Weaponisation and Militarisation of Space

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Introduction

Outer space is an environment that has long fascinated mankind, who have, from the dawn of time, tried to interpret its significance for us mortals down below. The recent years have seen not only scientific and astronomical success in investigating outer space, but also a remarkable growth in its utilisation for a wide range of civilian and military purposes. Today, it is estimated that there are some 1,000 satellites in operation, owned by over 60 countries. Importantly, no longer is exploitation of outer space the preserve of a small group of advanced industrialised countries. A dozen countries currently have the capacity to place an object into orbit and an even larger number own and/or operate satellites. The developing countries, besides the developed ones, are increasingly found to be possessing satellites, and practically every country is a consumer of space-based services in some form or the other.

A vast array of functions, from remote sensing of ecological and weather activity, to communication and navigation services is being performed via space-based assets. These assets have not till now been threatened from space or the ground and have been able to operate freely.

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This condition, in turn, reflects the status of outer space as a global commons: "the province of all mankind", the use of which shall be for "peaceful purposes" and "carried out for the benefit and in the interests of all countries".

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Even as space has been explored extensively for peaceful and commercial purposes for the benefit of all across the globe, the military planners, on the other hand, are focussed on militarisation and weaponisation of space to establish their supremacy over the other military users of space. It is not only missiles that can traverse outer space or satellites that can spot targets and guide the missiles, but weapons could be permanently placed outside the Earth's atmosphere, and then, on a signal from the earth, bombard target bases and cities. These two uses of outer space—one for the peaceful purpose of benefit for humans and the other as a venue for war and synchronised killings—coexist. That's the paradox of today's world, where peace comes from deterrence and weaponisation; and even outer space, God's sole preserve, has not been left out. The focus of this article is to give an overview of the weaponisation and militarisation of outer space.

Missile Defence: The Prelude to Space-Based Weapons

The first military use of outer space was the development of Inter-Continental Ballistic Missiles (ICBMs). The second was the defensive system designed to stop them. As far as the technology is concerned, much of it developed for ground-based missile defence is being exploited to design missile defence, launched from outer space, and is also applicable to space weaponisation. The concept of a missile defence system is based on when and where to destroy the enemy missiles on their flight path to the intended target.

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One possible means of defence is to destroy the enemy's missile sites at the launch site, before the missiles are launched. This requires outer space satellites to identify the sites. The possible danger in such an option, where a missile (most likely with a nuclear warhead) is destroyed in the enemy's own territory, is that the enemy, would, in most likelihood, retaliate with its remaining missiles. Another option could be destruction of enemy missiles in the boost phase, which seems a practical option because the relative speed of the missile in the boost phase being slow, the missile would not yet have the opportunity to disguise its flight through deceptive decoys. However, the challenges of stopping a missile attack during the boost phase are formidable. Firstly, a boost phase attack would require the launching system of the missile defence to be close to the area of launch so that the anti-missile could reach the missile while it was still in the atmosphere. It is not possible to keep land or ship-based missile defence so close to the enemy's launch site for obvious reasons. In case the missile defence system is orbital, with satellites circling the earth approximately every ninety minutes, it would require an enormous number of satellites to ensure that at least one satellite was close enough to hit the missile in the boost phase. The cost of such a system would be prohibitive. No country has yet been able to develop an effective "boost phase" defence.

Halting a nuclear armed missile as it homes down upon its target at twenty times the speed of sound in the "terminal phase" does not seem viable, because in the event of the missile actually being hit, the explosion would rain destruction on the land being defended. Therefore, the most compelling option is to destroy the missile in mid-course, after it has left the atmosphere, as it transits outer space and before it reenters the atmosphere close to its target.

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In current missile construction, the missile disgorges its nuclear weapons during the 25 to 30 minutes of transit time in outer space. These nuclear weapons then reenter the Earth's atmosphere to land independently on their targets. One missile can carry up to ten separate hydrogen bombs, which can be released together or separately. Prior to their release, or as the bombs are disgorged, they can be accompanied by similar balloons, decoys with the same shape and temperature as the warheads. To an anti-missile device, the decoys are indistinguishable from the warheads. Any defensive system can be overwhelmed by decoys, which could number up to a hundred per warhead. As they would encounter no resistance in outer space, the balloons (decoys) and warheads will travel at the same speed. If the decoys have the same shape and temperature as the warhead, the sensor system of a defensive weapon system designed to destroy these bombs will, therefore, be unable to discriminate between the decoys and the bombs. It is technically easy to build these decoys which are much cheaper than the warhead itself; decoys would invariably accompany the real warhead, thus, posing a serious problem of destroying the missile in outer space. After almost 60 years of research, the decoy issue remains unsolved and it is a known fact that the US ground-based missile defence system does not offer a complete solution to the problem of multiple decoys.

With all the options considered and found unworkable, the truth is inescapable. A foolproof missile defence system is simply not feasible in the foreseeable future. This realisation has led to consideration of yet other option i.e. weaponisation of space through the ambitious projects that the US undertook like the Strategic Defence Initiative (SDI) and "Star Wars".

The development projects for militarisation and weaponisation of outer space have been on the increase with the aim of one country achieving military dominance over the other in outer space.

Why Militarisation and Weaponisation of Space?

The militarisation and weaponisation of space are fundamentally at odds with constructive commercial and scientific projects. The war in space would destroy the intrinsic trust and cooperation necessary to maintain the systems deployed in space for peaceful purposes. Despite these facts, the development projects for militarisation and weaponisation of outer space have been on the increase with the aim of one country achieving military dominance over the other in outer space.

The desire to establish military supremacy in outer space emerges out of two basic apprehensions; firstly, lack of faith in the present missile defence system to stall an incoming ICBM armed with a nuclear warhead and, secondly, to preserve own satellites in space against other Anti-Satellite (ASAT) weapons. Besides these two reasons, the deployment of weapons in space would also give supremacy to a country in the conduct of war over the land, sea and air.

Concept of Weaponisation of Space

The concept for space weaponisation came up in the early 1980s through the "Strategic Defence Initiative" (SDI) also known as the "Star Wars" programme of the United States. The idea was to put a large number of satellites into orbit that would detect the launch of enemy missiles and then shoot them down. This space-based anti-missile defence was conceived not as a substitute for ground-based defence but as part of the concept of multi-layered defence which also included sea-based interceptors that are carried onboard ships and the ground-based Terminal High Altitude Area Defence (THAAD), the system designed for the engagement of the short and medium

range missiles. Essentially, the idea was to form a protective shield against possible missile attacks carrying nuclear warheads.

Like any other air defence system, the space-based system is prescribed to comprise sensors to detect and track the enemy missile from its very launch and the kill weapons that would destroy it along with the associated command and control elements. Development was undertaken of space-based sensors onboard satellites for surveillance, detection and tracking of enemy missiles, and space-based laser weapons and interceptors for thier destruction. The multi-layered approach envisioned engagement of enemy missiles by ground and sea-based weapons as a last resort if the space-based weapons miss their targets.

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Militarisation Vs Weaponisation of Outer Space

Spatial weaponisation refers to the placement in orbit of space-based devices that have destructive capacity. Ground-based systems designed or used for space-based attacks also constitute space weapons, though they are not technically part of the weaponisation of outer space since they are not placed in orbit. Weapons that travel through space in order to reach their targets, such as hypersonic technology vehicles, also contribute to the weaponisation of space. Many elements of the missile defence system currently being deployed or planned could constitute space weapons as well, as many possess "dual use" characteristics, allowing them to destroy space assets as well as ballistic missiles.

On the other hand, militarisation of outer space refers to the use of space in support of ground, sea and air-based military operations. It

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also includes developing assets to be based in space with supporting ground infrastructure for military use such as early warning, communications, command and control, Position Navigation and Timing (PNT), monitoring (remote sensing), and National Technical Means (NTM) that can be used for verification, surveillance and intelligence purposes. It helps improve command and control, communications, strategic and battlefield surveillance and weapon targeting.

Weaponisation is, therefore, a subset of militarisation and there is only a subtle difference between the two. If one envisions a continuum running from space systems being used for civil purposes to satellites providing services to support terrestrial military operations, to satellites being an integral part of terrestrial weapon systems or the weapons themselves being deployed in space, the weaponisation occurs when the upper range of the spectrum is reached. At its most extreme, space weaponisation would include the deployment of a full range of space weapons, including satellite-based systems for Ballistic Missile Defence (BMD), space-based Anti-Satellite (ASAT) weapons and a variety of Space To Earth Weapons (STEWs).

Two subsets of weaponisation of space are space control and space force application. Space control/denial (or space dominance) missions involve protecting orbit assets of own and friendly countries, attacking enemy assets and denying enemy access to space. The primary means of achieving these tasks are either launch suppression, or destroying or degrading the performance of the enemy satellites. These actions can either be defensive (protecting friendly assets) or offensive (denying the enemy the benefits of space-based assets). It is more or less analogous to sea and air control/denial, both of which likewise involve ensuring

friendly access and denying the same to an adversary.

Space force application envisages attacking terrestrial targets from space-based weapons which would reduce the reaction time, the cost of human attrition and the other associated problems of attacking strategic targets. The idea of having satellites/space planes orbiting overhead, awaiting a signal to rain down weapons constitutes a part of space force applications of weaponisation of space.

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Satellites as Vehicles of Space Weapons

Most of these weapons are planned to be deployed in satellites orbiting the earth. The Low Earth Orbit (LEO) satellites are approximately 300 to 1,000 km above the earth and circle the earth in an hour and a half to three hours. The speeds in LEO are very high in the range of 7 to 8 km per second i.e. 30 times faster than a 747 jet aircraft. Satellites in LEO orbits are used for high resolution imagery of the earth. The Medium Earth Orbit (MEO) satellites go around the earth less frequently and are used for the Global Positioning System (GPS) and navigation systems. Geosynchronous Orbit (GEO) satellites are stationed 36,000 km above the earth, with 24 hours orbital time at the same rate as that of the earth. These are mostly communication and weather satellites.

Once the orbit of the satellites is known, it can be accurately tracked and, thus, is vulnerable to attack. A Medium Range Ballistic Missile (MRBM) can knock out a satellite in LEO. Such a missile can be launched from the ground or the air. Also effective would be a nuclear explosion which would create an electron belt that would damage all the satellites

passing through the belt. Knocking out a satellite in GEO and MEO is harder to accomplish as it would take approximately a trip of five hours by a missile or a directed energy weapon. During the wars in the Middle East, the United States had demonstrated its dependence on satellites for military reconnaissance, communication, target identification, weapon guidance, fire direction and command and control of the battlefield.

The need for protection of these sophisticated satellites has led to the development of equally sophisticated weaponry to protect them – mostly designed to be based in space. These include counter-jamming devices, shielding against blast and radiation and "redundancy" – the deployment of more satellites than necessary to insure against loss. Weapons have also been developed to protect the ground station from which such missiles are launched.

Research and Development in the Field of Space Weapons

Apart from the defensive measures, the dependence on satellite directed warfare has led to the development of aggressive means to destroy or counter the space capacity of other countries. The United States is the world leader in developing the "Star Wars" technologies and space-based weapon systems. The major categorisation of these could be: reconnaissance weapons, intelligence weapons, ASAT weapons and direct strike weapons to include Directed Energy Weapons (DEWs), Particle Beam Weapons (PBWs), Kinetic Energy Weapons (KEWs) and nuclear detonations.

At present, it appears that the United States' programme for developing space weapons is leading the field by some margin. Some of its declared projects for space weaponisation include:-

- **Space-Based Lasers (SBLs):** These would operate in LEO and destroy hostile ballistic missiles during their boost phase. These are further divided into two types:
  - *Chemical Lasers* (MIRACL—Mid-Infrared Energy Chemical Laser): This is a joint US-Israeli programme to develop a point defence

system to defeat mortars, rocket, artillery and cruise missiles.

- *Solid State Lasers (SSLs):* The technology is leading from chemical lasers to solid state lasers, as their potential is far greater. They have no ammunition *per se;* whereas chemical lasers require chemicals, the SSLs require only electricity.

- **Space-Based Missile Interceptors:** The satellites in this system would destroy their targets through kinetic contact i.e. by ramming them with the extraordinary speed possible in LEO.
- **Electro-Magnetic (EM) Rail Guns:** These are probably going to be the heart of any STEW. They are set to replace all conventional cannons in the future and have the utmost potential for deployment in space.
- **Evolutionary Air and Space Global Laser Engagement (EAGLE):** This project will put mirrors underneath a huge airship. Lasers fired from either the ground/air/space would bounce off these blimp-borne mirrors to track or destroy the enemy missile.
- **Space-Based Infra-Red (SBIR):** This system will be used to guide ballistic missile defence interceptors in three phases i.e. boost, mid-course and terminal. It would also provide warning of missile launches and greatly expand capabilities for intelligence, surveillance and reconnaissance. It would be deployed in LEO and GEO.
- **Space Tracking and Surveillance System (STSS)**: This will be a constellation of LEO sensor satellites that will track enemy missiles, discriminate between warheads and decoys and assess the outcome of possible interceptions.
- **Anti-Satellite (ASAT) Weapons:** A whole range of supporting technologies is presently underway for the development of anti-satellite weapons. These include: high powered lasers, micro-satellites, Kinetic-Energy Anti-Satellites (KE-ASAT) weapon, Near Field IR Experiment (NFIRE), etc.
- **High Altitude Nuclear Detonations:** These are effective methods of destroying satellites and are within the capacity of all nuclear capable countries.

- **Global Strike Programme**: This project envisions dropping sensors or bombs anywhere on the earth's surface from outer space, with 30 minute response time.
- **Common Aero Vehicle (CAV)**: This project envisions an unmanned manoeuvrable spacecraft armed with intelligent sensors and loads of munitions. This would have global reach capability against high pay-off targets.
- **Rods from Gods**: Also called the brilliant space weapon, this would dispatch 20-feet-long orbital tungsten or uranium rods that would enter the earth's atmosphere using the accelerating force of gravity to attack ground targets at speeds higher than 10,000 km an hour.

Pitfalls of Space Weaponisation

The ensuing arms race for weaponisation of outer space would create an environment of uncertainty, suspicion, miscalculations, competition and aggressive deployment between nations, which may lead to war. It would put at risk the entire range of commercial satellites as well as those involved in scientific explorations. The problem of space debris, radio frequencies and orbital slots are some of the other alarming issues that would get further muddled should space weaponisation be resorted to in the real sense.

The testing of missile defence systems is already posing a danger to people and spacecraft by its production of debris. Due to the very high speed in low orbit, about 10 km/sec, particles less than one-tenth of a millimetre in diameter can damage satellites and spacecraft. When debris in LEO returns to the Earth, it poses a lethal danger to people and to property.

The mid-course missile defence, which shatters missiles in outer space, poses enormous dangers because it would create a massive amount of debris. The same kind of dangers would be created by space-based interceptors. If there were hundreds of interceptors in low earth orbit, the dangers would be immense, because the interceptors themselves

would collide with already existing debris, as well as producing debris themselves, creating space-based turmoil.

Another casualty to be incurred by weaponisation of space, in addition to the destruction wrought by debris, is the coopting of scarce radio frequencies and orbital slots. As the peaceful scientific and commercial operations in space increase yearly, so does their reliance on radio frequencies and their need for an orbital path, particularly in the geosynchronous orbit. A major problem is that a country that deploys a military satellite is reluctant to disclose its orbital slot and radio frequency, fearing that such information could be used by an adversary to track the satellite, with the possibility of shooting it down or jamming the signal. Another problem is that countries, particularly developed ones like the United States, may reserve an orbital slot and may not use it for several years, thus, monopolising the diminishing number of orbital slots. These actions have rightly become a source of international tension.

Preventing an Arms Race in Outer Space

The overwhelming majority of UN member states are concerned that the weaponisation of outer space will lead to an arms race and insist that a multilateral treaty is the only way to prevent this. Towards this, an Outer Space Treaty was conceptualised by the United Nations in 1967. The treaty emphasises the fact that the exploration of outer space should be beneficial to all mankind and nations and it should be for peaceful purposes. It claims that one nation cannot claim national sovereignty in outer space. Over 100 nations have signed and ratified this treaty and 26 nations have signed the treaty but have yet to ratify it.

The UN is further striving to improve and facilitate the inhibition of an arms race in outer space by strengthening the 1967 Outer Space Treaty through various committees on prevention of an arms race in outer space and resolutions on establishment of transparency and confidence-building measures in outer space.

"Peaceful uses" of outer space include military uses, even those which are not at all peaceful, such as using satellites to direct bombing raids or to orchestrate a "prompt global strike" capability, which is the ability to control any situation or defeat any adversary across the range of military operations.

Conclusion

As far as anyone knows, currently, no weapons have been deployed in space. The United States has invested in developing potential technologies and both the US and China have demonstrated anti-satellite capabilities. Although space has not been weaponised, it has been militarised since 1960 when the earliest communication satellites were launched. Today, militaries all over the world rely on satellites for command and control, communication, monitoring early warning and navigation with the GPS. Therefore, "peaceful uses" of outer space include military uses, even those which are not at all peaceful, such as using satellites to direct bombing raids or to orchestrate a "prompt global strike" capability, which is the ability to control any situation or defeat any adversary across the range of military operations. It is, therefore, evident that militarisation of space itself is enough to cause tensions among nations, and in case weaponisation of outer space is also resorted to, it would bring numerous harmful effects, as discussed in this article. Thus, it becomes imperative that countries like the US and Israel which have been abstaining from UN sponsored efforts to prevent an arms race in space are coerced by the international community to fall in line and abide by all the provisions of the Outer Space Treaty to ensure that weaponisation of space does not take place.