priority of the latest rule. This possibility has even been accepted in connection with the United Nations Charter, despite the postulated superiority of the Charter over any other obligation.[190]

RELATIONSHIP BETWEEN TREATIES

Even though there are peremptory universal rules, or *jus cogens,*[191] which ensure a modicum of unity and coherence for the international legal system, it is hard to see that such rules can concern the arms race, at least for the time being.

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[190] See, for instance, the ICJ advisory opinion on *Legal consequences for States of the continued presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276 (1970),* 21 June 1971, particularly paras. 21 and 22, *ICJ Reports 1971,* p. 22.

[191] Under the Vienna Convention "a peremptory norm of general international law is a norm accepted and recognized by the international community of States as a whole as a norm from which no derogation is permitted and which can be modified only by a subsequent norm of general international law having the same character" (art. 53).

For example, while the threat or the use of force are forbidden, and while this is generally agreed to be a norm of *jus cogens,* a distinction must be drawn between the use of weapons and their development and testing, not to mention research relating to them. These activities are not in themselves contrary to the prohibition, particularly when the right to self-defence can be invoked.

There may be a ranking of treaties, and thus a difference in the legal force of the obligations they contain. Thus, the Charter has a claim to superiority, and no treaty contrary to it can prevail over it. This superiority, however, must be established by each treaty itself.[192] Otherwise, the rule is that the latest treaty applies in the relations between the parties.[193] There is no principle of superiority of multilateral treaties over bilateral treaties, any more than of bilateral treaties over multilateral treaties. Basically, each treaty is an independent entity, although it interrelates with other treaties. This inevitably complicates its interpretation and application since it must be interpreted in the context of the rules applicable among the parties.

THE SIGNIFICANCE OF RESOLUTIONS

Finally, in the case of resolutions we pointed out that they did not in principle directly create rights or obligations for States. They contribute to the elaboration of agreements and to their interpretation, but have no direct binding effect. However useful they may be, their contribution to the legal prevention of an arms race in outer space is therefore limited.[194]

This diversification stemming from the lack of a comprehensive articulation of the various applicable rules is compounded by the variation in their scope, both in space and in time.

7.2. SCOPE

The problems of customary law may be left aside here, since customs are in principle general, subject to derogation by States which have made initial and continuing objections to the applicability of the rule. Likewise, resolutions extend in principle to all States Members of the Organization.

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[192] See, for example, article X of the ABM Treaty: "each Party undertakes not to assume any international obligations which would conflict with this Treaty".

[193] See art. 30 of the Vienna Convention (Application of successive treaties relating to the same subject matter).

[194] Most resolutions call for the conclusion of agreements, both multilateral and bilateral (see, for instance, paras. 5 and 9 of 41/53 of 7 January 1987).

It is therefore with respect to treaties that the question of the scope of obligations is thorniest. The principle, as is clearly recalled in the Vienna Convention on the Law of Treaties, and as it results from general international law, is that of the relative effect of treaties: a treaty creates neither rights nor obligations for third parties without their consent. Thus, as regards the body of treaty law relating to the limitation of arms and their use in space, at first glance the situation seems relatively simple, and consists of a distinction between multilateral and bilateral agreements. In practice, however, it is a great deal more complex.

DISTINCTION BETWEEN MULTILATERAL AND BILATERAL TREATIES

The initial impression acquired by merely reading the various instruments mentioned in section 1.2. of this chapter is that a primary distinction must be made between multilateral treaties on the one hand and bilateral treaties on the other. The bilateral treaties, in this context, are those that concern relations between the Soviet Union and the United States. They govern only those relations, and stem from negotiations conducted exclusively between these two countries. Some States are careful to stress that the agreements thus concluded do not concern them and could not be binding upon them nor even take their situation into consideration. Multilateral treaties are drawn up collectively, either within or outside the United Nations, and seek to establish rules that are as general as possible. There are thus two possibilities for establishing rules governing the limitation of arms in space: that of direct agreements between two, i.e. the two major Powers, and that of a collective effort to draft universal rules.

This first impression, however, is a superficial one, and the reality is much more complex even from the legal standpoint.

Thus, there is no genuine opposition between the two processes, which are mutually supportive much more than competitive. Progress often goes hand in hand in the two series of negotiations, and periods of stalemate or regression are likewise parallel. The Outer Space Treaty is not incompatible, rather the reverse, with the SALT negotiations and agreement,[195] any more than the NPT. For the past ten years or so the record as regards agreements is very poor at both the bilateral and the multilateral levels.

The interdependence of the two processes is confirmed by experience. Thus, resolution S-10/2 as well as resolutions 40/87 and 41/53 appeal not only to the international community, but also to the States "with

[195] It may be noticed that its signature coincides with the process that was to result in the SALT negotiations, at the initiative of the United States.

major space capabilities", and to the Soviet Union and the United States,[196] to contribute to the objective of preventing or halting the arms race. The international community's desire to intervene in the bilateral negotiations and influence their course is thus clear, even if it has no formal legal consequences.

It should be noted that some bilateral treaties are perceived to be in the general interest. Conversely, it is clear that many multilateral conventions could not have been concluded, nor be adopted in the future, without agreement on them between the Soviet Union and the United States. Indeed, such agreement is frequently a condition for the success of the convention.

Often, however, bilateral agreements are more technical in content, more conditional in nature and more transient in their duration than multilateral treaties, which refer more to principles of law, are more abstract and tend to be permanent.

Finally, it should be emphasized that multilateral convention is not a synonym for general convention, and that there may be significant graduations in the acceptance of the relevant conventions. While some essential instruments are so widely accepted that they form the basis for a general custom - the United Nations Charter and the Outer Space Treaty, for example - others have a much narrower status: for instance, the Partial Test-Ban Treaty, the NPT, and the Moon Treaty.

7.3. PERMANENCE

Here again, it is probably necessary to confine the analysis to treaties, inasmuch as customary rules seem flexible. While in principle they are intended to be permanent, they may be modified depending on the behaviour of States, but their transformation does not follow clearly identifiable stages. In contrast, treaties in principle contain precise provisions governing their effects over time, even though these are tempered by practice.

Most treaties in question are of a permanent nature, insofar as they do not include a date for the cessation of their effect and are also not concluded for a fixed period. This permanence can nevertheless be affected through different ways. We will not treat here the general international rules of law which permit in certain circumstances to

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[196] Para. 3 of resolution 41/53 "*Emphasizes* that further measures ... should be adopted by the international community"; para. 5 "*Reiterates* that the Conference on Disarmament ... has the primary role in the negotiation of a multilateral agreement or agreements, as appropriate..."; para. 9 "*Urges* the Union of Soviet Socialist Republics and the United States of America to pursue intensively their bilateral negotiations ... aimed at reaching early agreement for preventing an arms race in outer space...".

question the treaties, but simply the particular reasons invoked by the treaties themselves.[197]

TREATIES NOT IN FORCE

In the first place, there is the situation of treaties that are not in force because they have not been ratified by a State, or have not been ratified by a sufficient number of States. The same situation applies to treaties that are in force for States that have signed them but have not ratified them. In principle, such treaties are not binding upon the States concerned, even if the latter are not entirely free with regard to them. Under article 18 of the Vienna Convention on the Law of Treaties, a State in such a situation is obliged to refrain from acts which would defeat the object and purpose of the treaty, or may do so only under certain conditions. The scope of this provision, however, is subject to divergent interpretations.[198] Although not legally bound by treaties, various States observe their provisions. This applied, for a long period at least, to SALT II for the United States and the Soviet Union; and also to the 1963 Partial Test-Ban Treaty, or the NPT, which are in practice respected by some States that are not parties to them. The legal status of this situation is nevertheless precarious, since it involves a practice which can at any time be revoked, at least theoretically.

PRECARIOUS TREATIES

Next, there are treaties that have been concluded for a limited period, such as the SALT I agreement, or which, while in theory permanent, may easily be denounced without any real constraints. This is true of most bilateral treaties.[199] The inclusion of such provisions for denunciation

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[197] As they are formulated by the Vienna Convention in art. 56-64 concerning in particular the right of withdrawal, the conclusion of a new treaty on the same subject, the violation of a treaty, the occurence of the situation which makes the execution of the treaty impossible, a fundamental change of circumstances (rebus sic stantibus), the occurence of a new norm of jus cogens. It should be noted that the occurence of one of these conditions need not necessarily be an obstacle to the continuation of certain norms resulting from the treaty as customary rules.

[198] Art. 18 of the Vienna Convention: "A State is obliged to refrain from acts which would defeat the object and urpose of a treaty when:

(a) it has signed the treaty or has exchanged instruments constituting the treaty subject to ratification, acceptance or approval, until it shall have made its intention clear not to become a party to the treaty; or

(b) it has expressed its consent to be bound by the treaty, pending the entry into force of the treaty and provided that such entry into force is not unduly delayed."

[199] See, in particular, art. XV of the ABM Treaty:

"1. This Treaty shall be of unlimited duration.

highlights the fragility of the stabilization of the legal situation thus achieved.

In the case of some of these treaties, in practice there seems to have developed a situation that is half-way between compliance and rejection. Either they are respected although not in force (as in the case of SALT II for a period), or else they are only partially implemented without being formally denounced (as in the case of the ABM Treaty, as will be seen below). This situation confirms the precarious nature of the instruments in question. Furthermore, as a rule, they do not include any provision for the binding settlement of disputes concerning their application.

7.4. CONTENT

This is not the place for a systematic survey or even a comprehensive classification, which would go well beyond the bounds of this report. We may merely single out some major lines of analysis, in connection with the endeavour to prevent an arms race in outer space.

STATIC AND DYNAMIC ASPECT

A first classification could distinguish between the static aspect and the dynamic aspect of the instruments.

The static aspect concerns the laying down of rules that are in principle permanent with a view to limiting military installations, weapons or their use: i.e. the Charter of the United Nations, the Outer Space Treaty, and the Moon Treaty. This is the classic rule-making procedure traditionally used in international law, and it may be perfectly well suited to the objective of prevention.

The dynamic aspect concerns the use of the treaty as a means to gradually attain a given result. This is a technique traditionally used in resolutions, and less frequently in the case of treaty instruments. The ABM Treaty is a good example. Its preamble sets out a process aimed at the cessation of the arms race and subsequently general and complete disarmament.[200] The attainment of that objective implies that

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2. Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests. It shall give notice of its decision to the other Party six months prior to withdrawal from the Treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests."

See also article XVI of the Outer Space Treaty, article IV of the Partial Test-Ban Treaty, article X, para. 1 of the NPT.

200 "The United States of America and the Union of Soviet Socialist Republics... Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms

subsequent stages will be completed. Machinery is even established to facilitate that result: article XIII provides for a Standing Consultative Commission whose tasks include (g) "to consider, as appropriate, proposals for further measures aimed at limiting strategic arms".

It is this dynamic aspect of the ABM Treaty and indeed of the whole SALT process which has been halted and to some extent reversed, at least in the late 1970s and early 1980s. And it is in this sense that it is possible to say that the Treaty has only partially been implemented. However, the main aim of the dynamic process is not prevention but rather the more ambitious goal of reversing an arms race that has already begun, or of challenging the status quo. It relates more to disarmament than to the prevention of an arms race, even if it can perfectly well include the latter.

TYPES OF OBLIGATIONS

A second classification could concern the types of obligations accepted by the parties to the various instruments.

First there are general obligations, formulated by reference to concepts, which are more frequently found in multilateral treaties. Some are prohibitions, such as the prohibition on the use of force; others are positive obligations, such as the duty to co-operate.[201] Still others are the expression of a universal commitment towards a wider objective such as the norm reserving outer space for peaceful uses, the moon for exclusively peaceful purposes.

It must be recognized that in fact such obligations alone may well need to be translated in terms of specific commitments to certain kinds of action in furtherance of the objectives defined in the more general formulation. It is important not to confuse the use of weapons with their manufacturing or deployment. A prohibition on their use alone cannot in itself prevent an arms race. To reserve outer space for

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race and to take effective measures toward reductions in strategic arms, nuclear disarmament, and general and complete disarmament...".

[201] Art. IX of the 1967 Outer Space Treaty: "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..." Art. 4, para. 2 of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies: "States Parties shall be guided by the principle of co-operation and mutual assistance in all their activities concerning the exploration and use of the moon. International co-operation in pursuance of this Agreement should be as wide as possible and may take place on a multilateral basis, on a bilateral basis or through international intergovernmental organizations."

peaceful purposes may give rise to many intellectual or theoretical arguments; but in the absence of an interpretation that is generally accepted by the parties, it does not entail any very clear obligation. We shall return below to the problems raised by self-defence in space. To posit a duty to co-operate remains theoretical as long as it is not accompanied by specific obligations.

These specific obligations generally take the form of relatively precise prohibitions, such as the prohibition on testing certain weapons in a specified environment (Partial Test-Ban Treaty) or manufacturing or possessing them (NPT), on stationing or installing them in specific parts of outer space (Outer Space Treaty), or on building specified types of installations (Moon Treaty, ABM Treaty). The difficulty is then to define both precisely and comprehensively the weapons concerned, as well as the exact type of development, stationing or use that is prohibited.

VERIFICATION

With regard to verification, beyond the differences in their specific provisions most of the treaties under consideration share the same spirit.

In the first place, the verification provisions are relatively undeveloped, and are based essentially on national technical means (with the noteworthy exception of the NPT, which only indirectly concerns an arms race in outer space). Very briefly, the situation may be explained by the fact that for a time, now past, it was considered both unnecessary and dangerous to provide for international verification procedures. Unnecessary, because national technical means were considered adequate to deal with the still relatively limited possibilities of concealment of non-compliance with obligations, but also because in fact the prohibitions concerned only activities that could be verified by such means. The partial prohibition of nuclear tests is a clear example. Dangerous, because to provide for more stringent measures could have been perceived as presenting a risk of intrusion into the activities of the parties which the latter, or at least some of them, refused to accept.

The result of this state of international means of verification is profound inequality in the actual exercise of verification, since only a few Powers have in fact the necessary national technical means. Besides, this inequality is merely a reflection of the overall inequality enshrined in and to some extent protected by the instruments in question. In some cases, for example, verification procedures only apply to some Parties and not others.

Secondly, the verification machinery provided for is largely based on the use of satellites, which can monitor compliance with the undertakings entered into, although unilaterally and without any objective possibility of contradiction. Hence the provisions, particularly in bilateral instruments, aimed at ensuring special protection for reconnaissance or telecommunications satellites.[202] The objective is wider than the prevention of an arms race and concerns stability as a whole; but for that purpose it includes the former.

Profound changes have recently taken place in this respect, and the demand for new means of verification has increased considerably in recent years. The desire for "effective international control"[203] responds to a number of concerns: to establish procedures that are above reproach because they are international and not purely national; to establish an appropriate set of combined techniques; and to establish non-discriminatory machinery which will allow all States to participate in the verification of compliance with obligations that are deemed to be in the general interest. The positions of the States directly concerned have likewise evolved, and it is noteworthy that the official stance of the Soviet Union has now radically changed in favour of international verification procedures.

This is an area where the role of purely national activities could be, if not diminished, at least successfully supplemented by international procedures on the basis of treaty instruments. Nevertheless, in the present state of the law, over and above verification problems, the role of unilateral acts remains considerable.

8. Unilateral acts and attitudes

We have already pointed out that the role of unilateral acts and attitudes is important, as space activities are only loosely covered by customary or treaty obligations, and States have great freedom of action. The prevention of an arms race, and also its possible development, thus depends to a large extent on the behaviour of the States concerned acting on their own account.

Moreover, this role does not disappear once agreements are in force and obligations have been accepted by States. The latter must interpret and implement the agreements. In the absence of a formula for the binding settlement of disputes, for example by a specified jurisdiction or arbitration tribunal, and at a time of impasse in negotiations or pending

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202 See, in particular, the agreement of 30 September 1971 on a direct communications link between the United States and the Soviet Union, and the ABM Treaty, art. XII, para. 2.

203 This formula is a leitmotiv of resolution S-10/2 and is summed up in the expression "general and complete disarmament under effective international control".

their outcome, it is the unilateral behaviour of States that becomes decisive. States may base their conduct on different interpretations of treaties, and as a general rule international law allows parties every latitude to interpret their own obligations.[204] The substantive rules for the inerpretation of treaties are sufficiently flexible so as not to really curtail their freedom in this respect.[205]

However, this freedom of action is not exercised in a legal void. If, for example, States may in principle freely (in the absence of any specific obligations prohibiting them) develop whatever weapons sytems they wish, despite an unchallenged rule of the prohibition of the threat or use of force, it is because there is another rule which guarantees the inherent right of self-defence. In a weakened form there is also a right of protection of States which entails the possibility of their taking countermeasures in certain circumstances. The consequences ensuing for outer space should be analysed.

Finally, mention should be made of a controversy which has been and remains the focus of attention in this field, and which is closely linked with the possible developments of the SDI programme, namely, the debate on the interpretation of the ABM Treaty. Here it is in fact the unilateral position of the United States with regard to this treaty which is at issue.

8.1. SELF-DEFENCE AND COUNTERMEASURES

PROBLEMS OF SELF-DEFENCE IN SPACE

The difficulties connected with the possible exercise of self-defence are well known,[206] as is the fundamental role played by this idea in the evolution of the system of peace and security established by the Charter. What must be examined here is whether self-defence is possible in space; if so, under what conditions, and what does it allow?

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204 See, for instance, Basdevant: *Règles générales du droit de la paix,* RCADI, 1936, IV, p. 588: "It is incumbent upon a State confronted with an international situation to determine and affirm its viewpoint. It must conform to international law, but it is for the State to assess the requirements of that law in the specific case, as well as all the circumstances of that case, and to formulate its approach accordingly. In principle, and in the absence of any special rules on the matter, every State makes all judgements for itself and on its own behalf and takes decisions itself."

205 See Vienna Convention, art. 31-33. Serge Sur: *L'interprétation en droit international public.* LGDJ, 1974.

206 See, for example: T. Brownlie: *International Law and the Use of Force by States.* Oxford: Oxford University Press, 1963. D.W. Bowett: *Self Defence in International Law.* Manchester, 1958: A. Cassese: "Commentary on Article 51". In: *La Charte des Nations Unies,* edited by J.P. Cot and A. Pellet. Paris: Economica, 1985.

In favour of the applicability of the right of self-defence, there is the consideration that the Charter does not specify any territorial limitations, and furthermore the Outer Space Treaty explicitly recognizes such applicability. This recognition is perhaps superfluous in so far as the Charter stands above any other treaty and furthermore self-defence is a customary right of general application.

Some countries, however, with a view to guaranteeing their rights as well as the peaceful use of space, have challenged the possibility of invoking self-defence to justify the use of force in space or from space.[207] In their view article 51 of the Charter could not be interpreted as justifying the use of space weapons for defensive purposes or the possession of defensive arms based on the use of space weapons. They also stressed that article 51 could not be invoked to legitimize the use or threat of use of force in or from space.

It may also be considered that peaceful use, over and above setting a general standard which requires more precise rules in order to be operational, implies the prohibition of the use of force and of aggression in space. Peaceful utilization, then, is non-aggressive utilization. The violation of that obligation would then justify resorting to self-defence.

In the absence of general agreement on this point, no final conclusion can be drawn. Provisionally, however, it would seem that the restrictive view of self-defence tends to highlight the conditions and limitations surrounding its exercise, rather than its total prohibition.

The general conditions that stem from article 51 of the Charter are well known. The article contains one substantive condition (self-defence is exercised in response to an armed attack) and a procedural condition (the State or States exercising this right must immediately report thereon to the Security Council). In practice the latter condition has apparently been largely ignored. As for armed attack, the definition of this concept is known to be problematical. The resolution adopted by the General Assembly (resolution 3314 (XXIX) of14 December 1974) does not settle all the questions. Besides the question of its legal value, it contains only an indicative and not a limitative list of possible cases. The general formula in article 1 refers to "the use of armed force by a State against the sovereignty, territorial integrity or political independence of another State, or in any other manner inconsistent with the Charter...". It may therefore be considered that armed attacks against space objects and their destruction violate the sovereignty and

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[207] See, for example, the account of the *ad hoc* Committee of the Conference on Disarmament on the Prevention of an Arms Race in Outer Space (document CD/732, para. 16, page 103).

political independence of a State, and it seems hard to imagine that the space Powers will give up this point of view.

The exercise of self-defence, however, does not justify every kind of reaction. It is generally agreed that the measures taken must obey the principle of proportionality, so as not to constitute excessive retaliation which could go beyond defence and turn into counter-aggression. This is probably where the most serious restrictions are placed, not on the principle, but on the use of self-defence. Some may argue that nuclear weapons or weapons of mass destruction are *per se* disproportionate to any aggression that does not involve their use. This is a problem of fundamental importance, but because of the absence of any practice it remains a theoretical one.

It must also be recognized that self-defence must not in principle violate the rights of third parties, whose utilization of space, as well as territory, must remain guaranteed.

A delicate question concerns preventive self-defence which, according to some, could be authorised in space in reaction to an immediate threat.[208] In the event of such a possibility, some may invoke new military technologies to prevent attacks rather than face destruction. They consider that despite Article 51 of the Charter, the evolution of customary law permits such a recourse to preventive self-defence, but this view is not shared by many States. The evolution of customary law in this matter would be difficult to demonstrate in the absence of pertinent practice.

In a more general way, the questions raised by self-defence are only apparently removed from the problem of the prevention of an arms race in outer space. Admittedly, it concerns the use of force, and not the development and deployment of weapons systems for or in space. The two are nevertheless closely linked. For it is the possibility, and indeed the widely felt necessity, of establishing the foundations of self-defence which leads to militarization, inter alia the militarization of space and an arms race.

STATUS AND ROLE OF COUNTERMEASURES IN SPACE

The status of countermeasures in international law is far from codified, and still raises many problems.

In a nutshell, they may be seen as the possibility for a State to take measures that are in principle contrary to law in reaction against an

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208 See, for example, H.H. Almond: *Military activities in outer space.* New York, 1982. pp. 150-151; and the negation by V.S. Vereshchetin: *Prevention of the arms race in outer space.* Geneva: UNIDIR, 1986. pp. 13-14.

initial violation of the law by another State so as to safeguard its interests and possibly punish the original violation. In a broader sense, but one which is also currently used and which may be considered here, countermeasures may also refer to behaviour that is not contrary to law, but is unfriendly and based on distrust, involving withdrawal of advantages or taking steps unilaterally in response to behaviour of a similar type. In both cases, it is considered that countermeasures, to remain within this category, must be proportional to the initial act justifying them.[209] This shows how far reciprocity lies at the heart of international undertakings in the absence of machinery for the collective assessment and implementation of obligations.

It is thus clear to what degree the right of countermeasures permanently threatens to undermine instruments aimed at preventing an arms race. If one of the parties feels that another party is not living up to its undertakings and that the burden of the treaty is unevenly balanced in favour of the latter, it is almost unavoidable that it will consider resorting to countermeasures to restore its position. Thus it is not enough for treaty instruments to exist. It is essential that they should create a situation of trust to avoid their being called into question.

The political conditions are obviously important, but legal conditions are no less important. Treaties should contain sufficiently precise provisions, sufficiently flexible means of adjustment, and sufficiently comprehensive verification procedures to prevent any misunderstanding about behaviour, the obsolescence of engagements, or doubt about compliance with obligations. Otherwise, far from constituting a safety valve which makes it easier for States to agree on prohibitions that are compatible with their security, countermeasures become a loophole for endlessly restarting or continuing the arms race.

It is likewise clear that freedom to use countermeasures encourages and fosters inequality, as only some States are in a position to respond effectively to certain types of behaviour.

8.2. Problems of the Interpretation of the ABM Treaty

The ABM Treaty is a complex whole which includes the text of the agreement proper, together with agreed interpretations (initial

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209 See, for example, a Soviet study: *SDI: possible countermeasures* (Opinions of Soviet scientists). Moscow: Novosti Press Agency Publishing House, October 1986. See also the statement made by General Secretary Gorbachev of 12 October 1986 following the Reykjavik summit meeting: "There will be a response to SDI. An asymmetrical rewponse, it is true, but one which will not require much of a sacrifice from us." While countermeasures must be proportional, they have no need to be symmetrical.

statements and common understandings) and unilateral statements made by the United States. The negotiating record has not been published.

In view of the technical nature of the agreement, complexity would not in itself be an obstacle to its convergent implementation if the machinery established for that purpose by the Treaty - the Standing Consultative Commission (SCC) whose overall objective, under article XIII, is to promote the objectives and implementation of the provisions of the Treaty[210] - were functioning properly. But the essential climate of confidence is obviously lacking, and the major two nuclear Powers seem more engaged in a series of unilateral public statements than in the resolution of divergent interpretations within the framework of the SCC.

For the time being, the essential problem is to decide how far US and Soviet projects, programmes and activities relating to outer space are in conformity with the obligations in force between the United States and the Soviet Union. Central obligations in this field - which limit ABM/BMD systems and in particular ABM systems which could be deployed fully or in part in space - stem from the ABM Treaty. The argument - at any rate the legal controversy - therefore focusses on the interpretation of that treaty. Since a great deal has been written on the subject, this report confines itself to summarizing the essentials.

GENERAL ASPECTS OF THE INTERPRETATION OF TREATIES

In principle, only the parties to a treaty can, by common consent, give an authentic interpretation of the treaty,[211] that is to say an interpretation that is binding on them and has the same legal force as the treaty itself. A binding interpretation could otherwise only be obtained by recourse to arbitration or a judicial procedure.

The States bound by a treaty are free to interpret it for themselves, provided they act in good faith. This unilateral interpretation establishes their legal position. It does not bind the other parties, but only the author of the interpretation itself in so far as the other parties

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210 Art. XIII, para. 1: "To promote the objectives and implementation of 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;

[...]".

211 In accordance with the maxim *"Ejus est interpretari cujus est condere"*.

have accepted its position, so that an agreement has been reached (situation of *estoppel)*.[212] The modification of an interpretation that has remained purely unilateral may raise a number of political issues.

The methods of interpretation are not very stringent, and the provisions of treaties are usually sufficiently general or sufficiently ambiguous that they can be interpreted in good faith in various ways.[213] In particular, there is no obligation to refer to the *preparatory work.* Furthermore, while under the Charter treaties should be registered with the Secretariat and published by it (article 102), there is no obligation to publish the preparatory work. In practice it is only rarely published, and there is no guarantee that such publication is genuinely complete.

The preparatory work nevertheless constitutes "supplementary means of interpretation", in particular when reference to the text of the treaty alone leaves its meaning ambiguous or obscure.[214] There is thus a possible contradiction in stating that the meaning of a treaty is ambiguous and refusing to take the preparatory work, or more generally the circumstances of the conclusion of the treaty, into consideration.[215]

The *internal discussions* that may surround the scope of a treaty obligation must not be confused with the official position taken by a

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212 Estoppel is a sort of principle of non-contradiction, which precludes a subject of law from unilaterally going back on a previously stated position, where third parties have relied on that position to determine their own attitude. Charles Vallée: "Quelques observations sur l'estoppel en droit des gens". In: *Revue Générale de Droit International Public,* 1973. pp. 949-999.

213 Disputes on methods of interpretation are habitual, and the Vienna Convention has not eliminated them. While the Convention seems to give the text of the treaty a certain precedence over the intentions of the parties (objective rather than subjective interpretation), it makes extensive and not very clearly defined provision for recourse to preparatory work. Serge Sur: *L'interprétation en droit international public.* LGDJ, 1974.

214 Art. 32 of the Vienna Convention (Supplementary means of interpretation): "Recourse may be had to supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of article 31, or to determine the meaning when the interpretation according to article 31:

(a) leaves the meaning ambiguous or obscure; or

(b) leads to a result which is manifestly absurd or unreasonable."

215 According to the Legal Adviser of the US State Department, Abraham D. Sofaer, "my study of the treaty led me to conclude that its language is ambiguous...". Statement to the Subcommittee for Arms Control of the Committee on Foreign Affairs of the House of Representatives, 22 October 1985. In: *Current Policy,* No. 755. Following the debates in the United States Congress in Spring 1987, the administration launched a review of all documents relating to the ABM Treaty, and particularly the discussions precedings its ratification. The review was due to be completed by late April 1987 (statement by White House spokesman Marlin Fitzwater, 17 March 1987).

State, which alone matters at the international level. The preparation of a decision in such matters always gives rise to a process of internal discussion in the course of which various opinions are given. In general, this internal process is highly discreet and even secret. The risk of confusion is greater if this process is open.

THE POSITION OF THE SOVIET UNION

A basic point of the position of the Soviet Union concerning the ABM Treaty and the US Strategic Defense Initiative refers to the question whether SDI is a research programme only or a programme involving development, testing and deployment of a comprehensive ABM system, including space-based components, for the defense of the territory of the United States.

The following paragraphs try to present, as concisely as possible, the main points of the ABM Treaty interpretation by the Soviet Union. They all referg explicitly or implicitly to the US Strategic Defense Initiative.

The ABM Treaty does not prohibit research, but SDI goes beyond research

The Soviet Union does not deny that basic research in all areas of ABM/BMD technology is not prohibited by the ABM Treaty, but it claims that the SDI goes beyond such basic research in areas prohibited by that Treaty.[216] In this connection it is argued that the SDI is a programme unparalleled in terms of scale, costs and concentration and that the substantial amounts of money invested in the SDI programme cannot be intended merely for laboratory research.[217] The Soviet Union considers that the programme as a whole, not just its final stages, violate the Treaty; progressing from stage to stage, the contradiction of the letter of the Treaty would become ever more evident.

Setting out from the view that the SDI goes beyond mere research, the Soviet Union claims that it violates the ABM Treaty in two ways; firstly by aiming at the creation of an ABM system for the defense of the territory of the United States, and secondly by including space-based components.

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216 There is one type of ABM system for which the ABM Treaty does undisputedly not prohibit development, testing, and deployment: fixed land-based ABM systems within one deployment area with a radius of 150 km and within the ceiling of 100 launchers. In addition up to 15 launchers may be located in agreed test ranges and be used for development and testing.

217 *Star Wars" - Delusions and Dangers.* Moscow: Military Publishing House, 1985. p.35.

The ABM Treaty prohibits the deployment of a defense for the territory of the United States or the Soviet Union

For the first issue, one provision of the ABM Treaty is particularly relevant:

> Article I, paragraph 2:
> "Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty."

The Soviet Union maintains that the final objective of the SDI is the creation of a *comprehensive* ballistic-missile-defense system and points out that this goal is directly opposite to the goal of the ABM Treaty. SDI is perceived as a programme of step-by-step creation of a "base" for the ABM defense of the territory of the United States, in contravention of the above provision of the Treaty.[218]

The ABM Treaty prohibits development, testing and deployment of space-based systems and components

This second point of the Soviet position refers to article V of the ABM Treaty:

> Article V, paragraph 1:
> "Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based."

Authoritative Soviet observers say that in apparent violation of this obligation, the SDI is oriented at the creation of a full-scale *space-based* BMD system. Regarding the dividing line between research (which is not prohibited by the Treaty) and development, the Soviet position is that the SDI programme provides not only for research but also for development and testing. It considers that what the United States refers to as *demonstrations* and *subcomponents* are in reality *tests* and *components*, which fall under the provisions of article V.[219]

On the "broad interpretation": status and meaning of agreed statement D

Referring to the "broad interpretation" of the ABM Treaty (involving the relationship of agreed statement D to articles I, III, and V) which would allow development and testing of ABM systems based on other physical principles than those envisaged in the ABM Treaty (for example high-energy lasers), the Soviet position is that the "broad interpretation" has nothing to do with the letter and spirit of the Treaty. An eventual

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218 Yegveni Velikhov, Roald Sagdeev, Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. p. 134.

219 Yegveni Velikhov, Roald Sagdeev, Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. p. 135.

adoption by the US administration of the "broad interpretation" would be seen by the Soviet Union as a violation of the principle of observing in good faith international obligations.[220]

Agreed statement D, which refers to ABM systems or components "based on other physical principles", reads as follows:

> "In order to insure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the Treaty, 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."

The Soviet position is that this agreed statement complementsarticle III of the Treaty which allows for the deployment of fixed land-based ABM systems within certain parameters: e.g. one site with a deployment radius of 150 km, no more than 100 ABM launchers. Thus agreed statement D would apply exclusively to the ABM system deployment areas permitted under article III, and to fixed land-based systems only. Even so, in the Soviet view, systems based on these other physical principles may be deployed in the permitted area (and in a fixed land-based mode) only after consultations about specific limitations and amendments of the Treaty. In this view, agreed statement D does not in any way weaken or abolish the prohibitions included in articles I and V; it relates to article III only. Authoritative Soviet authors state that this is the only possible interpretation of agreed statement D.[221]

In January 1986, the Soviet Defense Minister said that the *development* of ABM systems based on other physical principles "is permissible only as applied to the limited ABM regions allowed by the Treaty and only on stationary land-based systems". Regarding *deployment* of such systems, the Defense Minister said:

> "[Statement] D bans the deployment of ABM systems and components based on other physical principles and capable of replacing 'traditional' ABM components outside the ABM region allowed to either side. Deployment of such ABM systems and components in the allowed region can be done only after preliminary consultations between the sides as to their specific limitation and the introduction of co-ordinated amendments in the text of the Treaty, which come into effect in accordance with the procedure stipulated by the ABM Treaty."[222]

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220 Yegveni Velikhov, Roald Sagdeev, Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. pp. 131/137.

221 Yegveni Velikhov, Roald Sagdeev, Andrei Kokoshin (Eds.): *Weaponry in Space: The Dilemma of Security.* Moscow: Mir Publishers, 1986. p. 136-137.

222 Marshal Sergei L. Sokolov (Defense Minister of the Soviet Union): "In Honour of the Delegation of the Communist Party of Italy". In: *Pravda*, 29 January 1986.

Soviet accusations of other US violations of the ABM Treaty

The Soviet Union accuses the United States of violating the ABM Treaty in some areas not directly related to the Strategic Defense Initiative. In November 1985, the Soviet Defense Minister said that the United States was building "Pave Paws" phased-array radars in Greenland (Thule) and Great Britain (Fylingdales Moor) in contravention of article VI, paragraph b of the ABM Treaty.[223] The construction of four "Pave Paws" radars on the periphery of the United States[224] was considered to be an equal violation of the Treaty provisions. In the Soviet view, their parameters are adjusted to the requirements applicable to ABM radars and they would be the backbone in the radar support of an ABM system for the territory of the United States. Moreover, the Defense Minister claimed that the US was developing components and systems of mobile ABM radars and multi-warhead nose sections for ABM missiles. An additional accusation concerned what was described as the deployment of a major radar station on Shemya Island in the Aleutians with the use of radar elements tested for ABM purposes.[225]

The US claims that the construction work at Thule and Fylingdales Moor involves the upgrading of already existing BMEWS (Ballistic Missile Early Warning System) facilities. The radar at Thule has been upgraded with a two-faced phased-array system while that at Fylingdales Moor is being upgraded with a three-faced phased-array system. According to an official US description, these upgrades will improve range resolution, provide a greater ability to count incoming vehicles and ensure more accurate impact prediction.[226] Since only upgrading is involved, the ABM Treaty (article VI, paragraph b) is not violated, in the US view. The US also considers the construction of the four "Pave Paws" radars at the periphery of the continental United States as being in full compliance with the Treaty. The other Soviet accusations are also refuted by the United States.

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[223] According to article VI, paragraph (b) of the ABM Treaty, the Parties undertake 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.

[224] The "Pave Paws" are located at Cape Cod Air Force Station (Massachusetts), Beale Air Force Base (California), Eldorado Air Force Station (Texas) and Robins Air Force Base (Georgia).

[225] Sergei L. Sokolov: "Keep All That's Been Achieved in Strategic Arms Limitation" (address delivered on 6 November 1985).

[226] *US Military Posture, FY 1988,* prepared by the Joint Staff. Washington, DC: US Government Printing Office, 1987; p. 41.

THE POSITION OF THE UNITED STATES

The US position may be seen as less clear-cut, or at any rate more ambiguous. However, it is necessary to distinguish between a public debate in which opposing arguments are exchanged and, on the other hand, definitively proclaimed official positions, which are all that count from a legal standpoint. Clearly, a number of future developments are linked to the US attitude towards the ABM Treaty. The fate of this bilateral treaty thus depends on a unilateral interpretation.

Leaving aside occasional variations, the United States appears to have adopted a position founded upon three elements. The first two refer to the "restrictive" (or "narrow") and the "broad" interpretation of the ABM Treaty, while the third concerns the relationship between the Strategic Defense Initiative and the ABM Treaty.

The United States considers that the ABM Treaty can in good faith be interpreted in two different ways.

"Narrow" interpretation

As described in 1986 by the SDI Organization, the restrictive interpretation treats ABM devices based on other physical principles and capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars, as ABM components within the meaning of Article II of the Treaty, and therefore subject to the provisions of the Treaty, including Article V.[227]

The relevant paragraph of the ABM Treaty reads as follows:

> "For the purpose of this Treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:
>
> (a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type tested in an ABM mode;
>
> (b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and
>
> (c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

According to the Legal Adviser of the US State Department

> "proponents of the restrictive view contend that the definition in Article II (1) is purely functional, and includes all components ever created that could serve the function of countering strategic missiles in flight. They argue that the three components identified in that paragraph - ABM missiles, launchers and radars - are merely listed as the elements of current ABM systems, and that all future

227 Strategic Defense Initiative Organization, Department of Defense: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. C-2.

> components of a system that satisfied the functional definition are also covered by Article II (1)."[228]

Advocates of the "restrictive" interpretation argue, in particular, that the words "currently consisting of" in Article II (1) imply that ABM systems might in future consist of different components and that systems consisting of different components therefore also fall under the definition of ABM systems.

It follows from this interpretation that development, testing or deployment of any space-based ABM systems, including those based on "other physical principles" is prohibited. Thus projects relating to BMD space weapons would have to be confined to research, if they were not to violate the Treaty.

According to this interpretation of the ABM Treaty, agreed statement D, (which requires that in the event that ABM systems based on other physical principles are created, specific limitations on such systems would be subject to discussion and agreement) refers explicitly to Article III of the Treaty and does not in any way detract from the total ban on development, testing and deployment of any ABM systems other than those which are fixed and land-based.

Thus *research* would not be prohibited on any kind of ABM technologies, regardless of their basing mode, but *development and testing* of systems or components (whether of "traditional technologies" or of technologies based "on other physical principles") could be conducted for fixed land-based systems only. *Deployment* of systems or components based on "traditional technologies" would be permitted for fixed land-based ABM systems, within the constraints set by Article III of the Treaty. Deployment of systems or components "based on other physical principles" would be allowed for fixed land-based systems only, and only after consultations and amendment of the Treaty.

This position has also been outlined in past Arms Control Impact Statements, for example in that of fiscal year 1984:

> The ABM Treaty bans the development, testing, and deployment of all ABM systems and components that are sea-based, air-based, space based, or mobile land-based. In addition, although the Treaty allows the development and testing of fixed, land-based systems and components based on other physical principles (such as lasers or particle beams) and including such fixed, land-based components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars, the Treaty prohibits the deployment of such fixed, land-based systems and components unless the Parties consult and amend the Treaty.

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228 *The ABM Treaty.* Part I: Treaty Language and Negotiating History, May 11, 1987. Washington, DC: Office of the Legal Adviser, Department of State; p. 7.

> The ABM Treaty prohibition on development, testing and deployment of space-based ABM systems, or components for such systems, applies to directed energy technology (or any other technology) used for this purpose. Thus, when such DE programs enter the field testing phase, they become constrained by these ABM Treaty obligations.[229]

"Broad" interpretation

As the SDI Organization describes it, the need for greater precision in the understanding of the limitations of the ABM Treaty led the US government to re-examine the Treaty as it relates to systems based on "other physical principles" (addressed in agreed statement D). This review led, in October 1985, to the judgement that a reading of the ABM Treaty that would allow the development and testing of ABM systems based on other physical principles, regardless of their basing mode, is fully justified.[230] Advocates of the "broad" interpretation argue that Article II of the Treaty defines ABM systems in terms of the technology currently existing in 1972 and that if it had been intended to include ABM systems based on other physical principles there would have been no need for agreed statement D which refers restrictively only to deployment.

Regarding space weapons, the difference between the two interpretations is that under the "restrictive" interpretation development and testing of any space-based systems and components is prohibited while under the "broad" interpretation it would be permitted for systems or components based on "other physical principles".

It is possible, notwithstanding the "restrictive" interpretation currently adopted by the United States, that the "broad" interpretation may be adopted at a later stage, even though the prospects of such a development seem faint at the present time.[231] In this connection, disputes on the interpretation of the Treaty can have no solution, other than agreement between the parties. In the event of a serious disagreement or the commission of an act deemed inadmissible by the other party, the way would probably be open to countermeasures and the unchecked development of an arms race in outer space.

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229 *Fiscal Year 1984 Arms Control Impact Statements.* Statements Submitted to the Congress by the President Pursuant to Section 36 of the Arms Control and Disarma-ment Act. Washington, DC: US Government Printing Office, April 1983. pp. 266-267.

230 Strategic Defense Initiative Organization, Department of Defense: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. C-1.

231 The US position remains flexible, in that it does not reject as invalid a broad interpretation permitting development and testing of future systems. The continuing preference for a narrower interpretation might not therefore be the last word, and a transition from one to the other would not even entail a change of interpretation but, rather, different conduct in the context of an unvarying legal position.

SDI and the ABM Treaty

The United States has stated that "the SDI research program is conducted in a manner fully consistent with all U.S. Treaty obligations". Reserving the right to conduct the SDI programme under the broad interpretation at some future time, the US administration applies the more restrictive treaty interpretation as a matter of policy, "although we are not legally required to do so".[232] This statement, made by the SDIO in June 1986, confirmed those made by Paul H. Nitze, Special Adviser to the President and Secretary of State on Arms Control Matters, and Abraham D. Sofaer, Legal Adviser of the State Department, in October 1986 before the Subcommittee on Arms Control, International Security and Science of the House Foreign Affairs Committee.[233] Abraham D. Sofaer stated: "Notwithstanding our belief in the merits of the broader interpretation, the President has decided to pursue the SDI program as currently structured, which can be accomodated within the confines of the 'restrictive' interpretation - namely research into, but not development or testing of, systems or components based on future technology and capable of substituting for ABM interceptors, launchers or radars."

The US position is that the ABM Treaty restricts only defenses against strategic ballistic missiles and does not apply to defenses against non-strategic ballistic missiles or cruise missiles.[234] This point is of particular relevance to the possibility of developing defenses against tactical ballistic missiles.

The border between research and development

Regardless of which interpretation one adopts, the ABM Treaty does not prohibit *research*. But according to the restrictive interpretation it does prohibit *development* and *testing* of systems which are partly or fully space-based. *Deployment* of the latter systems is again prohibited under both interpretations. In this situation, the distinction between research and development becomes a crucial one. It is clear that, for reasons dealing with the impossibility of verifying such activities, laboratory research in itself cannot be covered by the ban. Problems start only in the event of field testing which can be monitored by national technical means of verification. The current US interpretation is that the Treaty permits *research short of field testing* of a prototype

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232 Strategic Defense Initiative Organization, Department of Defense: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. C-1/C-2.

233 "The ABM Treaty and the SDI Program". In: *Current Policy,* No. 755, October 1985. Washington, DC: US Department of State, Bureau of Public Affairs.

234 Strategic Defense Initiative Organization, Department of Defense: *Report to the Congress on the Strategic Defense Initiative,* June 1986. p. C-3.

sea-, air-, space- or mobile land-based ABM system or components. It is this type of research, the US administration says, that is to be conducted under the SDI programme.[235]

If Article V of the Treaty prohibits, inter alia, the testing of ABM systems or components, one can imagine the definition of "testing" and of "components" becoming a matter of dispute. For example, it can be claimed that what is involved in a particular programme is the "demonstration" of "sub-components" of a system, as opposed to the "testing" of "components".

US accusations of Soviet violations of the ABM Treaty

The US Government accuses the Soviet Union of violating some provisions of the ABM Treaty. The main accusation concerns a large phased-array radar under construction at Krasnoyarsk.[236] The US claims that the Krasnoyarsk radar is designed for ballistic missile detection and tracking, including ballistic missile early warning and that it violates the Treaty because it is not situated at the periphery and directed outwards. The US does not believe that the Krasnoyarsk radar is designed for space tracking (such radars are not restricted by the ABM Treaty) since its design is, in their view, not optimized for this role and the radar would contribute little to the existing Soviet space tracking network. The US also says that Soviet actions with respect to ABM component mobility are ambiguous. Another accusations says that the Soviet Union has probably violated the ABM Treaty prohibition on testing surface-to-air missile components in an ABM mode (article VI, para. a) by conducting tests involving the use of SAM air defense radars in ABM-related testing activities.[237]

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[235] The dividing line between laboratory and field testing was also addressed by the Soviet Defense Minister in January 1986: "The USSR deems it inadmissible to engage in any extra-laboratory work relating to the manufacture and tests of mock-ups and experimental samples of separate units and components. Everything that is done for subsequently designing and producing respective strike space systems must be prohibited." (Marshal Sergei L. Sokolov , Defense Minister of the Soviet Union: "In Honour of the Delegation of the Communist Party of Italy". In: *Pravda*, 29 January 1986.

[236] According to article VI, paragraph (b) of the ABM Treaty, the Parties undertake 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.

[237] For US claims of ABM Treaty violations by the Soviet Union, see: *Report to the Congress on Soviet Noncompliance with Arms Control Agreements,* 23 December 1985. Washington, DC: US Government Printing Office, 1985. *Soviet Strategic Defense Programs,* released by the Department of Defense and Department of State. Washington, DC: US Government Printing Office, October 1985; pp. 10-12. *Fiscal Year 1987 Arms Control Impact Statements.* Washington, DC: US Government Printing Office, April 1986; pp. 48-49.

In November 1985, the Soviet Defense Minister addressed these US accusations. He said that the Krasnoyarsk radar is to be used solely for tracking space objects. Referring to the Moscow ABM system he said that no mobile radar complexes or multi-charge launchers are set up and that its modernization is carried out strictly within the limits of the Treaty.[238] The Soviet Union also points out that radars for the purpose of tracking objects in outer space or for national technical verification are exempted from the restrictions set by the ABM Treaty (agreed statement F). The Soviet Union points out that for an early-warning radar this installation is placed too far away from potential opponent launch areas (Chukchi and Bering seas), and that it cannot serve as an ABM battle management radar because of lack of protection from nuclear effects, absence of autonomous energy sourse and the wrong radiation frequency envisioned. In the function of space-tracking radar it will, according to Soviet information, monitor polar orbit launches from the US Vandenberg site and Soviet launches from Baikonur cosmodrome.

THE POSSIBILITY OF WITHDRAWAL

Leaving aside the ever-present possibility of a change of interpretation or, more simply, a change of attitude in the context of a flexible interpretation, withdrawal from the Treaty is provided for in article XV, paragraph 2, which states:

> "Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests. It shall give notice of its decision to the other Pary six months prior to withdrawal from the Treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests."

In this connection, the United States has made reference to Soviet activities which it deems incompatible with the ABM Treaty and would not fail to cite them if necessary. Moreover, a unilateral declaration annexed to the Treaty (A. Withdrawal from the ABM Treaty) asserts that failure to conclude an agreement for more comprehensive limitations on offensive strategic weapons within five years would jeopardize the supreme interests of the United States, a statement which opens the way for unilateral termination. There is nothing to prevent the Soviet Union from itself denouncing that treaty by rejecting the United States conception or application.

However, it is clear that the State that took the initiative of officially denouncing the ABM Treaty - but also the State that would erode it in

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238 Sergei L. Sokolov: "Keep All That's Been Achieved in Strategic Arms Limitation" (address delivered on 6 November 1985).

the public perception -would, diplomatically more than legally, risk bearing a heavy responsibility in the eyes of the international community. To date, the Soviet position has tended more towards ensuring the stability of the ABM Treaty by obtaining a US commitment not to denounce it for a given period (10 years, at the Reykjavik meeting in October 1986). However, no commitment of this kind has been entered into.

Ambiguities of the present situation

A final observation may be in order. It is not exclusively of a legal nature, but it serves to give to the relevant instruments a profound ambiguity - or to reinforce this ambiguity - and concerns the general uncertainty which relates to the objectives of legal rules and more particularly to the frame of reference for the maintenance of peace and security.

The prevention of an arms race in outer space is in fact compatible with several different frames of reference, but its form and range changes, depending on the frame of reference within which it is placed. The fundamental question is whether the prevention of an arms race in outer space is envisaged within the context of arms control or that of disarmament or the prevention of war.

The degree of uncertainty on this subject is striking. While mention is frequently made of general and complete disarmament, an objective solemnly reaffirmed in the Final Document of SSOD I, the concept of preventing an arms race is definitely compatible not only with the former objective but also with arms control, which is largely based on a different logic. Arms control fits into the logic of nuclear deterrence. It implies limitation of weapons of mass destruction but not their total elimination, being on the contrary based on the possession of such weapons and the possibility of their being used in self-defence. In this context, the prevention of an arms race in outer space would be fully compatible with a resumed process of arms control.

The ambiguities of the present situation are evident in the positions of both sides. The resolutions of the General Assembly refer to general and complete disarmament, and certain official statements of the United States and the Soviet Union endorse this objective, with some differences of emphasis. Thus, the aim of SDI, or at least its stated initial objective, is to bring about the complete and final elimination of strategic offensive weapons, while the Soviet Union proposes that all nuclear weapons should be eliminated by the end of this century. While the means are diametrically opposed, the end is of a similar nature, involving theoretically a radical and definitive move beyond deterrence. However, there are other countries with a continued declared commitment to nuclear deterrence, and the Soviet and United States positions are not entirely clear.

Treaties and agreements relevant to outer space

Multilateral treaties/agreements

Treaty/agreement	*place/date of signature entry into force depository Power*	*duration/ parties*	*contents*
Charter of the United Nations *(UN Charter)*	San Francisco 26 June 1945 24 October 1945 United States	unlimited duration 159 member States	Prohibits the threat or use of force against any State in all environments (art. 2, para. 4) and lays down the right of individual or collective self-defence in response to armed attack (art. 51).
Treaty banning Nuclear Weapon Tests in the Atmosphere in Outer Space and Under Water *(Partial Test-Ban Treaty)*	Moscow 5 August 1963 10 October 1963 USA, UK and USSR	unlimited duration, with right of withdrawal (art. IV) 115 States (1 Jan 1986)	Prohibits any nuclear explosion in the atmosphere, in outer space, or under water.
Treaty on Principles Governing the activities of States in the Exploration of Outer Space, including the Moon and Other Celestial Bodies *(Outer Space Treaty)*	London, Moscow, Washington 27 January 1967 10 October 1967 USA, UK and USSR	unlimited duration, with right of withdrawal (art. XVI) 85 States (1 Jan 1986)	Prohibits the placing into orbit around the earth of any objects carrying nuclear weapons or any other kind of weapons of mass destruction, the installation of such weapons on celestial bodies, or the stationing of them in outer space, as well as the establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies (art. IV)
Treaty on the Non-Proliferation of Nuclear Weapons *(Non-Proliferation Treaty, NPT)*	London, Moscow, Washington 1 July 1968 5 March 1970 USA, UK and USSR	In 1995 a conference shall be convened to decide whether the Treaty remains in force indefinitely or shall be extended for a fixed period(s) of time. The Treaty contains a withdrawal-right clause (art. X). Review conferences were held in Geneva in 1975, 1980 and 1985. 132 States (1 Jan 1986)	Limits the number of States that might possess nuclear weapons or other nuclear explosive devices (art. I and II).
Convention on the Registration of Objects Launched into Outer Space (adopted by UNGA Res. 3235 (XXIX) of 12 November 1974 *(Registration Convention)*	New York 14 January 1975 15 September 1976 UN Secretary-General	35 States (15 Aug 1987)	Provides for the registration as soon as practicable of space objects with the Secretary-General of the UN and for the supply of information on space objects, such as orbits and general function (art. IV).

Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques (adopted by UNGA Res. 31/72 of 10 December 1976) *(ENMOD Convention)*	New York 18 May 1977 5 October 1978 UN Secretary-General	unlimited duration (art. VII). Review conferences may be convened at intervals of not less than 5 years (art. VIII). A first review conference was held in 1984 (Geneva). 52 States (15 Aug 1987)	Prohibits the military or hostile use of environmental modification techniques, which would change - through the deliberate manipulation of natural processes - the dynamics, composition or structure of the earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space (art. I and II).
Agreement Governing the Activities on the Moon and Other Celestial Bodies (adopted by UNGA Res. 34/68 of 5 December 1979) *(Moon Treaty)*	New York 18 December 1979 11 July 1984 UN Secretary-General	ten years after the entry into force of the agreement, the question of its review shall be included in the provisional agenda of the UNGA. Review conferences may be convened five years after entry into force (art. 18). The agreement contains a withdrawal-right clause (art. 20). Australia, Austria, Chile, Netherlands, Pakistan, Philippines, Uruguay (15 Aug 1987)	Stipulates that the moon shall be used exclusively for peaceful purposes. It prohibits the threat or use of force or any other hostile acts on the moon, as well as the placing in orbit around or other trajectory to or around the moon of objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place such weapons on or in the moon. It also prohibits the use of the moon for committing any hostile act or threat of a hostile act in relation to the earth, the moon, spacecraft, the personnel of spacecraft or man-made space objects. The provisions of the Moon Treaty also apply to other celestial bodies within the solar system, other than the Earth.
International Telecommunication Convention (adopted by the Plenipotentiary Conference of the ITU on 6 November 1982) *(Telecommuncation Convention)*	Nairobi 6 November 1982 1 January 1984 Secretary-General of the ITU	regularly revised by the Plenipotentiary Conference of the ITU. The next one will be held in May 1989 in Nice. The Convention contains a denunciation clause (art. 47). 132 States (July 1987)	Concerns the allocation of radio frequencies in space, so as to avoid harmful interference. Art. 38, para. 1, provides however that members retain entire freedom with regard to military radio installations.

Bilateral treaties/agreements

Agreement on Measures to reduce the risk of outbreak of nuclear war *(Nuclear Accidents Agreement)*	Washington, DC 30 September 1971 30 September 1971	unlimited duration (art. 8) USSR, USA	Requires Parties to notify each other of any sign of interference with missile warning systems or related communications facilities, including those in outer space, if such interference could create a risk of outbreak of nuclear war.
Agreement on Measures to improve the direct communications link (update of the 1963 agreement, and amended on 29 April 1975 and 17 July 1984) *(Hot Line Agreement)*	Washington, DC 30 September 1971 30 September 1971	USSR, USA	Provides for the establishment of a satellite communications system, with each Party selecting a system of its own choice.

Treaty between the USA and the USSR on the Limitation of Anti-Ballistic Missile Systems *(ABM Treaty)*	Moscow 26 May 1972 3 October 1972	The Treaty is of unlimited duration and contains a withdrawal-right clause (art. XV). Five years after its entry into force and thereafter at five-year intervals the Parties shall conduct a review of the Treaty (art. XIV). USSR, USA	Limits the number and possibility of deployment of ABM systems to two. Prohibits the development, testing or deployment of ABM systems or components which are sea-based, air-based, space-based or mobile land-based. Provides for verification by national technical means and establishes the principle of non-interference with such national technical means (art. III; art. V, para. 1; art. XII, paras. 1 and 2).
Protocol to the Treaty between the USA and the USSR on the Limitation of Anti-Ballistic Missile Systems *(Protocol to ABM Treaty)*	Moscow 3 July 1974 24 May 1976	USSR, USA	Limits the number and possibility of deployment of ABM systems to one.
Interim Agreement between the USA and the USSR on Certain Measures with Respect to the Limitation of Strategic Offensive Arms *(SALT I Agreement)*	Moscow 26 May 1972 3 October 1972	The Interim Agreement shall remain in force five years (art. VIII) and contains a withdrawal-right clause (ibid.) USSR, USA	Provides for verification by national means and establishes the principle of non-interference with such national technical means (art. V, paras 1 and 2).
Treaty between the USA and the USSR on the Limitation of Strategic Offensive Arms Protocol to the Treaty Agreed Statements and Common Understandings regarding the Treaty *(SALT II Treaty)*	Vienna 18 June 1979 Not in force	This Treaty shall remain in force through 31 Dec 1985 (art. XIX) and contains a withdrawal-right clause (art. XIX). USSR, USA	Provides for verification by national technical means and confirms the principle of non-interference with such national technical means. Stipulates that each Party undertakes not to develop, test or deploy systems for placing into Earth orbit nuclear weapons or any other weapons of mass destruction, including fractional orbital missiles (art. XV, paras. 1 and 2; art. IX, para. 1c).

Part IV:
Proposals and Negotiations Related to Arms Limitation in Outer Space

This part aims at providing an account of proposals for the prevention of an arms race in outer space at both the multilateral and bilateral levels. Therefore, its nature is mostly descriptive. In order to avoid too lengthy a treatment of the subject, the focus will be on negotiations undertaken since the First Special Session of the UN General Assembly devoted to Disarmament of 1978. Besides, technological developments linked to the military use of space have progressively gained momentum since the late seventies, thereby raising the stakes for efforts to prevent such an arms race and adding to the interest in a detailed examination of the evolution of negotiations since 1978.

The analysis will be divided in two parts. The first will concentrate on negotiations carried out at the multilateral level, while the second will focus on bilateral negotiations. It should be noted that emphasis was placed on multilateral negotiations, in view of the fact that the present work was conceived within the context of the United Nations' concern for the prevention of an arms race in outer space.[239]

The first part will not include any reference to regional initiatives, since there have been none except for a suggestion of the Federal Republic of Germany to resort to regional multilateral technical means of verification of compliance with agreements on the prevention of an arms race in outer space.[240] However, it will devote special attention to the role fulfilled by the United Nations in favour of the prevention of an arms race in and the peaceful use of outer space. The account will include a presentation of the work undertaken by the General Assembly which resulted in several resolutions on the subject, and a discussion of proposals submitted by the Soviet Union and the United States referring to the link between outer space disarmament and its peaceful use.

A description of negotiations that took place at the Conference on Disarmament will complete this first part. The account will focus on the proposals made by a number of States in the form of working papers submitted to the *Ad Hoc* Committee on the prevention of an arms race in

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[239] Resolution 40/87 of 12 December 1985 bears testimony for the special interest that the General Assembly took in it.

[240] See CD/PV.318; 4 July 1985. p. 16.

outer space. In order to provide a clearer view of the way in which these proposals were to be interpreted or the direction in which they evolved, this subsection will be completed with declarations made by the representatives of the same States at plenary sessions of the CD. Secondly, this section presents a number of proposals made by the delegations of other States, not included earlier on, which are thought to be relevant to the debate on the prevention of an arms race in outer space. The criterion used for determining their inclusion has been that of ensuring the representation of the different groups that exist in the Conference.

The second part of this section will address the bilateral negotiations conducted by the United States and the Soviet Union. It will deal with the ASAT systems[241] negotiations that took place between 1978 and 1979; the Geneva negotiations as they were conducted from 1985 to 1987; the proposals advanced at the Reykjavik summit meeting between President Reagan and General-Secretary Gorbachev in 1986; and other proposals first made outside the framework provided by the bilateral fora named above.

9. Multilateral negotiations

9.1. THE ROLE OF THE UNITED NATIONS IN THE PREVENTION OF AN ARMS RACE IN OUTER SPACE

The United Nations has been in the forefront of the endeavour to prevent an arms race in outer space. Its main forum for debate is the First Committee of the General Assembly, whereas the Conference on Disarmament,[242] the single multilateral disarmament negotiating forum, acts in close coordination with the United Nations. Both serve as multilateral fora for the topic of the prevention of an arms race in outer space,[243] and will be treated bearing in mind the nature of their links.

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241 On anti-satellite weapons see the forthcoming UNIDIR publication *Satellite Warfare: A Challenge to the International Community*.

242 The Conference's role was performed in the past by different bodies which can be considered to be its forerunners, starting with the Ten-Nation Disarmament Committe which acted between the end of 1959 and June 1960. Subsequently, at the request of the General Assembly, the United States and the Soviet Union proposed the establishment of an Eighteen-Nation Committee on Disarmament, which began sessioning on 15 March 1962. By 1969 membership of the latter was expanded to include 26 States; the Committee changed its name then to *Conference of the Committee on Disarmament"*(CCD). In 1979, again, the CCD was succeeded by the *Committee on Disarmament,* which, in turn, was renamed *Conference on Disarmament* in 1984 and given its present status.

243 The Disarmament Commission provides a mere forum for debate of specific issues.

Negotiation of suitable treaties has been, and continues to be, a vital element for creating conditions amenable to the peaceful utilization of outer space and for the prevention of an arms race in that environment. The objective of creating a legal order for the harmonious pursuit of space activities was established by the General Assembly in resolution 1721 (XVI) of 1961. After that, the groundwork was laid for the adoption of a number of space-related multilateral treaties.[244]

9.2. THE GENERAL ASSEMBLY

Resolutions

Since 1978 the General Assembly has indicated in a number of specific and action-oriented resolutions its concern to prevent an arms race in space. Initially, in the *Final Document* carried unanimously in that year at SSOD I, it declared that,

> "In order to prevent an arms race in outer space, further measures should be taken and appropriate international negotiations held in accordance with the spirit 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".[245]

From 1981 to 1986 this theme was elaborated in much greater detail in a number of resolutions of the General Assembly,[246] starting with

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[244] Resolutions 1962 (XVIII) of 1963, and 2222 (XXI) of 1966, laid the basis for the Outer Space Treaty of 1967; Resolution 2345 (XXII) of 1967 was the forerunner of the Treaty concerning the rescue of astronauts and the return of objects launched into outer space of 1968; Resolution 2777 (XXVI) of 1971 preceded the Liability Convention of 1972; Resolution 3235 (XXIX) of 1974 lead to the conclusion of the Registration Convention of 1976; and Resolution 34/68 of 1979 commended the terms of the Moon Treaty which entered into force in 1984. All of these treaties were originally elaborated at meetings of the Legal Sub-Committee of the Committee for Peaceful Use of Outer Space (COPUOS), established by the General Assembly in 1959 (Resolution 1472 A (XIV)) to *inter alia* study the nature of legal problems which may arise from the exploration of outer space.

[245] Resolution S-10/2, paragraph 80.

[246] The listing includes the following:

36/97 C, 9 December 1981, Prevention of an arms race in outer space
Voting record: 129-0-13 (abstaining: Afghanistan, Bulgaria, Byelorussia, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Lao People's Democratic Republic, Mongola, Poland, Ukraine, USSR, Viet Nam)

36/99, 9 December 1981, Conclusion of a treaty on the prohibition of the stationing of weapons of any kind in outer space
Voting record: 123-0-21 (abstaining: Australia, Belgium, Canada, Denmark, France, Federal Republic of Germany, Greece, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Tunisia, Turkey, United Kingdom,

Resolution 36/97 C. There, on the basis of the commitment assumed by the State parties to the Outer Space Treaty in its Article III, and recalling the above mentioned paragraph of the SSOD I's *Final Document* and other considerations, the Assembly urged all States, in particular those with major space capabilities, to contribute actively to the goal of preventing an arms race in outer space and to refrain from any action contrary to that aim. It also requested the Committee on Disarmament to consider, from the start of its sessions in 1982, the question of negotiating effective and verifiable agreements geared towards preventing an arms race in space and to address, as a matter of priority, the negotiation of an agreement to prohibit ASAT systems, as an important step aimed at the fulfilment of the formerly mentioned objectives.

In Resolution 36/99 of 9 December 1981 the General Assembly called for the "conclusion of a Treaty on the Prohibition of the Stationing of Weapons of any Kind in Outer Space", requesting again the Committee on Disarmament to embark on negotiations with a view to achieving agreement on the text of such a treaty.

On 9 December 1982 the Assembly passed Resolution 37/83 and expressed its awareness of the various proposals submitted by the Member States,[247] concerning the establishment of a working group on outer space and its draft mandate - especially the express wishes of

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United States)

37/83, 9 Dec 1982, Prevention of an arms race in outer space.
Voting record: 138-1-7 (against: USA; abstaining: Australia, Belgium, Canada, Israel, Luxembourg, Netherlands, United Kingdom)

37/99 D, 13 December 1982, Prevention of an arms race in outer space and prohibition of anti-satellite systems
Voting record: 112-0-29 (abstaining: Afghanistan, Angola, Argentina, Benin, Bulgaria, Byelorussia, Colombia, Cuba, Czechoslovakia, Ecuador, Egypt, German Democratic Republic, Guinea-Bissau, Hungary, Lao People's Republic, Lebanon, Madagascar, Mexico, Mongola, Mozambique, Panama, Peru, Poland, Saudi Arabia, Sri Lanka, Ukraine, USSR, United Republic of Tanzania, Viet Nam)

38/70, 15 December 1983, Prevention of an arms race in outer space
Voting record: 147-1-1 (against: United States; abstaining: United Kingdom)

39/59, 12 December 1984, Prevention of an arms race in outer space
Voting record: 150-0-1 (abstaining: United States)

40/87, 12 December 1985, Prevention of an arms race in outer space
Voting record: 151-0-2 (abstaining: Grenada, United States)

41/53, 3 December 1986, Prevention of an arms race in outer space
Voting record: 154-0-1 (abstaining: United States)

[247] Official Records of the General Assembly, Thirty-Seventh Session, Supplement No. 27 (A/37/27 and Corr. 1), paras. 101-106.

the majority of members of the Committee on Disarmament - for the creation of such a group. The Assembly declared that any use of outer space other than for exclusively peaceful purposes would run counter to the agreed objective of general and complete disarmament under effective international control. It also requested the Committee to consider above anything else the problem of preventing an arms race in outer space. To that end it asked again the Committee to establish an *ad hoc* working group on the subject at the beginning of the 1983 session, with the purpose of concluding agreements to prevent an arms race in all its aspects in outer space.

Four days later, the Assembly reaffirmed in Resolution 37/99 D the need to consider the negotiation of effective and verifiable agreements oriented towards the prevention of an arms race in outer space and the conclusion of an accord on the prohibition of ASAT systems.

The General Assembly, in Resolution 38/70, on 15 December 1983, took note of the Draft Treaty on the Prohibition of the Use of Force in Outer Space and from Space Against the Earth,[248] submitted by the Soviet Union, as well as views and comments expressed during the discussion of that Draft at its thirty-eight session. It again stated its concern and disappointment that, although there existed no objection in principle to the establishment without delay of such working group on the subject, the Committee on Disarmament had not been able to reach an agreement on an acceptable mandate for the working group during its 1983 session.

Resolution 39/59 confirmed the Assembly's previous recommendations on the matter and pointed out that in the context of multilateral negotiations for preventing an arms race in outer space, bilateral negotiations between the Soviet Union and the United States could make a significant contribution to such an objective. In connection with it, the Assembly requested them to advise the Conference on Disarmament regularly of the progress of their talks. It also reiterated its concern and disappointment that the Conference had not been able to reach an agreement on a mandate for an *ad hoc* committee to deal with this issue during its 1984 session. The Assembly once again asked the Conference to establish an *ad hoc* committee at the beginning of its 1985 Spring Session, with the purpose of concluding agreements to prevent an arms race in outer space.

The General Assembly adopted in 1985 Resolution 40/87 whereby it noted with satisfaction that bilateral negotiations between the United States and the Soviet Union had begun in that same year, aimed, *inter*

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[248] Official Records of the General Assembly, Thirty-Eighth Session, Supplement No. 27 (A/38/27), sect.III. G. Annexes, agenda items 43-63, 139, 141, 143 and 144, document A/38/194, annex.

alia, at preventing an arms race in outer space. It also welcomed the establishment of an *Ad Hoc* Committee on the Prevention of an Arms Race in Outer Space by the Conference on Disarmament, and urged its re-establishment at the beginning of the 1986 session. In relation to it, the Assembly observed that the Committee's mandate should be adequate with the intention of undertaking negotiations to conclude appropriate agreements. In paragraph 5 the Assembly asked the Secretary-General to invite all of its Member States to deliver their views in respect of "enhancing international co-operation in the field of preventing an arms race in outer space", setting up the "relevant machinery for that purpose", and to submit the report on the subject to the General Assembly at its forty-first session.

In 1986 a similar resolution was passed under number 41/53. Its text did not differ much from the previous one, although it is worth mentioning that it included a reference to the Harare Declaration of the Eighth Conference of Heads of States or Government of Non-Aligned Countries.

Soviet Union

Apart from producing resolutions, the First Committee provided as well the forum for initiatives by some States on the prevention of an arms race in outer space. On 10 June 1986, the Soviet Government sent a letter addressed to the UN Secretary General in response to the invitation to submit its views on the peaceful co-operation in outer space, in fulfillment of paragraph 5 of Resolution A/40/87. There it outlined a comprehensive proposal for such co-operation under the name of "Star Peace".[249] Its text repeated earlier suggestions made in the Conference on Disarmament on the immunity of artificial satellites, a ban on "space-strike weapons", the destruction of existing ASAT weapons and strict compliance with the ABM Treaty. It also included a suggestion concerning the verification of an agreement on these matters, namely, that access should be granted to laboratories engaged in space research and all nuclear testing should be stopped, to the extent that it promotes the arms race in space by intensifying that on earth.[250] As to the actual international co-operation in the peaceful use of outer space, the programme envisaged its implementation in three stages:

1. Investigation on that which the world needs and could be satisfied by space technology. An international Conference, a special session of the General Assembly or some sort of

[249] A/41/470, pp. 34-38, 10 June 1986. The contents of the letter were made public on 13 June 1986.

[250] A/41/470, p. 35, 10 June 1986.

gathering on outer space could review them and "approve a programme of action covering the 1990s and looking ahead to the following 10 or 15 years". Furthermore, the gathering could establish a world space organization (WSO) "with a charter in the form of an international treaty, linked to the United Nations by an agreement on co-operation", and "draw up specialized programmes for the execution of specific co-operation projects under WSO auspices". It was suggested, as well, that overall responsability for activities undertaken at this first stage should be assumed by COPUOS. Finally, special reference was made to the participation of developing and least developed countries. Developing countries "would participate in those programmes under preferential conditions" while least developed countries would receive special assistance through the application of the results emerging from those programmes.

2. During the first half of the 1990s "the development and production of space technology for agreed projects" would take place with a view to making them economically viable.
3. By the year 2000 co-operation should be self-financing and result in the creation of "the organizational and physical infrastructure" necessary for the "joint manufacture of spacecraft" and for bringing into operation "the necessary ground systems".[251]

Shortly after issuing this proposal, the Soviet Union declared its readiness "to open up its laboratories, on a reciprocal basis, for verification of such an agreement" on preventing an arms race in space.[252] The US had already tabled a similar proposal at the CD on 20 March 1986, in order to provide a possibility for verification of the research undertaken in the context of the Strategic Defense Initiative.[253] The connection between the prevention of an arms race in outer space and the peaceful utilization of that environment was thus affirmed by the Soviet Union.

United States

The United States in 1985 denounced such a link as excessively dangerous for the purpose of maintaining the division of responsibilities among the different bodies of the United Nations. In its view, paragraph 5 of draft resolution A/C.1/40/L.68/Rev.1,[254] which asked the UN Secretary-General to invite all Member States to submit their views on international co-operation in the peaceful use of outer space, involved the consideration of an issue proper to the Special Political Committee, a body that worked on the basis of consensus. Moreover, the attempt of the First Committee

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[251] A/41/470, p. 36-37, 10 June 1986.

[252] A/41/422, p. 28, 11 July 1986.

[253] CD/PV.349, p. 14, 20 March 1986.

[254] Eventually passed as Resolution A/40/85.

> "to countenance the linking of the question of preventing an arms race in space with the issue of peaceful co-operation in space is fraught with danger."[255]

This argument was further developed in a letter to the UN Secretary-General of 23 May 1986. There the United States said that paragraph 5 apparently referred

> "to a proposal of the Soviet Union (agenda item 145) which sought consensus on what the Soviets termed 'non-militarization' of outer space as a precondition for enhanced international co-operation in the peaceful uses of outer space". [256]

The US delegation added that the linkage of both issues

> "would, in fact, seriously undermine the practice of three decades of considering questions concerning co-operation in the peaceful uses of outer space separately from, and independently of, questions relating to outer space arms control".[257]

The letter concluded by pointing out that there existed a number of specialized fora which dealt with arms control, while COPUOS had been given a "mandate as the only standing committee of the General Assembly for international cooperation in the peaceful uses of outer space".[258]

9.3. THE CONFERENCE ON DISARMAMENT

The *Final Document* of the First Special Session of the General Assembly on Disarmament (1978) states that the Conference on Disarmament, as the successor to the Committee on Disarmament, is the "single multilateral disarmament negotiating forum" of the international community. Thus, it sets up its own rules of procedures, determines the content of its agenda - even if it takes into account the recommendations of the General Assembly - and reports to the latter on an annual or a more frequent basis, depending on whether it deems it necessary to do so. The Conference's budget is included in that of the UN and it performs its duties on UN premises. The Secretary-General of the CD is designated by the UN Secretary-General in consultation with the Conference's Member States, acting as his personal representative.

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255 A/C.1/40/PV.47, 22 November 1985.

256 A/41/470, p. 38, 18 August 1986. Agenda item 145 concerned "International co-operation in the peaceful exploitation of outer space under conditions of its non-militarization".

257 A/41/470, pp. 38-39, 18 August 1986.

258 A/41/470, p. 39, 18 August 1986.

In 1982 the Committee on Disarmament included the item "Prevention of an Arms Race in Outer Space" in the agenda of its Plenary Sessions, after the General Assembly had repeatedly called for negotiations on treaties prohibiting deployment of space weapons and of ASAT systems.[259] However, it was only in 1985 that an *Ad Hoc* Committee was created with a mandate

> "to examine, as a first step at this stage, through substantive and general consideration, issues relevant to the prevention of an arms race in outer space.
>
> "The *Ad Hoc* Committee will take into account all existing agreements, existing proposals and future initiatives and report on the progress of its work to the Conference on Disarmament before the end of its 1985 session".[260]

The same mandate, with some minor modifications, was repeated in 1986 and 1987, although some States made manifest their wishes to proceed to more concrete action regarding the prevention of an arms race in outer space.[261] The disagreements in respect of the mandate delayed the start of work within the *Ad Hoc* Committee in 1986. The following year agreement on continuing work according to that same mandate was quickly reached, but a debate took place on the Committee's programme of work.[262]

The following paragraphs provide an overall view of negotiations on the prevention of an arms race in outer space taking place at the Conference on Disarmament. Attention will be focused first on *working papers* submitted by a number of States to the *Ad Hoc* Committee which will be complemented by the *statements* produced by their Representatives in the Conference's plenary sessions. Subsequently, the present investigation will deal with the statements made by the delegations of some other countries on the same subject. For the sake of clarity and in order to avoid unduly extending this section, it has been felt necessary to choose among all those available a few which are considered to be representative of the many proposals submitted and of the different negotiating positions held at the Conference. A comparison of the

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[259] See Resolutions 36/97 C and 36/99.

[260] Report of the Ad Hoc Committee on Prevention of an Arms Race in Outer Space, CD/641, p. 1, 26 August 1985.

[261] See, for instance the statements by the Representative of India (CD/PV.378, p. 12, 12 August 1986 and CD/PV.392, p. 7, 26 February 1987) asking for negotiations on a ban of space weapons and ASAT systems, Poland's position on the subject (CD/PV.402, p. 10, 2 April 1987); and that of Czechoslovakia (CD/PV.371, p. 10, 17 July 1986), Sri Lanka (CD/PV.340, p. 15, 18 February 1986) and Egypt (CD/PV.389, p. 31, 17 February 1987).

[262] Cf. CD/PV.404, p. 10, 9 April 1987.

various proposals will round up the present description and it will include views expressed by some delegations on very specific issues which were not mentioned earlier on.

PROPOSALS PRESENTED AS WORKING PAPERS IN THE AD HOC COMMITTEE.

Two United Nations world conferences have been held on the Exploration and Peaceful Uses of Outer Space in 1968 and 1982. The second one, Unispace 82, and subsequent General Assembly resolutions stated that the Conference on Disarmament should be entrusted with the role of negotiating agreements on the prevention of an arms race in outer space.[263] Since 1982 the Conference has had on its agenda the item "Prevention of an Arms Race in Outer Space", which was discussed at plenary meetings. In 1985 it decided to establish an *Ad Hoc* Committee under that same item, and requested it to analyze issues relevant to it.[264] Its mandate included, as well, the consideration of existing agreements and proposals pertinent to the matter. Despite a valuable exchange of views by a number of States, no consensus was reached in 1985 on any of the items listed in the Committee's agenda.[265] This situation repeated itself in 1986,[266] with some delegations wanting further consideration of the topics concerned along the lines of the 1985 and 1986 mandates, whereas other demanded the start in 1987 of negotiations towards an agreement on space weapons.

The following are proposals forwarded by different States under the form of Working Papers and considered by the *Ad Hoc* Committee. They have been supplemented with statements made by those States' representatives at the plenary sessions.

Soviet Union

The Soviet Union introduced a draft treaty on the prohibition of the stationing of weapons of any kind in outer space at the 36th Session of

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263 A/RES/39/59 of 1985. For an account of the debate on this subject in the Special Political Committee, in November-December 1984, see B. Khabirov: "Consideration of Matters Relating to the Peaceful Uses of Outer Space at the 39th Session of the General Assembly", *Journal of Space Law,* Fall 1984, Vol. 12, No. 2, p. 188.

264 Report of the *Ad Hoc* Committee on Prevention of an Arms Race in Outer Space, CD/642, p. 116, 4 September 1985.

265 Cf. Report of the *Ad Hoc* Committee on Prevention of an Arms Race in Outer Space, CD/642, p. 116, 4 September 1985.

266 Cf. Report of the *Ad Hoc* Committee on Prevention of an Arms Race in Outer Space, CD/726, pp. 108 ff., 19 August 1986.

the General Assembly in 1981.[267] The draft was submitted to the Committee on Disarmament in 1982[268] and included general provisions on the matter. Article 1, paragraph 1, committed the signatory Parties

> "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 State Parties may develop in the future".

Article 2 recognized international law and, especially, the Charter as the main instruments ruling the use of space, while Article 3 stated that

> "Each State Party undertakes not to destroy, damage, disturb the normal functioning or change the flight trajectory of space objects of other States Parties, if such objects were placed in orbit in strict accordance with Article 1, paragraph 1 of this Treaty".

As regards to verification, the draft foresaw the use of national technical means and consultations among the signatory Parties.

In the latter half of 1983 the Soviet Union made a number of initiatives concerning the prevention of an arms race in outer space. An excerpt from a TASS communiqué about a meeting between General-Secretary Andropov and a group of United States Senators contained the first of them.[269] The Soviet Union remarked on the necessity of coming to terms with a complete prohibition of the testing and deployment of any space-based weapons for hitting targets on earth, in the air or in outer space. Furthermore, it declared to be ready to submit a proposal for the solution of these issues to the General Assembly. In addition, it assumed the commitment not to be the first to put into outer space any type of anti-satellite weapon and, on 18 August 1983, declared a unilateral moratorium on such launchings which would last as long as other countries, including the United States, refrained from stationing anti-satellite weapons "of any kind" in outer space.[270]

The Soviet Union submitted to the General Assembly on 23 August

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[267] A/36/192, 11 August 1981.

[268] CD/274, 7 April 1982.

[269] CD/420, 23 August 1983. The meeting took place on 18 August 1983.

[270] On 12 April 1984 the US Representative to the Conference on Disarmament commented on this move, saying that such moratorium was flawed since the Soviet Union had already established an advantage in this field. He also noted that the Soviet draft treaty on a ban of ASAT systems overlooked "enormous verification problems involved in such agreement" (CD/PV.258, p. 23). US spokesmen have often pointed out that any manoeuverable object which can be launched into space has potential ASAT capabilities .

1983[271] a draft treaty on the prohibition of the use of force in outer space and from space against the earth. The draft was then tabled at the Conference on Disarmament in 1984.[272] Its Article1 reproduced to some extent the first Article of the former draft; however, it added to the prohibition of stationing "instruments of destruction" in space explicit references to the commitment not to use force in outer space. Article 2 contained a number of other specific commitments which States would undertake in accordance with the principles of Article 1. States would agree

1. not to test or deploy any space-based weapons for the destruction of objects on the earth, in the atmosphere or in outer space;
2. not to utilize space objects as means to destroy any targets on Earth, in the atmosphere or in outer space;
3. not to damage, destroy or 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 such systems they may already possess;
5. not to test or use manned spacecraft for military, including anti-satellite purposes.

Finally, Article 3 repeated the formulation of Article 1, paragraph 2 of the former draft in so far as it prescribed that no States should assist or encourage in any way other States or international organizations to engage in activities which would contravene Articles 1 and 2. Verification provisions were contained in Articles 4 to 6, and centered, as was the case with the former draft, on the use of national technical means and consultation among the signatory Parties. However, it included, as well, the proposal of creating a Consultative Committee of the Parties to the Treaty which could deal, among other things, with questions related to verification of compliance.

In a subsequent declaration General-Secretary Chernenko defénded the feasibility of verifying a moratorium of anti-satellite weapons, specifying that the use of orbital-effect weapons could be checked by tracking space objects, whereas sub-orbital effect anti-satellite systems could be controlled by the same means and the employment of "radio-electronic devices deployed on land, in the Pacific Ocean and space".[273] It must be noted that these measures are for verification of a bilateral freeze and would not be independently verifiable by all Parties to a multilateral treaty.

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[271] Doc. A/38/194.

[272] CD/476, 20 March 1984.

[273] CD/510, 18 June 1984. The interview was published on 12 June 1984.

Towards the end of the 1985 sessions of the Conference on Disarmament, the Soviet Union proposed the creation of "a world space organization for international co-operation in the peaceful exploration and use of outer space under conditions of its non-militarization".[274] The proposal envisaged that the new organization would have some arms control verification functions. The Soviet Union also proposed the inclusion in the agenda for the 40th Session of the General Assembly of an item on the "International Co-operation in the Peaceful Exploration of Outer Space Under Conditions of its Non-Militarization", and submitted a draft resolution to that effect.[275]

On 20 February 1986, General-Secretary Gorbachev sent a letter to the Conference on Disarmament containing a proposal for a complete ban of "space strike arms".[276] The Soviet Representative to the Conference added that

> "an international agreement on ensuring the immunity of artificial earth satellites and on banning the development, testing and deployment of anti-satellite systems as well as eliminating those systems that already exist"

would be a major contribution towards that goal.[277] On 17 March 1987 the Soviet delegation advanced a new proposal to consider the possibility of establishing an international verification of non-deployment of any weapons in outer space, a system that would provide for the establishment of an international inspectorate. Such an inspectorate would be given the right of access, for the purpose of on-site inspections, to all objects destined to be launched and stationed in space, and to their corresponding launch vehicles.[278] Foreign Minister Shevardnadze, addressing the CD on 6 August 1987, noted that there are as yet not many space-launch centers and said that the presence of international inspectors would reliably guarantee that the objects placed in outer space are not weapons. The Soviet Union proposes not merely a presence but a permanent presence of groups of inspectors at all space launch sites. Information about each upcoming launch, including the location of the site, the type of launch vehicle, general information about the object to be launched and the time of launch would be given in advance to members of the inspectorate. The Soviet

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[274] CD/PV.332, p. 23, 22 August 1985.

[275] CD/639, 21 August 1985.

[276] CD/671, p. 2, 20 February 1986. The letter's date is 18 February 1986.

[277] CD/PV.341, p .14, 20 February 1986.

[278] CD/PV.397, p. 17.

proposal also provides for the right to conduct an on-site inspection should suspicion arise that a launch was carried out from an undeclared launch site. In the event of a total ban on space weapons, the Soviet Union would be willing to extend inspections to storage facilities, industrial plants, laboratories and testing centers.[279]

France

At the First Special Session of the General Assembly devoted to Disarmament, held in 1978, France advanced proposed the establishment of an International Satellite Monitoring Agency (ISMA). France pointed out that surveillance satellites played an important role in the verification of some bilateral arms control agreements and in the monitoring of crises. Within the framework of current disarmament efforts, this new monitoring method should be placed at the service of the international community. The use of observation satellites for purposes of verification could help reduce the difficulties in verifying compliance with agreements and thus advance the cause of disarmament. Observation satellites could also contribute to effective management of crisis situations and thereby strengthen international confidence and security, France said.[280] During the past nine years the proposal has generated great interest in the international community but a decision is still pending on the timing and manner of its possible implementation.

With respect to arms limitation in outer space, France introduced a working paper in April 1983.[281] There it argued that the problem posed in relation to the prevention of an arms race in space derived mainly from the following facts:

1. the inadequacy of existing legal instruments with respect to foreseeable technological developments;
2. the ambiguity surrounding the idea of the immunity of space objects;
3. the constraints resulting from the long-standing and by now irreversible overlapping of civilian and military uses of outer space.

France urged that the international community's efforts to prevent an arms race in outer space be directed towards achieving two main objectives: to prevent outer space from becoming a base for military action; and to protect space vehicles, particularly ensuring the

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[279] CD/PV. 428 of 6 August 1987.

[280] For the French proposal, see document A/S-10/AC.1/7. See also the UN Study "The Implications of Establishing an International Satellite Monitoring Agency" (Doc. A/AC.206/14 of 1981).

[281] CD/375, 14 April 1983.

immunity of satellites.

The solution of the latter problem was extremely important to France. In its view, the question of the immunity of military observation satellites was closely linked with the recognition of the international legitimacy of the role they play. In this regard, the French paper contained a number of specific questions. First, did the international protection accorded to "national technical means of verification" specifically include satellites? If so, was such immunity subject to any limitative interpretation concerning the scope of acceptable verification or was any observation capability considered legitimate? And, finally, was the non-interference clause contained in the bilateral Soviet-American instruments also valid for third countries or international organizations?

It was France's view that the difficulties encountered in trying to distinguish between satellites for military and those for civilian purposes, and in the use of ill-defined concepts such as "weapon", should lead to the consideration of more specific measures rather than a general prohibition on the placing of weapons in orbit. It proposed that the immunity of satellites extended beyond the scope of bilateral arrangements concerning non-interference with "national technical means of verification", to apply to all existing satellites "if they are equipped only with passive means of defense". France urged the adoption of co-operative measures to strengthen confidence in the immunity of satellites, including more detailed notification measures to remove suspicions which might be aroused by certain manoeuvres of space vehicles. Finally, the proposal reiterated earlier suggestions that higher priority be given to finding ways to promote international co-operation in the use of earth observation systems for the verification of compliance with arms limitation agreements and for crisis control.

In 1984, France again expressed its concern over the possible deployment of anti-satellite weapons and the prospects of the development of BMD systems , in view of the destabilizing impact on the military use of space both of them would entail.[282] While recognizing that it would be unrealistic to seek the complete demilitarization of space, France felt that it was possible to achieve undertakings on the following basis: (a) They would be limited, having as their objective the forestalling of destabilizing military developments, without affecting the military activities that contribute to strategic stability and those that could be of assistance in the monitoring of disarmament agreements; (b) they would be progressive, with a view to limiting those developments that would not lend

[282] CD/PV.263, pp. 19-22, 12 June 1984.

themselves to subsequent verification; and (c) they would be verifiable. With this in mind, France proposed the initiation of international consultations on:

1. the very strict limitation of anti-satellite systems, including in particular the prohibition of all such systems capable of hitting satellites in high orbit;
2. the prohibition of the testing and deployment of beam-weapon systems capable of destroying ballistic missiles or satellites at great distances;
3. the strengthening of the present system of declaration established by the 1975 Convention on the Registration of Space Objects, in order to provide more detailed information on the specifications and purposes of objects launched so as to improve the possibility of verification; and
4. a pledge by the United States and the Soviet Union to extend to the satellites of third countries the provisions concerning immunity of certain space objects contained in bilateral agreements.

In 1987 France once again addressed the issue of ASAT weapons, observing that satellites could be destroyed in many different ways and that "it would therefore not be realistic to found an international régime on the prohibition of ASAT systems, which could be only incomplete".[283] Hence, France saw it as a priority to apply the "fundamental principles of the present space régime", i.e. its peaceful use on the basis of equality, non-discrimination and non-appropiation. The choice of such an approach would, then, open the way for the adoption of those specific measures related to "the registration and notification of space objects" and the "code of conduct" it had already advanced earlier on.[284]

Italy

Italy urged a review of Article IV of the 1967 Outer Space Treaty and submitted a proposal to that effect to the UN General Assembly in September 1978.[285] In 1979 it submitted a draft Additional Protocol to the Committee on Disarmament in Geneva which it hoped would provide a concrete basis for discussions on the prevention of an arms race in outer space.[286] In accordance with the principle that outer space shall

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283 CD/PV.390, p. 6, 19 February 1987.

284 CD/PV.390, pp. 8-9, 19 February 1987.

285 Doc. A/7221, 9 September 1978.

286 CD/9, Italy, "Additional Protocol to the 1967 'Treaty on Principles Governing Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies' with a view to preventing an arms race in outer space", 26 March 1979. In 1987 Venezuela suggested a similar action, namely, the introduction of an amendment to Article IV of the Outer Space Treaty, banning "any type of space weapon" (CD/PV.398, p. 9, 19 March 1987).

be used for peaceful purposes only, the document suggested in its Article I that States should refrain from taking measures such as: establishing military bases, installations and fortifications or the stationing of devices having the same effect; 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 in space; and the testing of any type of weapon in space. However, this Article would not prevent the use of military personnel or equipment for scientific research or any other peaceful purposes and would permit their use in any control system established to ensure compliance with disarmament and security agreements. This proposal, which is no longer current, foresaw that verification of compliance with the provisions of the Treaty would be implemented through national legislative measures to prevent any activities in violation of the provisions. Any Party that suspected a breach of the Treaty by another could lodge a complaint with the UN Security Council and all Parties would undertake to co-operate with the Security Council in any investigation it might initiate.

Statements also focused attention on the question of immunity of satellites.[287] In 1985 Italy identified four main threats in and from outer space: physical attack with conventional or nuclear weapons; collision and physical tampering with manoeuvring space craft; directed-energy weapons, particularly lasers; and interference with electromagnetic communication systems in space. In addition, there were problems posed by technologies and systems designed for other purposes which might give rise to capabilities inherently useful for ASAT purposes, such as BMD systems. Italy urged that consideration be given to the adoption, prior to or parallel with more incisive measures of arms limitation, of collateral steps which would be aimed at increasing confidence, avoiding provocative or ambiguous actions in space and would help to pave the way for further disarmament negotiations. One such step would be the strengthening and expansion of the Registration Convention.

Italy suggested that the possibility of collision between spacecraft could be reduced by agreeing on minimum separation distances for satellites in orbit or in transit to orbit. In addition, it was claimed that it would be helpful to implement the prompt communication to an international authority of the full orbital elements of every object launched into space accompanied by a detailed description of its mission on the basis of a standarized reporting instrument. This latter suggestion would involve a modification of the Registration Convention.

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[287] CD/PV.274, pp. 7-8, 19 July 1985.

Italy envisaged the development of co-operative measures to permit ready verification of orbit and general function on the basis of Article IX of the Outer Space Treaty, which calls for prior consultations on activities that would "cause potentially harmful interference with the activites of other States Parties".

Sweden

Sweden advanced some specific proposals for the prevention of an arms race in outer space in a working paper tabled in the *Ad Hoc* Committee in1985.[288] It summarized different statements made by the Swedish Representative to the Conference. Its main points are the following:

1. The necessity of negotiating an international treaty banning all space weapons.
2. Any disturbance in the functioning of space objects should be forbidden.
3. Negotiations should be conducted to ban the development, testing and deployment of space-based BMD systems.
4. Fractional Orbital Bombardment Systems (FOBS) should also be prohibited.
5. Satisfactory means of verification should be found and an "international direct inspection be applied, including on-site inspection whenever feasible".
6. "Military space systems which could have particularly destabilizing characteristics must be identified" while recognizing "that certain military space systems can have a stabilizing effect".
7. The establishment of an international space monitoring system along the French ISMA proposal could be considered.
8. A collateral measure for the prevention of an arms race in outer space could involve the strengthening of the 1975 Registration Convention.

Canada

In 1982 Canada submitted a working paper to the Committee on Disarmament which offered a conceptual approach to arms control in outer space.[289] The main premise of the paper was that "as a prime criterion for arms control, a measure should contribute to the stability of international relations, and in particular to the stability of strategic deterrence of agression and war". According to Canada, practical progress in arms limitation should be sought on the basis of gradual measures to establish equitable limits on systems of the types presently deployed, and to prohibit new systems not yet deployed whose presence would be clearly destabilizing from the point of view of crises or of arms limitation.

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[288] CD/OS/WP.8, 1 August 1985.

[289] CD/320, 26 August 1982. See as well CD/PV.252, pp.15-20, 22 March 1984; CD/PV.301, pp. 16-19, 21 March 1985.

The paper described the important military applications of satellites and attempted to classify the various types of space systems as either stabilizing or destabilizing. It concluded that when the criterion of stability applied to the question of control of military space systems, very few of them could be classified as either completely stabilizing or completely destabilizing. The overall effect of a satellite system depended on a number of factors, including the nature of the military balance between the nations in question, the international setting, and the military strategies of the opposing nations. However, the paper acknowledged that, on balance, some of the military space systems seemed to be more stabilizing than destabilizing especially when considered from the perspective of arms limitation. From this it followed that anti-satellite measures would be destabilizing, particularly for arms control, in part because the functions performed by some military satellites were stabilizing, and in part because anti-satellite measures would tend to generate countermeasures, both offensive and defensive, for the sake of satellite protection. Therefore, the prevention of anti-satellite measures was a desirable aim, but practical considerations, such as verification problems, indicated that the complications and difficulties in the way of a workable agreement were formidable.

On 30 April 1987, the Representative of Canada to the Conference on Disarmament advanced some general traits of a forthcoming Canadian proposal consisting of a dual-purpose verification system of space and conventional weapons limitation agreements, named PAX-SAT A and B.[290] Such system could become operative if the following conditions were met:

1. There should "be the prospect of a significant multilateral agreement" on any one of those types of weapons.
2. The States Parties to it should be given the option of taking part in those verification procedures.
3. The system should be geared towards the verification of compliance of specific treaties, which would envisage its use for that purpose.
4. Such treaties would have to "establish the requisite political authority for the verification mechanism and its operation".
5. Costs and requirements of the technology needed for its implementation "would be met collectively by the participants".
6. As far as possible, the system should rely on existing technology "without requiring major improvements".

To conclude, Canada held an "Outer Space Workshop" in Montreal (14-17

[290] CD/PV.410, pp. 12-14. A detailed presentation of the proposal was scheduled for the second period of sessions of the Conference on Disarmament.

May 1987) to discuss broad legal questions relevant to the prevention of an arms race in outer space and to introduce the results of Canadian research on the use of space-based remote sensing techniques for verification of arms control and disarmament agreements.

Pakistan

In June 1986 Pakistan presented a working paper[291] which dealt with both the prevention of an arms race in space and the ABM Treaty. In the document, the Pakistani delegation suggested that, pending a global solution of the first issue, a number of "interim confidence building measures" could be agreed upon:

1. establishment of an International Space Agency;
2. proclaiming a moratorium on the development, testing and deployment of ASAT weapons;
3. calling for the immunity of space objects;
4. requesting the "Space Powers to share information regarding their current and prospective activities in space"; and
5. asking those Powers to indicate their understanding of and adherence to relevant treaty obligations.

But the most substantial part of this working paper concerns the approval of an instrument that would supplement the ABM Treaty, in order to inhibit both Powers from explicitly or implicitly infringing any of its clauses. Such an agreement would include, among other things:

1. an explicit formulation of both Powers' commitment "to abide strictly by the provisions of this [ABM] Treaty, in particular its Article V ...;"
2. "a clear interpretation of the research activities permissible under the ABM treaty;"
3. "a commitment by other technologically advanced States not to take their own research beyond the limits accepted by the United States and the USSR;"
4. "a mechanism to provide for the redress of such activities that are contrary to the limitations contained in the ABM Treaty."

China

In a working paper produced in 1985, the Chinese delegation expressed its full support to the "non-militarization of outer space" and the peaceful utilization of that environment.[292] In order to avoid such militarization, it suggested that the ultimate aim of negotiations on the prevention of an arms race in space should be the limitation and prohibition of "space weapons with actual lethal or destructive power and military satellites of all types". However, it recognized the need to

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[291] CD/708, pp. 1-2, 26 June 1986.

[292] CD/579, p. 1, 19 March 1985.

adopt interim measures which would secure a "de-weaponization of space", i.e. a ban on the development, testing, production, deployment and use of any space weapons, advocating as well the destruction of those already existing. Thus, it invited all States to engage in an examination of the major existing legal instruments regarding outer space, the formulation of new provisions and the conclusion of new agreements. In order to create an atmosphere favourable to negotiations, all States with space capabilities would immediately refrain from developing, testing and deploying space weapons.

Venezuela

In the context of the debate on militarization, weaponization and the peaceful use of outer space, Venezuela presented in July 1986 a working paper suggesting a draft definition of space weapons:[293]

> "'Space strike weapons' means any offensive or defensive device, including its operational components, whatever the scientific principle on which its functioning is based:
>
> "(a) capable of destroying or damaging from its place of deployment in outer space an object situated in outer space, in the air, in water or on land;
>
> "(b) capable of destroying or damaging from its place of deployment in the air, in water or on land an object situated in outer space.
>
> "The following are also space strike weapons: any offensive or defensive device including its operational components, and any system of such devices, whatever the scientific principle on which its functioning is based, that is capable of intercepting, from outer space or from land, water or the atmosphere, ballistic projectiles during their flight".[294]

SOME STATEMENTS BY REPRESENTATIVES IN PLENARY SESSIONS OF THE CONFERENCE ON DISARMAMENT

United States

In 1985 the United States expressed its views on the request made by some Member States that the Conference should start negotiating outer space arms control agreements suggesting that

> "polemical statements to the effect that there is a need to establish an arms control régime in space are counterproductive and misleading. There already is a broad arms control régime applicable to outer space indeed, that régime is

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[293] CD/709/Rev.1, 22 July 1986. Its text incorporated suggestions made in different proposals submitted by Bulgaria and Hungary, China, Sri Lanka, USSR and Venezuela itself in a paper presented to the *Ad Hoc* Committee on outer space on 21 July of that same year (CD/0S/WP.14/Rev.1). China had already stated its views on the subject in 1984 (CD/PV.261, p.32, 24 April 1984; note that the word "spacecraft", as translated in the provisional verbatim records, was incorrect).

[294] CD/709/Rev.1, p. 2, 22 July 1986.

> far more comprehensive than the arms control régime on earth. The Outer Space Treaty already prohibits the stationing of nuclear weapons or other weapons of mass destruction in space. The Limited Test Ban Treaty already prohibits nuclear explosions in space. And the ABM Treaty already prohibits the deployment of ABM systems in space".[295]

Later on, it stressed the need to clarify the extent to which Member States interpreted the UN Charter to offer a credible instrument for preventing the use of force in outer space. At the same occasion, it demanded that arms control should "be clearly defined, significant, equitable and verifiable", reiterating as well the need to preserve the distinction between those areas which were the responsibility of COPUOS and those which concern, strictly speaking, arms control.[296]

Federal Republic of Germany

On 7 February 1985 the Federal Republic of Germany urged the Conference on Disarmament to concentrate on specific, verifiable rules that would enhance stability and prevent an arms race in outer space.[297] The aim, it was said, should be to ensure the safe functioning of satellites and thus increase stability and strengthen mutual confidence.

The Federal Republic of Germany also raised the issue of definition and interpretation, both in existing international agreements and in proposals and statements in the Conference on Disarmament.[298] It drew special attention on the difficulties in interpreting the expressions "militarization of outer space" and "peaceful use of outer space" in connection with international legislation on the matter. It concluded that grave lacunae affected the latter and called for their detailed identification and for adapting the agreements involved to "the dynamics of new space weapon technology". As to verification of compliance with the provisions of those or future agreements, the Federal Republic of Germany stressed the need for "stringent provisions of verification, preventing the abuse of space technology". It also advocated the involvement of international verification organizations along the lines of the French ISMA proposal or the use, within a regional context, of organizations such as the European Space Agency.

Finally, two approaches were advanced for further arms limitation measures and eventual multilateral negotiations. The first one involved the establishment of a protective régime for space objects through the

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[295] CD/PV.321, p. 9, 16 July 1985.

[296] CD/PV.349, p. 14, 20 March 1986.

[297] CD/PV.289, p. 9, 7 February 1985.

[298] CD/PV.318, pp. 13-17, 4 July 1985.

strengthening of the obligation to register space satellites and the second the introduction of specific "code of conduct" for the stationing of satelllites.

In 1986 the Federal Republic of Germany expanded this latter idea by pointing out that protective measures could result from combining restrictions on hardware (to be negotiated primarily at the bilateral level), and "the legal immunization of satellites - predominantly under multilateral auspices".[299] The question of setting up criteria for satellite immunity faced, from its viewpoint, the problem posed by defining the use of force in outer space, be it by a major power against the other or by any one of them against a third country - a difficulty which, according to the Federal Republic of Germany, seemed to arise from the fact that the Charter by itself does not appear to be effective enough for preventing the threat or the use of force in outer space. In order to establish such criteria of immunity it proposed the consideration of the stabilizing function satellites fulfill, their geographical position, the degree to which immunity should be extended to the environment of certain strategically indispensable satellites, and its extension, as well, to the satellites' "related ground facilities".

The suggestion of a "code of conduct" was again subject of the attention of the Federal Republic of Germany in 1986. It remarked that they would contribute to attenuate "the effects of unintended escalation and [...] the risks arising from misunderstandings in crisis situations" in so far as they would prevent States from accidentally engage in threatening activities, facilitate the reception of information on space objects' behaviour, and the consultation among the parties involved, should any one of them feel threatened by another's activities.

To conclude, the Federal Republic of Germany indicated that a clear delimitation of competence should be made between the work undertaken by the Legal Sub-Committee of COPUOS, on the one hand, and the Conference on Disarmament on the other. The point was made in view of the debate on the relationship existing between the prevention of the militarization of space and its peaceful use, which has been already dealt with when discussing the issue in the context of the proposals submitted to the General Assembly. The Federal Republic of Germany suggested that the Legal Sub-Committee should care for legal aspects concerning civilian use of outer space, whereas the Conference should be entrusted with everything pertaining to the "military relevance of the protection of satellites - specifically in their military and stabilizing role".

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[299] CD/PV.345, pp. 5-12, 6 March 1986.

Poland

In 1987 Poland stated that the task of identifying and analyzing the lacunae of the present outer space régime had already been accomplished and that negotiations should proceed to a second stage "aimed at improving and strengthening that régime". It also suggested that a step-by-step approach for addressing the issue was to be preferred, beginning with the "concrete discussion of measures to eliminate the possibilities of the deployment of weapons in space". It emphasized that the Conference could take as a starting point the different suggestions already made by its Members, and underlined its support for Venezuela's suggestion of producing a Protocol to the Outer Space Treaty - an initiative first advanced by Sri Lanka in 1985 - as an interim measure while negotiations went on. The Polish Representative also stressed the interest of his country in concluding an agreement or agreements that would secure immunity for all satellites, since "to draw the precise line between different functions of satellites is almost impossible". Consequently, it demanded a ban on all ASAT systems, and supported the proposal of the Federal Republic of Germany to establish a "code of conduct" for the placing into orbit of space objects. Finally, it supported the Soviet proposal of creating an international inspectorate for implementing a verification system before it would be too late.[300]

Sri Lanka

In 1984 the Representative of Sri Lanka underlined the importance of agreeing on a suitable mandate for the *Ad Hoc* Committee. Such mandate would have to foresee a time limitation for completing the identification of issues relevant to the item in question and it should also explicitly enunciate the aim to be pursued, namely, the negotiation of an agreement or agreements on the prevention of an arms race in outer space.[301]

Later on, Sri Lanka reiterated calls made by different States for a ban on space weapons, proposing, that the Conference should engage in the examination of the feasibility of extending Article IV of the Outer Space Treaty to include a ban on all kinds of weapons in space, regardless of where they are based.[302] It also stressed the importance of agreeing on definitions of the different categories employed when dealing with outer space issues, since a classification of the various

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[300] CD/PV.402, pp. 10-12, 2 April 1987.

[301] CD/PV.254, p. 11, 29 March 1984.

[302] This proposal was raised again by Venezuela in 1987, receiving the support of Poland.

space systems was necessary in order to:

1. identify those systems which were covered under current principles of law and those which escaped their rule;
2. establish whether the latter should be dealt with as individual components or as a group in the future.

Sri Lanka also urged the Conference on Disarmament to explore methods for ensuring the inviolability of space systems which satisfy mutually agreed definitions as being space objects for permitted purposes. Registration of such systems and declaration of the functions they perform was deemed necessary before assurance of inviolability could be given. In this regard, "surveillance for prescribed verification purposes must be distinguished from intrusive systems with reprehensible motives which must of course be prohibited".[303] In a later statement, Sri Lanka completed this suggestion, saying that the difficulties obstructing an "agreement on the parameters of the discussion" before engaging in negotiations could be overcome with the help of "a group of scientific experts working on an independent mandate to provide this Conference with the technical expertise it requires".[304] The same proposal had been made by Sweden.

During the first period of the 1987 sessions of the Conference on Disarmament, Sri Lanka focused on the question of granting immunity to space objects. It noted that three out of four satellites in space fulfill military functions and that "to grant immunity to them is tantamount to legitimizing the military uses of space, unless we are clear about their scientific purpose and function".

So, it recommended a re-examination of the Convention on the Registration of Objects Launched into Outer Space of 1975, since "the strengthening of this Convention must go hand in hand with any move to grant immunity to certain space objects". In connection with it, Sri Lanka expressed its dissatisfaction with the procedure adopted for reviewing that instrument: the request that the Secretary-General should report on its past application to the Legal Sub-Committee did not allow for a thorough revision.[305]

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303 CD/PV.325, pp. 12-13, 30 July 1985.

304 CD/PV. 368, p. 12, 8 July 1986. Even if it did not oppose such proposal, Venezuela observed that the technical aspect of preventing an arms race in outer space should not be over-valued, since the issue was basically a political one (CD/PV.398, p.7, 19 March 1987); Poland also sustained a similar position on this matter (CD/PV.402, p.7, 2 April 1987).

305 CD/PV.404, p. 11, 9 April 1987.

India

In 1984 India deplored research and/or development of ASAT weapons and new ABM systems. India stated that it was urgent to begin negotiations on controlling or banning such weapons. The issue of verification should not, in its view, become the major stumbling block for any progress in negotiations. It stated that the way military technology was developing "most of the new weapons systems are likely to become unverifiable sooner or later". If this were to happen, it would only demonstrate how mistaken the emphasis on verification was, and how it had been used as a pretext for not engaging in serious and genuine negotiations for halting and reversing the arms race in outer space.[306]

In another statement the following year, India concentrated on the ASAT systems issue as treated by the Conference on Disarmament. It found it difficult to understand why efforts should be devoted

> "to distinguish between the various kinds of satellites and various activities of satellites and [why] demands are being made to have perfect verifiability before considering any ban on anti-satellite weapons".

Consequently, it suggested that "the only sensible course" was that of negotiating a comprehensive ban of ASAT weapons along the lines it had already described in 1984. However, it added that it was absolutely necessary to act soon, otherwise the problem of verifiability would indeed become unmanageable. It further stated that

> "in our opinion, the extent of verification is a function of the kind of treaty that is to be negotiated and to be verified. We also feel that, in the ultimate analysis, verification is a matter of trust and political will and therefore it cannot be seen only in technical terms".[307]

To conclude, India reiterated in 1986 and 1987 the need for engaging in actual negotiations concerning the international legal régime of outer space, critizicing the *Ad Hoc* Committee's mandate which, in its view, only contributed to postponing any concrete action.[308]

COMPARISON BETWEEN THE DIFFERENT PROPOSALS

The above proposals are fairly representative of the positions held by different groups within the Conference on Disarmament on the various aspects of the prevention of an arms race in space. The purpose of the

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[306] CD/PV.262, pp. 44-46, 26 April 1984.

[307] CD/PV.333, pp. 7-15, 27 August 1985.

[308] See CD/PV.378, pp. 12, 12 August 1986; and CD/PV.392, p.7, 26 February 1987.

present comparison will be that of providing a picture of common positions in respect of a number of specific topics relevant to this issue. As a consequence of it, an analysis of the individual stances taken up by States has been avoided; on the grounds that such undertaking would exceed the scope of the present investigation.

The successive reports of the *Ad Hoc* Committee on the Prevention of an Arms Race in Outer Space bear witness to the agreement of all State members to the CD about the need to "reinforce" the present legal régime of outer space.[309] However, disagreements become apparent when it comes to deciding on the specific issues whose resolution would actually contribute to such "reinforcement".

Differences between the Western and the Socialist groups of countries are most evident when it comes to addressing the issue of space weapons which would be part of BMD systems. The latter group favours a ban on *all* space weapons, whereas the former rejects such a proposal for reasons stated in Part II of this report. Verification of compliance with the provisions of agreements is a matter of primary concern to the West. It is, therefore, likely to introduce new proposals on this subject in the near future, probably taking as a starting point the French ISMA proposal. The reasons for this interest may be related to the perception that compliance with some limited disarmament agreements of the past has been unsatisfactory due to the absence of effective verification provisions. Although the Socialist countries have repeatedly recognized the value of such verification proposals, they seem to be worried that too great an emphasis on this issue would delay concrete progress on the prevention of an arms race in space. Some Non-Aligned countries take a similar view on this subject.

On the other hand, some convergence can be perceived between a number of members of the Western alliance and their Socialist counterparts on the convenience of providing immunity to *all* satellites. But many of the Neutral and Non-Aligned countries have expressed their opposition to such a move, since it would entail sanctioning the present military use of outer space. Observers of this latter group claim that the interest of both alliances in granting immunity to all satellites results from the need to count on a satellite system to support conventional and other types of military deployments on the Earth's surface, the atmosphere and outer space, and, particularly, the components of strategic nuclear deterrence. Thus, in their view, the ASAT question would highlighten the interrelationship between nuclear and outer space disarmament issues, and the distance separating the positions of States

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[309] See, for instance, CD/726, p. 14, 19 August 1986.

members of military alliances from those held by the Neutral and Non-Aligned group. However, it still remains unclear how a control on the satellites' application could be implemented in order to facilitate distinguishing satellites for civilian purposes from those which fulfill military functions.

10. Bilateral negotiations

Multilateral negotiations on arms limitation and disarmament are intertwined with bilateral negotiations between the United States and the Soviet Union. Given the military and political weight of these powers, and their space capabilities, these two countries play a very important role within the process of disarmament as a whole. An absence of bilateral negotiations might prove to be too big an obstacle for continuing negotiations at the multilateral level. On the other hand, bilateral negotiations need to be complemented with multilateral negotiations. The latter constitute the sole guarantee that the international community's interest will be taken into account when it comes to agreeing on disarmament issues and that if a bilateral agreement is reached its endorsement and universalization through a multilateral agreement would be facilitated.

10.1. ASAT NEGOTIATIONS

Until recently, negotiations on anti-satellite weapons did not constitute the focus of bilateral US-Soviet arms limitation efforts which concentrated mainly on strategic nuclear weapons. The issue of space-related weapons arose when the development and deployment of advanced ASAT systems became an imminent possibility. In view of this, the United States and the Soviet Union opened bilateral talks on the subject in Helsinki, in June 1978. There was concern that no combination of measures could guarantee the survival of satellites in the face of the new ASAT capabilities that might arise from an unrestrained competition in this particular field. Moreover, it was recognized that such competition would add a new dimension to the strategic arms race and might further complicate the process of arms limitation and definition of strategic parity.

Negotiators of both sides faced a number of specific problems related to the following issues:

1. Definitions of ASAT weapons and of research, testing, deployment and use of these systems.
2. Dual capability of some systems not originally conceived as ASAT oriented (ABM systems, for instance).
3. ASAT capability of some retrievable and non-retrievable space vehicles and ground-based facilities, such as laser and other directed-energy installations, which could be used against satellites.

In 1979, after three sessions had been held, the ASAT talks were interrupted. There was a variety of public conjecture as to why this was done and what stage had been reached during negotiations.

Subsequently, the United States explained its lack of interest in resuming them on the grounds of its inability to resolve the verification problems that an ASAT agreement might pose.[310]

The reasons advanced by the United States were challenged by the Soviet Union, which claimed that an ASAT ban would be verifiable by national technical means. The Soviet Union proposed an ASAT test moratorium as a confidence-building measure. This idea was not new; during the ASAT negotiations of 1978 and 1979 the United States first proposed a moratorium of limited duration on high-altitude tests, but no mutual agreement was reached. The US rejected the Soviet proposal arguing that the USSR already had ASAT weapons while the US did not.[311] Moreover, the US reiterated that any such ban would be unverifiable.[312] In response to other Soviet suggestions concerning an agreement on the elimination of existing anti-satellite systems and the prohibition of the development of new ones[313], the US referred again to the problems posed by the verification of compliance with such agreement and pointed out ambiguities contained in the Soviet offer with respect to the definition of an ASAT weapon. In its view, the components of the Soviet ABM system, allowed by the ABM Treaty, had also ASAT capabilities, and even if the USSR dismantled its co-orbital ASAT system, it would keep an open option to convert some of its ABM interceptors to that role. The USSR answered that this objection could be overcome by means of a draft treaty on the Prohibition of the Use of Force in Outer Space and from Space against the Earth, which it submitted to the UN General Assembly.[314] Later on, in August 1985, President Reagan informed Congress that the United States planned soon to conduct its first test of an ASAT weapon against an object in space.[315] The Soviet Union had already let it be known that the US decision to press ahead with these tests would be regarded as an

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[310] Ronald Reagan: Report to the Congress: US Policy on ASAT Arms Control as Required by the FY 1989 Department of Defense Authorization Act. Quoted from: *Arms Control Reporter*, 1984, 573 D.1.

[311] See CD/PV. 258, p.23, 12 April 1984.

[312] Strategic Defense and Anti-Satellite Weapons. Hearing before the Committee on Foreign Relations, US Senate, Washington, DC, 1984, p.27.

[313] *Pravda*, 19 August 1983.

[314] See CD/420, 23 August 1983; Doc. A/38/194 and CD/476, 20 March 1984.

[315] *Daily Bulletin*, US Mission (Geneva)/US Embassy (Bern), No. 154, 21 August 1985; pp. 3-4.

extension of the arms race into outer space.[316]

10.2. GENEVA NEGOTIATIONS

On 29 June 1984 the Soviet Union announced its interest in disarmament negotiations with the United States, stressing the need to avoid an arms race in outer space. The Soviet offer provided for a ban on the orbiting and stationing in outer space of weapons of any kind, including manned or unmanned systems. It was further specified that such weapons should not be developed, tested or deployed either for BMD or ASAT purposes, or for attacking objectives on the Earth's surface or in the atmosphere. Weapons that had already been deployed were to be destroyed. The Soviet proposal envisaged the prohibition of all space weapons. Its specifications concerning the verification of compliance emphasized the use of national technical means. It also foresaw the possibility of exchanging information and making consultations. Finally, with the offer to commence negotiations, the Soviet Union proposed that its unilateral moratorium should be converted into a bilateral one and observed on a reciprocal basis with respect to the testing and deployment of space weapons, starting from the day the negotiations opened.[317]

The United States rejected the suggestion of a bilateral moratorium. US National Security Adviser Robert McFarlane pointed out that "the militarization of outer space began when the first ballistic systems using outer space began to be deployed. Therefore", he said, "the United States draws attention to the pressing need for the resumption of negotiations aimed at a radical reduction of nuclear weapons, on a balanced and verifiable basis".[318] Thus, the United States linked the negotiations on outer space with the reopening of the previously broken off strategic arms reduction talks (START) and intermediate-range nuclear force (INF) negotiations.

In September 1984, in his speech to the UN Géneral Assembly, President Reagan suggested a new approach to nuclear arms reductions:

> "We need to extend the arms control process to build a bigger umbrella under which it can operate - a road map, if you will, showing where, during the next

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316 *Pravda*, 20 August 1985. The US position was that the Soviet Union had already carried out such an extension and possesses the world's only operational ASAT system. The Soviet position is that it has no operational ASAT system.

317 This proposal has already been discussed when dealing with multilateral negotiations. See CD/476, 20 March 1984.

318 *Daily Bulletin*, United States Mission (Geneva)/US Embassy (Bern), No. 123, 2 July 1984; p. 8.

> forty years or so, these individual efforts can lead. This can greatly assist step-by-step negotiations and enable us to avoid having all our hopes or expectations ride on any single set or series of negotiations. If progress is temporarily halted at one set of talks, this newly established framework for arms control could help us take up the slack at other negotiations."

1985 NEGOTIATION ROUNDS

After discussing the new proposals, the United States and the Soviet Union agreed to start negotiations on the entire range of questions concerning nuclear and space arms. In early January 1985, a meeting took place in Geneva between the Soviet Foreign Minister, Andrei Gromyko, and the US Secretary of State, George Shultz. The Joint Statement issued at the end of it said that the sides agreed that the subject of the negotiations would be a complex of questions concerning space and nuclear arms both strategic and intermediate-range, with all the questions considered and resolved in their interrelationship. The negotiations would have as their objective to work out effective agreements aimed at preventing an arms race in space and terminating it on Earth and limiting and reducing nuclear arms and at strengthening strategic stability.[319]

However, from the outset it was evident that the interrelationship between the two aspects of the negotiations was interpreted differently. According to Gromyko,

> "The difference essentially consists in the fact ... that the USA wished to leave space aside and to concern itself only with those types of armaments on which talks were already held: on strategic armaments and intermediate-range nuclear armaments in Europe".

The United States understood that the "interrelationship" consisted, according to McFarlane, in the possibility of taking advantage of progress in the discussions wherever it could be made.[320] The United States stated that its SDI project was not negotiable and that it should not be included in the negotiations. From the US position, a basic interrelationship between BMD systems and offensive nuclear arms is that development and deployment of the former may hold the promise for eliminating the latter.

The first two rounds did not produce any significant results. In November 1985, a summit meeting was held between President Reagan

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[319] "Joint U.S.-Soviet Statement". In: *Daily Bulletin*, US Mission (Geneva)/US Embassy (Bern), No. 54, 9 January 1985; p. 11.

[320] *Daily Bulletin* , United States Mission (Geneva),/US Embassy (Bern), No. 8, 19 January 1985; p. 7.

and General-Secretary Gorbachev in Geneva. A Joint Statement was issued, whereby the two leaders reiterated their commitment not to seek military superiority at each other's expense and "to prevent an arms race in space and terminate it on Earth".[321]

1986 NEGOTIATION ROUNDS

On 15 January 1986, General-Secretary Gorbachev proposed a major disarmament programme aimed at the complete elimination of nuclear weapons over a defined period of time. At the same time he called on the United States and the Soviet Union to renounce the development, tesing and deployment of space weapons.[322] The United States did not address the outer space issue in its response to that offer.

At the beginning of 1986, between the fourth and the fifth rounds of the nuclear and space talks in Geneva, the Director of the US Arms Control and Disarmament Agency reiterated the proposals advanced by Washington in November 1985. They concerned

> "deep reductions in strategic offensive forces, deep reductions or elimination of US and Soviet intermediate-range forces, and a serious dialogue on defensive weapons and the offense/defense relationship".[323]

Adelman complained that the Soviet delegation to the Geneva talks refused to specify and expand different aspects of the proposal made on 15 January by General-Secretary Gorbachev. He went on to denounce the Soviet attempt to link any progress in START negotiations to a prohibition of space weapons. With regard to SDI, the United States reaffirmed its commitment to the programme and its conviction that it did not violate the ABM Treaty. Moreover, Adelman expressed that during the Geneva talks, the US had explored

> "with the Soviets ways in which a cooperative transition towards a more defense-reliant régime could be accomplished should new defense technologies prove feasible".

A few days later, Paul Nitze, Special Adviser to President Reagan on arms control, made it clear that the United States demanded from the Soviet Union the "abandonment of the ... pretense that it has no counterpart to the US SDI research effort," as a condition for starting

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[321] *Pravda*, 22 November 1985.

[322] CD/649, 20 January 1986.

[323] Kenneth L. Adelman, Director of the US Arms Control and Disarmament Agency, in the *Daily Bulletin* ,United States Mission (Geneva)/US Embassy (Bern), No. 70, 23 April 1986; p. 11.

"serious discussion of defense and space issues"at Geneva.[324] The United States added the demand to a halt in the erosion of the ABM Treaty due to what it regarded as Soviet non-compliance with its provisions.[325]

The Soviet Union's position in the Geneva negotiations followed, generally speaking, that of the different proposals advanced in the First Committee of the UN General Assembly and the Conference on Disarmament. They have already been discussed in the paragraphs above; therefore, their consideration here is unnecessary. However, some suggestions made by the Soviet side are of particular interest and throw light on the evolution of its views on outer space arms control.

On 16 June 1986, TASS reproduced General-Secretary Gorbachev's speech delivered at the Plenary Meeting of the CPSU Central Committee. There, for the first time, the USSR suggested a solution to the stumbling block represented by the disagreement of both parts in respect of the SDI programme. The USSR offered the following "intermediate option":

1. Agreeing on a non-withdrawal from the ABM Treaty for at least 15 years, restricting simultaneously "SDI work to laboratory research".
2. Limitation of strategic offensive weapons (ICBM, SLBM and heavy bombers) to equal levels.
3. Medium range forces should be dealt with separately.

The United States welcomed this initiative. President Reagan considered it to be a positive move, particularly with regard to the SDI and INF issues.

On 23 September, President Reagan announced a new proposal in which it the United States reaffirmed its commitment to adhere to the Outer Space Treaty by not deploying any weapons of mass destruction in space. It further suggested that both sides should respect the ABM Treaty until 1991, in its broad interpretation. After 1991 a new ABM treaty would be signed; its text would include a provision whereby,

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[324] *Daily Bulletin* , United States Mission (Geneva)/US Embassy (Bern), No. 74, 29 April 1986; p.4.

[325] *Daily Bulletin,* United States Mission (Geneva)/US Embassy (Bern), No. 79, 7 May 1986; p. 9.

> "if after 1991, either side should decide to deploy such a system, that side would be obliged to offer a plan for sharing the benefits of strategic defense and for eliminating offensive ballistic missiles. And this plan should be negotiated over a two year period".

The proposal ended by stating the aim of eliminating all nuclear weapons from earth.[326]

Reykjavik

On 25 July 1985 General-Secretary Gorbachev sent a letter to President Reagan inviting him to an immediate meeting. The proposal was accepted. The event was originally conceived as a preparation for a coming summit and an effort to revitalize the Geneva negotiations.

The United States' position was based on the September1986 proposal: it was willing to negotiate INF separately, but not to halt the SDI project. The Soviet Union had not withdrawn earlier proposals made during 1986, although it is safe to say that its position by October was best summarized by its June 1986 proposal. The Soviet and US versions of what happened in Reykjavik were summarized by Vladimir F. Petrovsky, Deputy Minister for Foreign Affairs of the Soviet Union, and Kenneth L. Adelman, Director of the United States Arms Control and Disarmament Agency, when they addressed the First Committee of the UN General Assembly on 14 and 20 October 1986.

According to the Soviet Union, the objectives of the meeting were to engage in new disarmament efforts, reduce the threat of nuclear war and "to begin work on agreements and on the implementation of agreements reached at the Soviet-United States summit meeting held at Geneva in November 1985". In its view, positive changes raised by the latter had begun to dwindle and the Geneva talks were "virtually deadlocked". The Soviet Union proposed that both Governments should draft three agreements on strategic, intermediate nuclear and space weapons, so that they could be signed during a visit of the General-Secretary of the CPSU to the United States.

The first draft would stipulate "a 50 per cent reduction leading to the total elimination" of strategic nuclear weapons. The second one envisaged the complete elimination of INF in Europe - leaving aside British and French nuclear capabilities - and the negotiation of those deployed in Asia. As to the space weapons draft, the USSR suggested that both sides agree to respect the ABM Treaty during ten years and to

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[326] *Daily Bulletin,* United States Mission (Geneva)/US Embassy (Bern), Supplement No. 5, 23 September 1986; p. 3.

conduct ABM research and testing for this period in laborary conditions only. The USSR considered that the ABM Treaty had to be reinforced, by means of a ban of all tests of BMD elements in space or outside research laboratories. The Soviet Union regarded this latter proposal on space arms as a compromise between its original preference for a commitment to adhere to the ABM Treaty for a fifteen or twenty years long period of time and the US wish to reduce it to five years.[327]

The US started from the premise that "the Strategic Defense Initiative and arms control are not incompatible at all".[328] It was in favour of the elimination of INF in Europe and agreed also to the elimination of strategic nuclear weapons, and suggested its implementation by means of fifty per cent cuts to be completed in two stages of five years each. In line with the earlier suggestions, it envisaged a later deployment of strategic defense systems, if SDI should prove that to be feasible, in order to limit the consequences of non-compliance with the strategic weapons disarmament agreement and to protect both sides against third countries that might acquire nuclear missiles. Soviet misgivings about defense systems offering a first-strike capability were considered to be met by "the elimination of everything that could be used for this first-strike capability, namely offensive ballistic missiles". Adelman also claimed that Soviet concern about the US using their technological development "to their disadvantage" was unwarranted since President Reagan had already offered "to share the benefits of strategic defense".

Although some important moves in traditional US and Soviet positions were accomplished during the meeting, there was no agreement on the question whether testing of space BMD systems outside laboratories should be allowed or prohibited. In the US view, the Soviet demand involved a change of the ABM Treaty and would have killed the SDI project. This, and the Soviet side's lack of pronouncement with regard to a deployment of defense systems after the ten year period proved to be, according to Adelman, the major stumbling blocks in the negotiations. The US perceived that the USSR had backed down from earlier commitments not to tie the INF negotiations with the strategic

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[327] Vladimir F. Petrovsky: "What happened at Reykjavik?" In: *Disarmament, A periodic review of the United Nations*, Autumn 1986, Vol. IX, No. 3, pp.15-26.

[328] In fact, after the summit President Reagan and Secretary of State Schultz pointed out that only the SDI project could encourage an elimination of all offensive weapons. See the President's Address to the Nation of 13 October 1986 and the Secretary of State's News Conference of 12 October 1986 in *Department of State Bulletin*, December 1987, pp. 10 and 18, respectively.

defense initiative.[329]

In spite of Reykjavik, by November 1986 the United States considered that the Geneva negotiations had not produced tangible results due to the Soviet emphasis on linking the different areas into a single package.[330] Simultaneously, Ambassador Kampelman argued that the US should embrace the "broad interpretation" of the ABM Treaty.[331] On 2 to 5 December a between-round meeting between US and Soviet experts took place in Geneva, but there were no significant changes in the positions of either side.

1987 NEGOTIATION ROUNDS

On 15 January 1987 a new round of negotiations started in Geneva. Both sides continued to hold their former positions as regards to the SDI project, and the US announced that a phased deployment of BMD could start earlier than it had been originally expected.[332] Then the Soviet Union proposed that INF negotiations should proceed separately without being tied to the other areas. Thus, its linkage to SDI was no longer maintained, and negotiations on intermediate-range missiles could proceed beyond its former deadlock. The proposal was well received by the United States, which claimed that it was in line with the US INF-proposal of 1981. As to negotiations on space weapons, they seem to have lost their priority in the light of those conducted on the INF issue. On 13 April 1987, Soviet Foreign Minister Shevardnadze and US Secretary of State Shultz met in Moscow to carry out what were described as "serious, businesslike" discussions on arms control. In May the US reiterated earlier suggestions that the Soviet Union co-operate in the transition to a defense-based military structure.[333] On 13 May the State Department Legal Adviser gave a briefing on the latest US interpretation of the ABM Treaty. While reiterating that a "broad interpretation" would be legally justifiable, the United States

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329 Kenneth L. Adelman: "What happened at Reykjavik?" In: *Disarmament, A periodic review by the United Nations*, Autumn 1986, Vol. IX, No. 3, pp. 1-14.

330 *Daily Bulletin* , United States Mission (Geneva)/US Embassy (Bern), No. 205, 13 November 1986; p. 5.

331 *Daily Bulletin*, United States Mission (Geneva)/ US Embassy (Bern), No. 207, 17 November 1986; p. 6.

332 *Daily Bulletin*, United States Mission (Geneva)/US Embassy (Bern), No. 15, 26 January 1986; p. 3.

333 *Daily Bulletin* , United States Mission (Geneva)/US Embassy (Bern), No. 83, 5 May 1987; p. 1.

confirmed its decision to commit itself, for the time being, voluntarily to the "restrictive interpretation" of that instrument.

CONCLUDING REMARKS

There are a number of issues which emerge from an analysis of the process of bilateral negotiations on space weapons. It has been considered convenient to identify them because they concern the likely future evolution of those negotiations. The first observation touches upon the negotiability of the SDI project. Another involves the problem of consolidating the ABM Treaty, while the last is related to the question of whether space arms control and, specifically, the SDI project, should be linked with or detached from disarmament negotiations in other areas.

The United States has declared that the SDI project is non-negotiable. Its position follows from the evolution experienced by its strategic thinking towards a reformulation of the offensive-defensive relationship, wherein the development of space BMD systems has become a cornerstone. Moreover, the US maintains that SDI is necessary as a hedge against what it considers Soviet research in the same technologies. The Soviet Union opposes such views and will not accept any testing or development of the elements involved in the SDI project beyond the laboratory stage. In its view, the SDI programme is also a subject of the nuclear and space talks in Geneva.

The second topic, namely, the consolidation of the ABM Treaty, has been addressed by both Parties. Indeed, they have reiterated the need to stop the process weakening this instrument, accusing one another of promoting this process. The Soviet Union claims that reinforcement measures should concern both the adoption of a commitment whereby neither part would make use of its right to withdraw from it, and the agreement by both States that no testing and development of BMD systems[334] would be made outside laboratories, that the parties would respect the restrictive interpretation of the Treaty's provisions. The United States has agreed on this latter point for the time being. However, it has demanded that after 1991 a new treaty should be negotiated, bearing in mind the possibility of developing, producing, and deploying BMD systems in space.

The respective positions of both Parties on these two issues do not seem to allow for any major breakthrough. Things have turned out to be different with respect to the question of linking the different areas of

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334 This does not relate to BMD systems, as they are allowed by Article III of the ABM Treaty (fixed, land-based, up to 100 launchers and interceptors).

arms control negotiations. The Soviet Union has abandoned earlier positions of opposing separate negotiations on INF. However, there has been no hint so far that an agreement could be reached over decoupling the negotiations of space weapons from those of nuclear strategic missiles.