Document Title: New Technology and the Militarization of Space

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Date(s): 12 June 1983

Document Type/Physical Description : Type-written, 12pgs

Fonds/Collection Name: George Lindsey Fonds

Series: Space

File/Box Number: 2/1

Original Archival Reference: N/A

Item Description: This document is a typed paper that Lindsey wrote and presented at the Second Canadian Student Pugwash National Conference.

Keywords: Outer Space Treaty (1967); militarized space technology; verification of arms control treaties; space radar and sensors; ship surveillance; anti-satellite satellites (ASAT); ballistic missile defence (BMD); US: USSR

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NEW TECHNOLOGY AND THE MILITARIZATION OF SPACE

by

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Presented at

The Second Canadian Student Pugwash National Conference

June 9-12, 1983

Ottawa

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The Outer Space Treaty, which entered into force in 1967 and has now been ratified or acceded to by 76 countries, establishes space for exploration and peaceful use. It precludes the installation of military bases on, or any national appropriation of celestial bodies. It forbids the placing of nuclear weapons or other weapons of mass destruction in orbit around the earth, or otherwise stationed in outer space. It makes the launching state liable for any damage done to another state.

This treaty appears to have been strictly observed for sixteen years, so one might ask why there should be concern today about the dangers of militarization of space. There are two answers to the question: the treaty does not forbid all weapons in space, and new technology offers certain possibilities that could pose dangers in the future. There could also be a comment that space is already "militarized", but there may be legitimate concern regarding the prospects of it becoming "weaponized".

However, before we accuse new technology of being a source of insecurity, it must be pointed out that it has brought capabilities associated with space vehicles that are distinctly beneficial for international stability, and which need to be encouraged and protected. It is necessary to examine each application of space technology, identify what it makes possible, and then try to assess the consequences.

The rapid advance in space technology is making it possible to launch ever larger space vehicles, to construct and repair objects in space, and to maintain human astronauts in orbit for long periods. But quite apart from the increasing size, and the ability to have human operators in the vehicles, the instruments of observation have been improved to a remarkable degree.

Verification of arms control treaties, and confidence in the assessments of many of the key elements of military strength are coming to depend more and more on the extraordinarily detailed photographs now taken by reconnaissance satellites. These have allowed the deployment of the major strategic weapons such as ICBMs, missile-firing submarines, and bomber aircraft to be monitored with high confidence, and have made possible the close observation of military activities in times of crisis.

Supplementing the information gathered by photographic means, several other types of satellite-borne sensors have been extremely useful in the monitoring of the tests of weapons, including rockets as well as nuclear devices. The launching of large rockets can be detected by their infrared emissions, while control signals, radar, and telemetry from missiles and satellites in flight can be received by ELINT satellites. Thus, the experimental tests of new weapons can be followed in some detail, providing the means of verifying undertakings not to develop certain systems. Explosions of a nuclear device at or above ground level anywhere on earth would probably be detected by a space vehicle.

It must be remembered, however, that much could be done to deny effective observation by satellite. Installations could be covered over, exposure of moving vehicles could be kept to the hours of darkness, and telemetry could be enciphered. Instead, it has been the policy to give tacit assistance to this monitoring by non-intrusive national technical means, by not adopting these passive means of interference.

The same photography and recording of radar, communications, and telemetry that is so useful for verification of arms control agreements and monitoring of the deployment of weapon systems can be used to observe military activities during a crisis, and could also be employed for the preparation and conduct of military operations, including a surprise attack. For these purposes radar satellites could prove valuable adjuncts, since they can make their observations at night, and through cloud, and are better than photographic satellites for the surveillance of surface ships over large areas of ocean. But the observation of military activity during a crisis has a stabilizing character insofar as it can provide reliable early warning of the approach of missiles, aircraft, or warships.

Today the most reliable warning of the launching of large rockets, whether from land or sea, comes from surveillance satellites. Although the technology is not yet proven, it is probable that tracking of aircraft and possibly cruise missiles at any altitude will become feasible from satellites.

Thus, we see that the remarkable capabilities of satellites for detecting activities on the earth's surface provide an extremely valuable means of verification for arms control, together with services to the gathering of military intelligence that could be used in a crisis for both offensive and defensive purposes.

There are several other applications of satellites which have proven of immense value for non-military activities, but which also serve military purposes. The most important is for long range communications. The limitations of unreliable radio paths and narrow bandwidth submarine cables can be completely overcome by the use of communications relay satellites. Weather prediction has been advanced by enormous steps due to the observations of meteorological satellites. Mapping and delineation of earth resources owes great debts to photo, geodetic, and other types of scientific satellites. However, communications are vital for military as well as commercial operations, and it has been estimated that 70 to 80 area, it is probable that this could be done by the detonation of a nuclear explosion in a satellite.

For the attack of satellites in orbit, two methods have been developed already and more are on their way. Between 1960 and 1971, the United States experimented with ground-based missiles, designed for the ABM role, to make direct ascent to intercept orbiting satellites, while the USSR developed anti-satellite (ASAT) satellites to be launched from the ground and manoeuvred into an orbit nearly coincidental with that of the target satellite. This latter method has the advantage of allowing leisurely inspection of the target satellite if the intercepting satellite has the necessary instrumentation. The Soviet test program was reactivated in 1976, and has included explosion of the ASAT vehicle. The USA is now perfecting an ASAT interceptor, to be launched from an F15 aircraft and subsequently climbing to collide with the target satellite.

Of all the new weapon technologies under research today, the one that appears to have the largest potential for space applications is that of Directed Energy Beams. A favourite of science fiction for many years, the "Death Ray" is usually depicted as instantanteous and weightless, destroying everything in its path. Two possible ways of accomplishing something like this are to generate beams of charged atomic particles, or of electromagnetic radiation with wavelengths in the optical or possibly the X-ray bands. To make effective weapons, it would be necessary to generate high power, and to be able to direct the energy in a narrow beam that could be finely focussed and aimed with great accuracy. At the present time great rumours, claims, and expectations are being circulated, with the laser beam appearing to be the more likely eventually to produce a practical weapon.

If Directed Energy Weapons are to be used against satellites or missiles in flight, it is not clear whether it would be more practical to mount the projector on the earth's surface or in a space vehicle. The earth's atmosphere is likely to pose difficulties for efficient propagation of the energy, suggesting that the space-to-space path is the most effective. On the other hand, generation of a high powered beam requires heavy equipment and large quantities of fuel or power, probably too much to be easily accommodated in a space vehicle.

Since ballistic missiles are considered to be far more of a direct threat than are satellites, more priority is given to Ballistic Missile Defence (BMD) than to ASAT. BMD is a more difficult task, since a small reentry vehicle with a protective heat shield is a much tougher target than a satellite equipped with delicate instruments and solar panels. If a BMD system attempts to engage a missile in the first part of its trajectory, during which the booster rockets are far more vulnerable than the reentry vehicles. Moreover, any slight deviation from the planned trajectory will probably prevent accurate delivery of the warheads. For this type of interception it will certainly be necessary to mount the antimissile device in an orbiting space vehicle. Boost phase intercept offers the added advantage of engaging before multiple warheads have separated on their different paths.

A BMD system attempting to engage the missile in mid-course (i.e. after the end of the propulsion phase) could be based in space or on the ground, while one designed for interception in the terminal phase of the missile's trajectory (i.e. just prior to and during atmospheric reentry) would probably be based on the ground. Both might rely on information fed to them by a satellite able to track the missile and perhaps to distinguish actual warheads from decoys used to confuse the defence.

When the possibility of Ballistic Missile Defence is taken into account, two conclusions emerge regarding the "militarization of space". First, it is quite probable that a future BMD system will involve space vehicles, whether as carriers of sensors or of the ABM weapons themsevles, and especially if the system carries out its interception in the boost phase or in mid-course. Second, should mid-course or terminal phase BMD be deployed, it will have an ASAT capability against satellites in low-earth orbit.

As regards ballistic missile defence and existing arms control provision for space, the relevant agreement is the ABM Treaty, part of the bilateral SALT I accord signed by the USA and USSR in 1972. It forbids development, test, or deployment of an ABM system or components which are space-based. Moreover, as regards the use of Directed Energy Beams for BMD, the parties to the SALT Treaty agreed that in the event that ABM systems based on other physical principles are created in the future, specific limitations on such systems and their components would be subject to discussion. Thus it would appear that neither satellites nor Directed Energy Weapons can be employed for BMD without a revision of the ABM Treaty.

If no restrictions are placed on ASAT, and if Directed Energy Beams can be made into effective ASAT weapons small enough to be carried by space vehicles, a whole host of different types of space warship can be imagined, even if BMD should not be pursued. However, they will be limited in their freedom of action by Newton's inexorable laws of mechanics. It takes an enormous amount of energy to accelerate matter to the velocity needed to keep it in orbit around the earth. The higher the orbit, the more energy. This initial energy is expended by the huge booster rockets.

After the vehicle has adopted its orbit, to cause a significant change to the velocity vector also requires a lot of energy, and now this must come from fuel on board the vehicle itself. Space vehicles will not reverse course, or engage in the "dog fight" manoeuvres of fighter aircraft, which can turn using aerodynamic forces. There may be certain orbits or regions of space offering important tactical advantages, and consequently becoming subject to special competition. Two examples would be the 24-hour geostationary orbit, already becoming densely populated by communication satellites, and the "Lagrangian Points" near which an object will remain in a stable stationary position with respect to both earth and moon.

What is not clear is the desirability of control or prohibition of ASAT. Neither is it clear that a prohibition of ASAT could be adequately verified. It is not impossible that the best outcome for international security and stability in a crisis would be to have certain types of ASAT available on standby for use in a situation in which violence had broken out but in which intelligent efforts were being made to contain it without escalation. The existance of an ASAT system could be a deterrent to an aggressor who was contemplating an attack which depended for its success on the efficient functioning of his own satellites. However, from the point of view of arms control it is not difficult to foresee a race to achieve an ASAT capability, together with the development of countermeasures and counter-countermeasures. If, on balance, the current activities of space vehicles are considered to be more stabilizing than destabilizing, it would seem wasteful and dangerous to devote great resources to the building and the countering of Anti Satellite weapons. Moreover, a competition in the development of ever more powerful weapons to be used against satellites would be very likely to lead to the existance of weapons in satellites for use against targets on the earth. The decade of the 1980s is the right time to assess the situation before such developments have come to fruition.