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A Worldwide Desire for the Peaceful Use of Space Did Not Prevent its Militarization. Will Moral, Ethical and Legal Arguments Prevent its Weaponization?

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ABSTRACT

Space has long been militarised but not yet weaponized. This paper argues that space weaponization is inevitable and that moral, ethical and legal arguments will not prevent it. Information drawn from contemporary academic literature has been used to frame the current debate regarding weaponization. Pro-weaponizers would agree that military utility is the most convincing argument for placing weapons in the 'ultimate high ground'. Pro-sanctuary lobbyists employ various arguments against weaponization but all would seek to achieve this through international treaties. This paper argues that the realist behaviour of states in the international system means that space will be weaponized when the benefit of doing so outweighs the cost.

"It's politically sensitive, but it's going to happen. Some people don't want to hear this, and it sure isn't in vogue, but – absolutely – we're going to fight in space. We're going to fight from space and we're going to fight into space. That's why the US has development programs in directed energy and hit-to-kill mechanisms. We will engage terrestrial targets someday – ships, airplanes, land targets – from space."

- Gen Joseph W Ashy, Commander-in-Chief US Space Command.[1]

INTRODUCTION

Despite claims that the 1991 Gulf War was the first 'space war'[2], space remains militarised but not weaponized.[3] However, there is a certain inexorable inevitability that the status quo will change and it will change soon. Reacting to the developing geopolitical environment, the space weapons debate has become more polarised and the pro-sanctuary[4] lobbyists more vocal in their calls for space non-proliferation. This paper will argue that to some, the benefits of space weaponization will soon outweigh the financial and political costs and as such weaponization is inevitable. Where man and man's interests have gone, weapons have almost always followed; in the few cases that they have not, there has been no military utility in them doing so. Moral and ethical arguments have and will be used in an attempt to prevent weaponization but even if consensus can be reached, the international community is not strong enough to create or enforce a binding treaty that bans space weapons.

In order to place the space weapons debate in context it is essential to understand the strategic importance of space and to consider the space environment; these are the purposes of the first two sections of this paper. The first section explains how modern civilian society and military commanders are becoming increasingly reliant on the use of space and, in fact that space systems have brought about a revolution in military affairs. The second section seeks to explain that space has become (after land, maritime and air) the fourth physical military environment[5]. Space is not simply an extension of the air environment and this paper seeks to characterise it and make definitions that allow the space weaponization argument to be properly explored. The paper will explain that space is not a vast featureless darkness but a topography described by gravity and radiation that creates areas of overcrowding, strategic hubs and celestial lines of communication

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[1] From Aviation Week and Space Technology, 9 Aug 96; reproduced here as it appears in Shah, Anup 'Arms Control – Militarization of Outer Space', www.globalissues.org/Geopolitics/Armscontrol/Space.asp.
[2] Attributed to US Air Force Chief of Staff Merrill McPeak; as used in 'Background Paper, "Peaceful" and Military Uses of Outer Space: Law and Policy', (Montréal: McGill University 2005).
[3] Most debate regarding space weapons has taken place in an American context; hence the American convention on spelling has been adopted for 'weaponizing' etc.
[4] 'Pro-sanctuary' is used throughout this paper to denote those who wish to keep space weapon-free.
[5] British Defence Doctrine also considers the Electro-Magnetic Spectrum and Computer Space as environments, but for the purposes of this paper only the physical environments are considered.

with significant choke points. Having defined and described the space environment the paper will offer a definition of space weapons before using the third section to explain their characteristics and utilities. The definition of space weapons offered here is intended to be 'a' definition that allows the question posed by this paper to be properly considered. There are a number of possible definitions of space weapons and by the measure of some, space is already weaponized. In fact it is probably better to consider space weaponization as a philosophical area that is traversed rather than a line or point that is reached and crossed in a single step. By understanding the characteristics of space weapons, one is better able to examine the potential targets that they might engage and consider whether a space-based system is the best solution to particular target sets.

The central argument regarding the question posed by this paper is addressed by the two largest sections. Firstly the issue of who would weaponize space and why they would wish to do so is approached. The paper will contend that the most likely weaponizers will be the major nation states and most obviously the US. To some, space represents the ultimate high ground and space assets could enjoy unrestricted and timely access to all surface targets. Therefore, this paper will conclude that the most convincing argument for weaponization is that of military utility. Secondly, the moral, ethical and legal arguments against weaponization will be explained and the three major pro-sanctuary groupings described. Though the various pro-sanctuary groups have different reasons for opposing space weaponization, they seek to achieve their goal through similar means, international treaty; this, it will be argued, shows that despite lofty intentions these attempts seem doomed to fail.

The failings of the moral, ethical and legal arguments will be explained by the final section of the paper when human nature and the behaviour of states within the international system are discussed. Even if mankind's natural state is not war then it would take a supreme optimist not to recognise the self-interests not only of the individual, but of the state. The international system and the behaviour of states are dominated by national interests and the balance of power, Realism is not, as Condoleezza Rice suggested[6], dead - it offers an explanation for the inevitability of space weaponization. There is no Leviathan[7] in the international community that could enforce a space weapons ban but there is a single global superpower that will not concede her considerable military and technological advantages; if one of the means of maintaining those advantages is perceived to be space weaponization then, surely, a time will come where the benefit of deployment will outweigh the costs.

[6] Rice, C, Washington Post, 11 Dec 2005.
[7] The Leviathan was a representation of the state or ruler that enforced peace within the state as described by the seventeenth century writer Thomas Hobbes in his 1651 work *The Leviathan*.

A worldwide desire for the peaceful use of space did not prevent its militarisation. This paper argues that human nature and the behaviour of states will mean that moral, ethical and legal arguments will not prevent space weaponization.

THE STRATEGIC IMPORTANCE OF SPACE

"Who controls low-Earth orbit controls near-Earth space. Who controls near-Earth space dominates Terra. Who dominates Terra determines the destiny of humankind."[8]

Global strategic trends indicate that geopolitics in the coming quarter of a century will be characterised by increased interdependence and intensifying competition.[9] The globalisation that leads to interdependence is not possible without access to space and space systems. Space is *the* key enabler for the rapid global communications and transactions that power the world's economy. There is barely a credit card transaction or cash withdrawal from an ATM in the developed world that is not facilitated by the communications satellites orbiting our planet. Instant worldwide voice and data communications as well as immediate access to broadband internet are taken for granted by so many; the developed (and rapidly developing world) needs access to space systems lest economies falter: space is vital for commerce. The world benefits in many ways from the exploitation of the space environment. Satellites that provide imagery, by whatever means[10], support agriculture and survey for land use and resources; exploitation of this information is enhanced by the precise positioning given by satellite navigation. In the near future, research into the benefits of space manufacturing is likely to open-up new opportunities; this and the exploitation of space mineral and energy resources have the potential to create an extra-terrestrial economy and a requirement for a greater presence of man in space. Where man and man's interests have gone then conflict has usually followed.

The burgeoning space industry is itself a source of great wealth creation; the international commercial space sector was worth $80 billion in the year 2000, with revenues predicted to triple by 2010.[11] In 2004 more than 2700 non-military satellites orbited the Earth, with hundreds more launches planned and scheduled; the space sector is still dominated by the US and former Soviet states who own 85% of the existing commercial satellites, but that domination is challenged by

[8] Dolman, Everett C, *Astropolitik, Classical Geopolitics in the Space Age*, (London: Frank Cass Publishers 2002), p.8.
[9] DCDC Global Strategic Trends Programme (2006), p.4.
[10] Satellites provide optical, radar and infrared imagery from a variety of platforms provided by the commercial and military / government sectors.
[11] Hays, Peter L, 'Current and Future Military Uses of Space', from UNIDIR, 'Outer Space and Global Security' – UNIDIR/2003/26 (2003).

many other space faring nations.[12] More than twenty states have been represented by their own people in space, although most were placed there by the US or Soviet / Russian vehicles and programmes. The commercialisation of space is no-longer being pursued solely by state actors, the growing trend (particularly outside of the US) is for the private sector to fund and operate space systems using a multi-national approach. In 2003 the US was responsible for 94.8% of the military investment in space, but only 64.3% of public investment in civil space activity.[13] A recent expert working group on space traffic management[14] stated: "Many space objects and launch vehicles are now owned by private companies or international consortia, rather than by nations…if an Intelsat satellite is launched on a Sea Launch Vehicle (Sea Launch is incorporated in the United Sates, owned by US, Ukrainian, Russian and Norwegian companies, and is launched from a Norwegian-built platform registered in Liberia), it is unclear which 'launching state' should register the launch and who, as the 'launching state', should be held liable in case of damage caused by the object launched. If the satellite is later sold to a Hong Kong company and subsequently causes damage to another satellite, the original 'launching state' may still be held liable…"[15] The global trend for interdependence and intensifying competition has already become an astro-trend and the two are interwoven with geopolitics, creating what might be termed 'astropolitics'.[16]

From the earliest days of space exploration and the first writings of science fiction authors, the utility of space to project national interests and enhance military capability has been seen as the primary reason for its development. The world's only superpower and the dominant military nation is also the nation that has invested and continues to invest most in space. The US, more than any other nation, is reliant on space to provide enhanced military capabilities. In order to underline it's indispensable nature, Lambakis describes space as 'The Vital Force'; he goes on to state that the strength of the national security of the US 'rides confidently on its space power' noting that space activities are fundamentally changing the way that states deter and fight each other.[17] In his introduction to the United States Space Command Vision for 2020, the C-in-C Space Command described his organisation as 'stewards for military space' and recognised the reliance of US military forces upon space power. The Vision for 2020 built on the ideas of the US military Joint Vision 2010 that introduced the concept of 'Full Spectrum Dominance' advocating dominance of

[12] Weiss, Leonard, (Chairman, Federation of American Scientists [FAS]), 'Ensuring America's Space Security – Report on the FAS Panel on Weapons in Space' (Draft), (FAS 2004). P.11, original data from: 'Satellite Encyclopaedia, List of states and organisations' (2000).
[13] UNIDIR/2003/26, op cit, p.4.
[14] The Working Group on Space Traffic Management, report of an AIAA, UN/OOSA, CEAS, IAA Workshop (Mar 2001).
[15] As reproduced in, Krepon, Michael and Clary, Christopher, *Space Assurance or Space Dominance? The Case Against Weaponizing Space* (Washington DC: The Henry L Stimson Centre 2003), p.9.
[16] For a superb view of astropolitics see Dolman, op cit.
[17] Lambakis, Steven J, *On the Edge of Earth, The Future of American Space Power* (Lexington, Kentucky: The University Press of Kentucky 2001), p.3-4.

the space medium to protect US national interests and investment.[18] The utilisation of space assets allows militaries to have unrivalled communications abilities[19], unprecedented precision strike and concentration of force linked to a simultaneity that was previously unimaginable. All of these enhancements are supported with near real-time multi-spectral imagery and SIGINT as well as the ability to remotely pilot[20] and reconfigure assets in a distant area of interest. There has been a so-called 'Revolution in Military Affairs' and space is the enabler; this has led to an American, if not Western, way of warfare that would be much diluted if not rendered impotent by the neutralisation of space advantages.

The US recognises how its military and national interests are reliant on space, The Space Commission reported, "…the present extent of US dependence on space, the rapid pace at which this dependence is increasing and the vulnerabilities it creates, all demand that US national security space interests be recognized as a top national security priority."[21] As the benefits of space assets become greater and the reliance on them, especially by the US and the developed world, increases – so the strategic importance of space will increase. The US especially appears increasingly paranoid when describing possible threats to space interests leading to comments such as, "With regard to space dominance, we have it, we like it, and we're going to keep it. Space is in the nation's economic interest."[22] However, perhaps fear of the challenge to US space dominance is well founded; any nation that is threatened by military intervention from the world's only superpower, reliant as the US is on space enablers to see and hear as well as flex it's muscles, would be well advised to neutralise these advantages. Threats to space assets are considered elsewhere in this paper, but the notion that the US or others will be challenged in space because it is logical for that challenge to occur leads one to conclude that space will be a battlefield of the future.

Today, space is vital for the global economy and it will become even more so in the future as the economies of the worlds most populous nations develop and grow. As history has shown, any environment that has supported trade, particularly when this environment is dominated by a relative 'few', leads to tension between the 'haves' and the 'have-nots'.[23] The commercial space

[18] United States Space Command Vision for 2020 (Feb 1997). Forward by Gen Howell M. Estes III, Commander-in-Chief US Space Command.
[19] 83% of all allied communications in the 2003 Iraq conflict were sent via satellite; source: Sample, Ian, The Guardian (20 Jan 2007).
[20] All requiring enormous bandwidth, for example a single Global Hawk UAV requires approximately 500 megabits per second bandwidth or in other words about five times the total US military requirement during the 1991 Gulf War. Lewis, Jeffrey, 'What if Space Were Weaponized? Possible Consequences for Crisis Scenarios' (Washington DC: Centre for Defence Information 2004), p.14-15.
[21] 'Report of the Commission to Assess United States National Security Space Management and Organization' (11 Jan 2001) – Henceforth referred to as the 'Space Commission', the Commission was chaired by Hon Donald H. Rumsfeld.
[22] Hall, Keith, Assistant Secretary of the Air Force for Space, speech to The National Space Club (1997), as reproduced in Shah op. cit.
[23] This trend is articulated in the US Space Command Vision for 2020, op. cit., p.6.

sector is a growing economy and the rapid increases in technology, particularly regarding computing, are likely to cause exponential growth in this sector. Space used to be the domain of states because of the vast cost and infrastructure required reaching it. This is no-longer the case, increasingly, the commercial sector is launching and operating space vehicles and selling space services to state and non-state actors.[24] When commercial interests are at stake, wealthy companies with impressive political clout have lobbied for state protection; the paper argues that this situation is also likely to happen in space. The military of the US and to a lesser extent, those of other nations, has been revolutionised by the use of space assets. Hence for the US and its allies, space is of incredible strategic importance. This in turn means that the rivals and potential enemies of the US will also regard space as strategically vital since it confers such a significant advantage. Since space is of such strategic importance to states, non-state actors and to the global economy, it will be an area of competition and tension and mankind does not have an impressive track record in dealing peacefully with such matters.

THE SPACE ENVIRONMENT AND DEFINITIONS

"Some people tend to erroneously equate offensive counterspace [sic] *with a weaponization of space or* [with] *space weapons, that is just wholly inaccurate and very naïve."*[25]

- Lt Gen Dan Leaf, vice commander US Air Force Space Command.

It is not an exaggeration to suggest that the space environment is more misunderstood than understood. Space is not simply the continuation of the air environment vertically away from the surface of the Earth. Nor is space a vast featureless emptiness that lacks the variation and geography that we accept so readily on the surface of the planet. Space is a very different environment, one that bears more similarity to the sea than the air, and one that has a complex topography of its own with barriers, choke points, commerce lanes and strategic hubs defined by gravity and radiation rather than oceans and continents. The definitions of space and the areas of space are less clear than one would imagine. This paper uses a combination of definitions, described below, that have been adapted from current literature and thinking on the subject.

It is possible to define space using biological, administrative or aerospace engineering means; ie space could be said to begin at 14.5km above the Earth's surface (because above this height humans require pressure suits to survive) or 45km (the limit for air breathing propulsion), 50 miles

[24] Lecture by Col Mike Wills USAF (rtd) to ACSC10, 25 Jan 07; Wills postulated the theory that the cost of space access would fall as commercialisation increased therefore leading to greater commercialisation. Additionally, this paper argues that not only does commercialisation of space lead to a greater demand for protection, hence weaponization, it also enables it through the reduced cost of space access.

[25] As reproduced in, Sirak, Michael, 'Space Weaponization: Battle for Space', Jane's Defence Weekly, 5 Oct 2005.

(US astronaut wings are awarded for flight beyond this altitude) and so on.[26] For this paper the term 'space' refers to the area starting at the lowest practical orbital perigee (160km above the Earth's surface) extending to infinity.[27] In addition to this definition, this paper will also consider that there are four 'regions' within the space context: Terra or Earth (the surface of the Earth to just below the boundary with space), Terran or Earth Space (from 160km altitude to approximately 36000km altitude), lunar space (36000km to just beyond lunar orbit) and solar space (beyond lunar orbit but within the gravity well of the sun).[28]

The areas of most interest now and in the near future are 'Terra' and 'Terran Space'. The importance of Terra is obvious since mankind currently resides there and only there on a permanent basis; hence all astropolitical influence as well as physical space assets originates from the Earth. Terran geography has an important relationship to space because of the basic spherical shape of the planet. Those states (or others!) who have access to equatorial launch sites, particularly those who can launch in an easterly direction have an advantage in that less energy is required to achieve orbit.[29] An orbit at approximately 36000km[30] at 0° inclination (ie one that is equatorial) is said to be geostationary and is of enormous importance; just three correctly placed geostationary satellites give a continuous view of Earth to within 70° latitude north and south. The geostationary (GEO) band at the edge of 'Terran Space' is mainly populated with communication and weather satellites and is an area of congestion; satellites in close proximity may suffer from communications interference. A recognition of the importance of this band led to the 1977 Bogota declaration by nine equatorial states in an attempt to assert sovereignty of space upwards from their territory; just as coastal states attempt to maximise influence over sea lines of communication (SLOC) through the extension of territorial waters, equatorial states threaten this celestial line of communication (CLOC).[31]

A number of writers have compared the space environment to that of the oceans; where there are noticeable choke points and lines of communication.[32] The area where most satellites are concentrated is low Earth orbit (LEO), between 160 and 800km altitude. Satellites in LEO are

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[26] Klein, John J, *Space Warfare, Strategy Principles and Policy,* (London: Routledge 2006).
[27] This definition is consistent with Klein, ibid., Dolman, op. cit., and with US Joint Publication 3-14 – Joint Doctrine for Space Operations; it is also in keeping with customary law. Note that an orbital height below 160km (87.5 minutes orbital period) is possible but not practically achievable due to atmospheric drag; see Dolman, op. cit., p.64.
[28] Dolman, op. cit., p.68-70. Space beyond 'solar space' is not considered in this paper; this is not because it is unimportant, but because it is unlikely to become significant for weaponization considerations until the far future.
[29] For example a rocket launched east from Kourou, French Guiane, at 5°N has a 17% fuel advantage over a rocket launched from Cape Canaveral at 28.5°N. Additionally, highly stable orbits are achieved at 63.4° and 116.6° inclination, launch sites at equivalent latitudes (such as the Russian Plesetsk facility) will be able to deliver satellites to these stable orbits with a significant degree of fuel efficiency. ibid., p.74.
[30] Giving an orbital period that is coincident with the speed of rotation of the Earth, known as a *geosynchronous* orbit.
[31] Dolman, op. cit., p.74.
[32] See especially Klein, op. cit., p.21-32 and p.51-59.

relatively close to the Earth's surface so are well suited for detailed reconnaissance work.[33] The density of satellites at particular altitudes and certain orbits leaves them vulnerable to certain types of anti-satellite (ASAT) weapons. Other orbital heights are less vulnerable to surface launched ASAT but have many satellites networked at the same altitude (such as the NAVSTAR/GPS network at 20200km); potentially, this leaves them vulnerable to orbital ASAT weapons. Thus CLOCs are as predictable, if not more so, than the SLOCs that they resemble.

Other bottlenecks and chokepoints are also present in space. Firstly the Van Allen radiation belts exist as two irregular concentric 'doughnuts' around the Earth and can cause damage to space vehicles and injury or death to astronauts. The Van Allen belts are well mapped and predictable and have less malign effects at the edges; however they impact upon LEO and medium Earth orbits (MEO), constricting the useful areas for CLOCs.[34] Many orbital transfers use the so-called 'Hohmann transfer' method; this allows a two-stage transfer of orbital altitude and/or inclination whilst using as little fuel as possible. Since it is argued that, with sufficient knowledge of desired orbital or 'solar space' trajectories, these transfer points can be predicted they can be targeted or forces can be positioned in defence of them.[35] Finally there is the interaction between Terran and Lunar gravity to consider. There are five Langrange Libration points (usually labelled L1-5) where Moon and Earth gravity effectively cancel each other out and create quasi-stable points where an object so placed would ideally remain without ever having to expend energy; they are considered to have huge strategic potential.[36]

As has previously been described, space can be defined in a number of ways; this is also true of the term 'space weapons' and it is vitally important to do so in the context of this paper. Intercontinental Ballistic Missiles (ICBM) usually have trajectories that pass through space but for the purposes of this paper (and by common consent) they do not constitute space weapons. Some have argued that space is already weaponized because GPS guided munitions gain their precision from space assets or because of the recent Chinese ASAT test[37] but again, in the context of this paper they do not constitute space weapons or infer space weaponization. The definition of space weapons used here is those things that are intend to cause harm that are wholly or partially based in space. For example, this paper includes orbiting ASAT weapons but excludes Earth launched ASAT missiles; weapons released or fired from space against Terran or space targets are also included as well as the active defence measures employed by space vehicles that

[33] Reconnaissance satellites often have high inclinations to maximise coverage of the Earth's surface and can make 14-16 orbits per day. Polar orbiting satellites (ie those with an inclination of close to 90°) can be given a slightly retrograde inclination keeping them in sunlight for virtually all of the time and making them ideal for photographic imagery. Thus, not surprisingly polar LEO is particularly congested.
[34] The inner belt first appears 400-1200km extending to 10000km and the outer belt exists between 10000 and 84000km; the exact shape and concentration is dependent on latitude. Dolman, op. cit., p.75-76.
[35] ibid., p.72-4.
[36] In fact only two of the Lagrange points (L4 and L5) are truly stable, thus they are of the greatest strategic significance. Klein, op. cit., p.9.
[37] MacAskill et al, op. cit., p.18-19.

cause harm to other objects. A range of space weapons considered by this paper is described in the next section.

Space is an environment often compared to the maritime but its features are defined by gravity and radiation rather than by the great continents and oceans of Earth. Just as the maritime environment has SLOCs with chokepoints, space has CLOCs with similar bottlenecks and concentrations of traffic; however, the orbital traffic on CLOCs is even more predictable than the waterborne equivalent. This paper further divides space into four areas of which ‘Terra’ and ‘Terran Space’ are the most important to consider in terms of weaponization. There is potential confusion regarding what is actually meant by space weaponization and for the purposes of this paper the definition is constrained to weapons actually based in space not those that pass through it or into it without being based there.

SPACE WEAPONS – CLASSIFICATIONS AND CAPABILITIES

"It was a frightening weapon, against which there was no defence once it was on its way," admitted Timothy's father.[38]

The current controversy regarding space weaponization is the third time that a major policy debate over the subject has taken place. At the start of the cold war, the possibility of orbital bombardment satellites armed with nuclear weapons[39] was postulated and fears over nuclear weapons in space led to the UN Outer Space Treaty (OST) of 1967.[40] At the end of the cold war the Strategic Defence Initiative (SDI) of Star Wars notoriety brought the arms race, quite literally, to new heights. The current debate is wider and the arguments more polarised than previously mainly because technological development appears to offer an exponential increase in capability with, it is hoped, a reduction in relative cost. Thus the proposed and future space weapons are not simply envisaged in the context of fighting or deterring a terran nuclear confrontation but in their wider military-strategic utility. Having defined the scope of space weapons considered by this paper, it is necessary to describe their potential capabilities and utilities. This, in turn, will allow a better consideration of the merits and problems of space weapons. The concept of space weapons has provoked a somewhat hysterical line from some of the disarmament community and a bullish overestimation of the advantages of immediate weaponization by some policy hawks.

Space weapons, as considered by this paper fall into three distinct classes; one of these classes can then be sub-divided into three further weapons types.[41] The first class to be considered is that of directed energy weapons and includes laser, radio frequency and particle beam weapons. The second class can be effectively summarised as mass-to-target weapons that either employ kinetic energy 'kill vehicles' or the chemical energy of an explosive device to create harmful effect.[42] Finally, orbital Anti-satellite (ASAT) devices are considered separately[43] but, consistent with the definition of space weapons offered by this paper, surface launched ASATs directly targeted against a space asset are excluded. Each type will be individually characterised in this section before the paper explores the arguments regarding their deployment.

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[38] Allward, Maurice *Timothy's Space Book* (London: Collins 1963).
[39] The Soviet Union tested a fractional orbital bombardment system (FOBS) 1966-7 and the USA had previously considered such a system; FOBS conferred certain advantages over ICBMs but was eventually abandoned in their favour.
[40] 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies' from United Nations Treaties and Principles on Outer Space (ST/SPACE/11 UN 2002).
[41] The weapons classifications used in this paper are drawn from, Preston, Bob et al, *Space Weapons Earth Wars*, (Santa Monica CA: RAND 2002) and much of the summary of capabilities in this section of the paper draws on descriptions used therein, especially p.xvi-xxiii, p.24-49 and p.109-183.
[42] ibid., p.xvi-xvii.
[43] Due to the definition used by this paper, ASAT devices are described as their own category, this is not consistent with Preston et al, and thus the characteristics and descriptions are the authors own and are drawn from a number of sources.

Directed energy weapons may be characterised by the extremely rapid speed of propagation of the destructive or disruptive energy used to affect their targets. They range in type from electronic jammers to long range lasers. Electronic jammers consist of a transmitter (that can be tuned to the relevant target frequencies) of a sufficient power to create the desired effect with an appropriate means of directing the energy. Laser or particle accelerator weapons direct energy at the surface of, or deeper into, the target to create a heating effect that will disrupt or destroy a critical component. The speed of energy propagation is that of the speed of light[44]; however, the rapidity of effect can be considerably slower as, dependant on the target and desired effect, the energy beam will be required to dwell on the aim point for differing times. Since this class of weapon has such a high speed of propagation, it would seem to be ideally suited to space basing where, potentially, distances to targets can be huge. However, large distances require large accurate optics, extremely high power generation and accurate pointing.[45]

In the context of space weaponization, the most commonly postulated Directed Energy Weapon is the space based laser; by giving an overview of the key characteristics of such a weapon, including potential target sets, the advantages and disadvantages as well as the basing logistics may be considered. Such a weapon would be required to generate a large amount of energy; therefore it can be assumed that if it is to be used more than once it would require a substantial fuel source for the weapon.[46] Different target sets can be engaged by different types of laser since some laser wavelengths are not suitable for penetration of the Earth atmosphere. The laser weapon that has received the most funding is the hydrogen fluoride chemical laser; the wavelength of this particular weapon means that it is only suitable for engaging targets greater than 15km altitude but other weapons with differing wavelengths could be suitable for engaging targets deeper in the Earth atmosphere. Laser satellites designed for engaging ICBMs during the boost phase (boost phase intercept or BPI), such as the hydrogen fluoride example previously discussed, would require a constellation size of twenty four[47] if placed at an orbital altitude of ~1250km. The constellation size could be halved if the altitude was increased to around 3500km[48] but this would increase engagement times and reduce redundancy; additionally the power required for the weapons would increase to 35 megawatts in order to create the same effect. Due to the size of the satellites and

[44] With the exception of particle accelerators.
[45] In extremely basic terms this has to do with divergence and diffusion of the beam due to range as well as the angles of originating source, optics and target. 'The intensity of the beam at the target being divided by the square of the distance travelled.' ibid., p.128.
[46] For example, a hydrogen fluoride laser of approximately 5 megawatts power in a typical engagement against ICBMs would use 500-750kgs of fuel to engage 3 targets, ibid., p.114.
[47] The requisite constellation size and absentee ratio can be calculated using the combined time to detect, track and engage typical salvoes (including the time required for the re-pointing of weapons) and taking into consideration the expected launch points and weapon trajectories.
[48] The most convincing argument for constellation size is made in Preston et al, ibid., but other publications give different numbers, for example a constellation of six is described as 'operationally effective' in Lambeth, Benjamin S, *Mastering the Ultimate High Ground – Next Steps in the Military Uses of Space* (Santa Monica CA: RAND 2003)

the predictable nature of their constellations, these weapons would represent reasonably predictable, low-manoeuvre targets that may be considered vulnerable in terms of a space conflict.[49] Although the basing of lasers in space has been considered, particularly for so called BPI of ICBMs, the use of space-based mirrors to direct laser energy to targets has also been postulated; thus lasers could be based in the Earth atmosphere[50] saving cost on the deployment of the system (lasers are of greater mass than 'weapons mirrors') and allowing easier refuelling. The use of 'weapons mirrors' may also allow a smaller constellation of lasers although it could affect reaction time and kill capacity[51]. In the context of this paper, the use of space based weapons mirrors to wholly or partly facilitate a directed energy weapons system is also considered to constitute weaponization.

Exo-atmospheric kinetic energy weapons could be used in conjunction with space based lasers to target ICBMs just as the Brilliant Pebbles system envisaged by Reagan's Strategic Defence Initiative[52]. They would carry single or, more likely, multiple interceptor vehicles to launch at targets from a reasonably low orbit.[53] If used against an ICBM target, the projectiles could be of a fairly small size since they use a combination of weapon and target velocity to inflict damage. Other targets might require larger projectiles to destroy but because of the relative fragility of many space vehicles even small objects can inflict significant damage. The size and especially the mass of the payload of these weapons are significant since these are large factors in their cost.[54]

Kinetic energy weapons could also be used against terrestrial targets. This weapons category would release re-entry vehicles that use their mass and the extremely high velocity generated by a high altitude release to create destructive effect.[55] The re-entry vehicle has to be able to survive the thermal effect of entering the atmosphere but not have aerodynamic properties that create significant miss distances. ICBM re-entry vehicles are an example of the ideal shape for such a weapon, the one metre tungsten cone (or so called 'rod'[56]) would weigh approximately 100kg and would be suitable to be used against any target susceptible to a vertical attack including buildings, silos and large (slow manoeuvring) ships. The constellation size of such a system would depend totally on the responsiveness and potential target area that is envisaged. Potentially, these

[49] Preston et al, op. cit., p.109-120.
[50] Either on a fixed surface site or using an air vehicle such as the US Airborne Laser (ABL) programme currently under test.
[51] Due to spot size increase with range and optical imperfections.
[52] Brilliant Pebbles was originally conceived to be operated with Brilliant Eyes, a sub-system that comprised the detection and tracking element of the overall system, providing intercept data to the multiple kinetic energy interceptor vehicles or 'pebbles'. Over time and with improved miniaturisation of electronics, the system evolved to be numerous small (~20kg) orbital munitions with their own independent guidance systems. Brilliant Pebbles was cancelled by the Clinton administration in 1992, see Dolman, op. cit., p.163.
[53] It is highly desirable to intercept ICBMs before the end of their boost; if this category of weapon is used against ICBMs then to achieve BPI an orbital altitude of approximately 500km is required. Preston et al op. cit., p.39.
[54] Put simply, the cost of placing objects in orbit is dependant on their mass, size and orbital altitude.
[55] Preston et al, op. cit., p.40.
[56] Hence their nickname 'Rod or Rods from the Gods'.

weapons offer a highly responsive global power projection capability. In such a system, weapon launch is difficult to detect and predict (unlike air launched weapons) and has a shorter time of flight than an ICBM; however, the cost of placing these weapons in orbit is likely to be higher than the cost of delivering them by air or ICBM.[57]

There is potential to employ weapons that have an explosive effect, especially nuclear weapons, against space targets; weapons of this type used in any future space conflict, will probably become more relevant at a later time. Of most interest to this paper are space based conventional weapons that are launched against terran targets. Basing considerations are similar to the kinetic energy weapons described previously[58] but re-entry vehicles would be designed differently due to thermal factors.[59] Essentially any type of weapon, including nuclear, could be employed in this way but due to the cost considerations associated with mass, the small new-generation sub-munitions or sub-munitions dispensers would be most appropriate. There is no reason to believe that space launched weapons would be any less effective than the same weapon launched from the air or surface but they would be more expensive to deploy. The global power projection advantages described previously also apply to this category but the weapon effects and range of targets could be different as, unsurprisingly, they depend on the weapon type.[60]

Space-based ASATs have long been considered by the major space faring nations. The basic premise for these devices is the same though attack mechanisms and effects may vary considerably. The most basic form of this weapon is the space mine; it is a device that is placed into orbit and when activated detonates itself to cause damage and destruction through a combination of chemical and kinetic energy. Additionally, a space mine or similar ASAT device will create space debris that could be lethal to other orbital devices. Some orbital ASAT devices could be more sophisticated in that they approach another satellite and attack it with a kinetic energy projectile or a directed energy weapon; the directed energy weapon could be a dazzling or destructive laser or a high powered microwave device depending on the desired effect. Some nations, including China[61], are reported to be developing parasitic micro-satellites that will attach themselves undetected to the satellites of potential adversaries to create subtle and perhaps deniable effects upon their targets. International law currently prohibits the placement of nuclear weapons in orbit, but since payloads are difficult to predict, it is possible that a nuclear armed orbital ASAT is already in space awaiting the command to detonate and wreak havoc!

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[57] Preston et al, op. cit., p.40-44.
[58] A constellation of six satellites at 500km altitude could give global coverage with a 30 minute response time. Preston et al, p.47.
[59] Steep passage through the atmosphere is not required and a shallower path allows greater in-flight manoeuvre and the protection of the weapon from thermal effects that could degrade functionality.
[60] Preston et al, op. cit., p.45-47.
[61] Lewis, Jeffrey, 'False Alarm on Foreign Capabilities', Arms Control Association, Arms Control Today (November 2004), is one of a number who is sceptical as to the source of the report regarding Chinese capabilities in this area.

MASTERING THE ULTIMATE HIGH GROUND[62] - WHO WOULD WEAPONIZE SPACE AND WHY?

"Space superiority is not our birthright, but it is our destiny…space superiority is our day-to-day mission. Space supremacy is our vision for the future."

- Gen Lance Lord, Commander US Air Force Space Command.[63]

Almost half a century after the first satellite was placed in orbit[64] and despite decades of intense militarisation, the space environment has not yet been weaponized.[65] Yet the widespread policy debate that is taking place, primarily but not exclusively in the US, indicates that there is a growing body of opinion that supports taking such a step. This section seeks to explain who would consider weaponizing space and why they might choose to do so.

Previously this paper has described the historical dominance of space by state actors, mainly due to the costs and infrastructure requirements. Space was also explored and exploited for reasons of national prestige; it can be argued that the launch of Sputnik I opened a space race that eventually led to the US Apollo programme and man on the moon.[66] Despite the growing commercialisation and multi-national aspects of the space environment, astropolitics will, at least in the medium term, continue to be dominated by state actors. Militarisation of space was led by nation states and it is most likely that weaponization would follow the same path. Of the world powers, the only remaining superpower seems to be the most likely, as well as the most able, state to initiate space weaponization. Or as US Senator Bob Smith put it, "I do see an opportunity for us to exploit this period of unchallenged conventional superiority on Earth to shift substantial resources to space. I believe we can and must do this, and, if we do, we will buy generations of security that all the ships, tanks and airplanes in the world will not provide…Control of space is more than a new mission area- it is our moral legacy, our next Manifest Destiny, our chance to create security for centuries to come."[67]

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[62] Used as part of the title of Lambeth, Benjamin S, *Mastering the Ultimate High Ground, Next Steps in the Military Uses of Space*, (Santa Monica CA: RAND 2003).
[63] 'Air Force Seeks Bush's Approval for Space Weapons Programs', New York Times (18 May 2005).
[64] The Soviet Union launched Sputnik I on 4 Oct 1957.
[65] See previous section on Environment and Definitions for an explanation of what, in the context of this paper, constitutes Space Weaponization.
[66] Hays, Lt Col Peter and Mueller, Dr Karl, 'Going Boldly Where?', Aerospace Power Journal, spring 2001, p.34.
[67] Smith, Sen B, 'The Challenge of Space Power', Airpower Journal 13 no 1 (spring 1999), as quoted by Peña, Charles V and Hudgins, Edward L, 'Should the United States "Weaponize" Space? Military and Commercial Implications', from Policy Analysis (18 Mar 2002), p.5.

Though, in the near term, the US is the most likely to weaponize space, many of the reasons that would lead to a decision to place weapons beyond the Earth atmosphere are applicable to other major powers. The most compelling argument to weaponize space is military utility and the four major advantages of space-basing over terrestrial weapons have been described as: an ability to attack inaccessible targets, rapid response, long range attack capability (with a degree of protection conferred by distance) and a high likelihood of assured kills.[68] However, proponents of space weaponization find that these 'advantages', just as virtually everything else concerning the debate, have strong counter-arguments.

The first core attribute of space power listed by the FASOC is height[69] and since man first took up arms against man, height has represented an advantage in combat. Forces that command the high ground can see further as well as project their force and their weapons with a gravitational advantage; for combatants engaged with an opponent with a height advantage the opposites are true, frankly it is an uphill struggle![70] To many, space represents the ultimate high ground, conferring all of the traditional advantages to an exaggerated degree. Space vehicles have an incredible perspective of the Earth; as has been previously explained, just three satellites in a geosynchronous orbit could provide a view of virtually the entire habited area of the Earth. Additionally, and in very simplistic terms, a weapon fired 'down' the gravity well of the Earth has a considerable energy advantage over a weapon travelling 'up' the well; of course the weapon must first be placed (or perhaps in the future, manufactured) in space. Some of the comparisons between space and Earth based weapons will be considered shortly, but the value of the high ground is plain and the desire to master it keen, 'Weaponized space is the ultimate high ground. It is certain that someone will attempt, and perhaps succeed, in taking that high ground.'[71]

Whilst the advocates of sea power explain that 70% of the Earth's surface is covered by water, their air power colleagues will respond that the air surrounds all 100% of the globe. The space environment shares the ubiquity of air but confers greater freedom of passage. Space has long been viewed as an international commons and despite attempts to extend sovereignty vertically upwards[72], space vehicles have freedom of over-flight regardless of national territorial boundaries. Traditional power projection from the sea or air is limited by access, basing and over-flight

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[68] Krepon and Clary, op. cit., p.50.
[69] Future Air and Space Operational Concept (FASOC 2006); the others are: global reach, ubiquity, continuity, dispersal, political immunity, legal over-flight and pervasiveness.
[70] Take the example of aerial combat. If two aircraft are involved in a purely vertical or 'looping' fight in the same plane of motion, then their flight path is a squashed oval known as the 'combat egg'. At the top of the 'egg' pulling towards the earth the aircraft enjoys and extra 'G' advantage as it benefits from the Earths gravitational pull; an aircraft at the bottom of the 'egg' pulling upwards has to overcome an additional 'G'. The aircraft with the high ground not only has greater potential energy but a turn rate advantage, fighter pilots refer to this as 'God's G'.
[71] Excerpt from a speech by Senator Joe Lieberman (27 Feb 1999) as reproduced in Lambakis, op. cit., p.254.
[72] The Bogota declaration of 1977; see Dolman, op. cit., p.74.

considerations that are irrelevant in the space environment. A deep strike mission delivered by air assets is limited by the combined range of the weapon and the platform, with the added consideration that both air vehicle and weapon are liable to be attacked by enemy air defences. The same mission conducted by a space based weapon does not face the same limitations and, especially in the case of so-called 'rods from the gods', is less vulnerable to air defences.[73]

Space basing also offers advantages through the persistence of space assets and the potential speed from decision to delivery that these factors could give. When a decision to strike is made then appropriate forces must be sent to conduct the operation; naval forces are able to 'poise' and thus give an element of persistence but owing to the speed of travel of maritime assets pre-positioning or a continuous at sea presence is required. Space based assets offer a near omnipresent poise capability.[74] An air asset with its core attribute of 'speed' might take only a matter of hours after launch to reach a weapons delivery point, but it must be alerted, armed and fuelled; a space weapon could destroy a target half an hour after the decision was made.[75] Although time from 'decision to destruction'[76] can be considerably less than with terrestrially based weapons, even ICBMs[77], space basing lacks the flexibility of terrestrial weapons; kinetic energy weapons are not suitable for all targets and the suite of weapon types carried by conventionally equipped space-based systems is likely to be less than those available to terrestrial assets. It is also argued that space weapons, despite their rapid effect, are less economical and fuel efficient than terrestrially based alternatives. It has been calculated that in the 1991 Gulf War, 40 tons of fuel were required to drop one ton of bombs; the ratio for space based conventional / kinetic weapons is calculated to be in excess of 55:1.[78] However, quantitative comparisons such as this might be misleading; sometimes the *only* way to attack a particular target with the requisite degree of success and casualty risk might in fact be the least economical! Space based mass-to-target weapons might not be the first choice for all tasks but they could be the only acceptable choice for others.

Like space based mass-to-target weapons, directed energy platforms are not suited to all target sets in varied situations. However, the space-based laser has often featured as a potential key

[73] Kinetic energy space weapons for use against terrestrial targets would probably be a similar target to a MIRV from an ICBM; thus there are some limited capabilities against them that have been fielded, including the Patriot PAC3 and it's (yet to be deployed) successor PAC4. Outside of the US and its allies, including those who may benefit from elements of the projected BMD capability, there are few current capabilities that could deal with such a target.
[74] Providing that they are placed in an orbit that does not require the continuous use of fuel to maintain position or to reposition for reasons of target coverage. Weapons expenditure of space assets is also a consideration due to the cost and difficulty of re-supplying them or indeed of replacing them.
[75] Assuming an orbital altitude of 500km with a constellation absentee ratio of 5; higher altitudes (eg 8000km) have slower orbital periods and increased time to re-entry but could allow greater global coverage with smaller constellations and lower fuel usage if time was less of a factor, Preston et al, p.168-169.
[76] ibid., p.169.
[77] Conventionally armed ICBMs offer an alternative to space 'deep strike' but they are synonymous with the delivery of nuclear weapons and their use could easily be misidentified as a nuclear first strike.
[78] Preston et al, p.164-167.

component of a BMD system. Funding for the US space-based laser was cut in 2002[79] when the programme was cancelled, although this is more likely to represent re-prioritisation within the defence budget to concentrate on short-term solutions to pressing BM threats. The BPI of an ICBM salvo by a space based hydrogen fluoride laser satellite constellation has been previously described, but critics are quick to point out that such a system is more economically replaced with terrestrial assets. Though that argument might suffice for the very near term, as threats increase and long range BM technology proliferates[80] then a more capable, multi-faceted BMD with elements based above the atmosphere will become increasingly desirable. The threat imperative, coupled with a reducing cost of space launch and a maturing of laser technology over time[81] could eventually lead to the deployment of laser weapons in space as part of a BMD system; so although the equation might not add up now, it could do within a decade or less. Those who have argued for the deployment of space weapons because there is a significant military advantage to do so (and not before) probably represent the dominant military attitude within the US; they have been termed the *Space Controllers.*[82]

As has been noted, the US military uses space as a key enabler to achieve an unprecedented military capability; space is a vital component in 'full spectrum dominance'[83]. It doesn't take a student of Clausewitz to realise that targeting US space assets might reduce American military advantage and potentially unlock the centre of gravity of this dominant military superpower. The idea that a 'space Pearl Harbour' might occur has been postulated by a number of authors,[84] it describes a possible surprise attack on US space assets that has catastrophic consequences. Some US contributors to the space weapons debate have used this argument to strengthen the case for weaponization but the nature of the threat makes this a debateable standpoint. The threat to space assets, primarily by ASAT devices, is likely to come from states with a 'rival' military capability (unlikely in the case of the US) – so called 'peer competitors' as well as states who find themselves overmatched by a space power (or ally to a space power) who wish to respond asymmetrically – so called 'non-peer adversaries' Interestingly, the commercialisation of space and the proliferation of ICBM technology means that not only will non-peer adversaries be more

[79] The Space-based Laser was formally cancelled in 2002 but a number of directed energy initiatives remain in other programmes; 'Ensuring America's Space Security' op. cit., p.38.
[80] See Bracken, Paul, *Fire in the East, the Rise of Asian Military Power and the Second Nuclear Age* (New York: Harpur Collins 2000) for concerns over WMD and BM proliferation amongst the USA's potential adversaries in the Middle and Far East.
[81] Despite programme cancellations, considerable R&D money has been expended in this area. The journalist and space weapons opponent Karl Grossman has claimed that the original development package for the space-based laser was reported to be $20-30 billion and that '…some $6 billion per year – plus funds in the 'black' or secret- are now going into US space military activities.' Grossman, Karl, *Weapons in Space* (New York: Seven Stories Press 2001), p.19-20.
[82] Mueller, Karl P, 'Totem and Taboo: Depolarizing the Space Weaponization Debate', RAF Airpower Review, spring 2004, vol 7 no 1, p.1-22.
[83] 'United States Space Command Vision for 2020' (Feb 1997).
[84] For an early, if emotional, portrayal, see Baum 'Defiling the Altar: The Weaponization of Space', Airpower Journal, spring 1994, p.52-62. The term is also used in, 'Report of the Commission to Assess United Sates National Security Space Management and Organization' (11 Jan 2001), Executive Summary, p.8-9.

likely to field ASAT devices in the future, but that non-state actors (such as international terrorist organisations or multi-national corporations / criminals) might also gain the capability to attack space assets.

An attack upon space assets might not necessarily come from space-based weapons. Any group or state that has ballistic missile technology could potentially launch an ASAT weapon. For example, a North Korean Nodong[85] BM fitted with a so-called gravel warhead[86] could be launched to detonate in LEO targeted at certain orbital paths. Potentially even more effective would be similar launch technology that employed a nuclear warhead to create a HAND[87]. The potential results of a HAND have been extensively studied and because of the electro-magnetic pulse and radiation effects, the blast could be catastrophic; the HALEOS[88] study concluded that 'one low-yield, high-altitude nuclear explosion could disable – in weeks to months – all LEO satellites not specifically hardened…'[89] Although some space-based weapons might be able to counter these threats, for example a BPI conducted by space lasers, the answer to this threat most probably lies with a combination of Operationally Responsive Space (ORS)[90] and the hardening of space assets. US space weapons proponents who have highlighted these threats and argued for an extension of US hegemony beyond the atmosphere fall into a grouping sometimes known as the *space hegemonists*.[91] The *space hegemonists* are the most aggressive advocates of space weaponization and do not see immediate military utility as a prerequisite to weaponization.

Other ASAT weapons fall into the category of space weapons by themselves. These weapons might also be sought by major powers and the so called non-peer adversaries of the US. China has a rapidly developing space programme to match an impressive economic growth and has signalled an intent to contest space, not only with the Earth launched ASAT test of 11 Jan 2007, but with a reported plan to develop parasitic nano-satellites for ASAT usage.[92] Space mines and orbital ASAT devices could be pre-positioned near target satellites to create a less widespread but perhaps a more deniable and subtle effect. The deployment of these weapons would be seen as

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[85] A vertically launched Nodong could carry a 1000lb payload to an apogee of 500km making it suitable to attack LEO satellites; a Hohmann transfer would be required to reach higher altitudes. Source 'Ensuring America's Space Security', op. cit., p.20-22.
[86] Essentially a 'space shrapnel' device that relies on the kinetic energy of fragments and satellites to cause damage.
[87] High Altitude Nuclear Detonation or HAND is sometimes referred to as a High Altitude Nuclear Explosion (HANE).
[88] The Defense Threat Reduction Agency 'High Altitude Nuclear Detonations Against Low Earth Orbit Satellites (HALEOS) study' 2001.
[89] 'Ensuring America's Space Security', op. cit., p.24.
[90] ORS is the concept of surge launching or launch-on-demand to replace or maintain capability after such an attack.
[91] Mueller, op. cit., p.12.
[92] Peña and Hudgins, op. cit., p.8. However there are suggestions that this story was based on a single unreliable source prone to 'fanciful stories'; Lewis, Jeffrey, 'False Alarm on Foreign Capabilities', Arms Control Today (November 2004).

the *space controllers* as a rational move and one that could perhaps be justified by the potential adversaries of the US at the earliest opportunity.

The *space racers*,[93] as they have been described, are pro-weaponizers not because they believe in the immediate military utility of that course but because they believe that weaponization is inevitable and, '…[to] be the first state to weaponize space…will surely be better than being the second state to do so.'[94] This US pro-weaponization lobby tends to believe in restraining weapon proliferation but conforms to the pessimism of realism. Hence to follow this argument, one must believe that it is in the nation's (in this case the United States') best interest to pursue weaponization because others surely will and that doing so will prevent rivals from gaining a military edge and increased prestige.[95] The argument surrounding the inevitability of space weaponization will be explored in greater depth in the following sections. This argument could also be used to theorize why a future rival to the US, for example China, would seek weaponization even if the US had unilaterally decided not to do so; any threat of imminent weaponization by a rival would almost certainly provoke a US response.

The US is the most obvious candidate for space weaponization, not least because the US is the only superpower and easily the world's largest space investor. Continued American military superiority is heavily dependant on space assets and the concept of 'full spectrum dominance'. Within the US, the pro-weaponizers can be split into three groupings. The largest group are the so-called *space controllers* who advocate weaponization when it is advantageous to do so, citing the military utility of space weapons as the key reason for their advocacy. To some, space represents the 'ultimate high ground' and space-based assets are ideally placed to exploit height, ubiquity and persistence in order to deliver military effect that other assets cannot readily do. Space weapons offer reduced times between decision and destruction in the deep strike role and provide niche capabilities, such as BPI of ICBMs, as part of a BMD programme. Opponents of space weaponization have argued that the effects delivered by such capabilities can be produced elsewhere and at a cheaper price; they also note that space assets (including space-based weapons), particularly those in LEO, are vulnerable to attack. Or as the Space Commission put it, '…those hostile to the US can acquire on the global market the means to deny, disrupt or destroy US space systems…nowhere else does our defense [sic] capability rest on such an insecure firmament.'[96]

The vulnerability of space assets is a reason given by the *space hegemonists* for why the US should weaponize space at the earliest opportunity. However, there is a political price to pay for

[93] Mueller, op. cit., p.10.
[94] ibid., p.11.
[95] Here there is a parallel with the first space race between the US and the USSR sparked by the launch of Sputnik I.
[96] '"Peaceful" and Military Uses of Outer Space', op. cit., p.8.

being the first nation to break the taboo of space weaponization: 'The big, red line we all have is the weaponization of outer space, which would be immoral, illegal, and a bad mistake.'[97] Space weaponization by a nation would also provoke a response from other states, for example, it seems unlikely that China or Russia would stand idle in the face of US weaponization. Non-peer adversaries of the US, such as North Korea and Iran, already posses the components required for surface launched ASAT devices; although, in the context of this paper, this does not constitute weaponization, they may also decide to invest in orbital ASAT capabilities. Additionally, these particular non-peer adversaries, with growing nuclear programmes, could lead to an increased effort on the part of America to progress a BMD programme that included a BPI capability; this capability might be met, in part, by space-based weapons.

In the policy debate that has been taking place within the US, *Space Racers* have been described as the reluctant weaponizers.[98] They accept space weaponization as inevitable and as such, either for reasons of national prestige or for fear of others gaining an advantage, they advocate embarking upon space weapons programmes of their own. Whilst this argument does not appear as intellectually convincing as that of the *space controller*[99], it does raise two interesting points: firstly that arms control to prevent weaponization is highly desirable and secondly that this is doomed to failure. The first point is a subject that will be dealt with in the next section; the second is key to the central argument advanced by this paper that for all man's good intentions, the balance of power and national interests will decide whether space is weaponized.

SPACE SANCTUARY - THE MORAL, ETHICAL AND LEGAL ARGUMENTS AGAINST WEAPONIZING SPACE

"If we [the US] are forced to flight-test or deploy space weapons by the actions of others, that is deeply regrettable…If we take the lead in doing so, that is reprehensible."

- Michael Krepon[100]

In the previous section, three groupings for the space weapons advocates were identified; Mueller also divides the pro-sanctuary argument into three: *sanctuary nationalists, sanctuary internationalists* and *sanctuary idealists.*[101] The following section will examine the arguments of each of the three groups, concentrating on the moral and ethical standpoint. Since the sanctuary lobby argue that space weaponization can and should be prevented by international treaty and law,

[97] Canadian Foreign Affairs Minister Bill Graham, 2001 as quoted in Hyten, Col John and Uy, Dr Robert, 'Moral and Ethical Decisions Regarding Space Warfare', Air & Space Power Journal, summer 2004.
[98] Mueller, op. cit., p.10.
[99] At least not to Mueller, ibid., p.10-11.
[100] As reproduced in Sirak, op. cit.
[101] Mueller, op. cit., p.6.

the current legal status of space weapons will be considered; however, this paper will conclude that a strategy of seeking arms control treaties to prevent weaponization will be ultimately doomed to failure since: 'preoccupation with the niceties of law would [only] be appropriate in a utopian world'.[102]

The *sanctuary idealists* can be categorised by their opposition to the spread of weapons into any area not yet weaponized, in this case space. They believe that since weapons are necessary to wage war in (or from) an environment then the absence of weapons in that area will render war there impossible. They may have a '…aesthetic, moral or philosophical distaste for contaminating unpolluted territory with engines of war…' and often believe that the presence of weapons does not just make war possible but it makes it more likely.[103] Like other pro-sanctuary groups, many idealists believe that placing weapons in space crosses the Rubicon, 'Once this genie is out of the bottle, there is no way to put it back in.'[104] However, the idealists are given hope by international treaties that ban landmines as well as chemical and biological weapons. This paper argues that laudable though their stance is, concentrating on banning space weapons misses the point for, in the words of Colin Gray: 'The history of war is not primarily the history of weaponry; rather it is the history of the person who wields the weapon.'[105] The idealist position would obviously be less cynical regarding human nature and they would cite the 1959 Antarctic Treaty[106] as an example of a sanctuary agreement that has stood the test of time. But Antarctica does not have the military utility of space, nor is it already intensely militarised as space is; put simply, if Antarctica were of strategic significance, it would have already been militarised and if significant advantage could be gained from doing so, then weapons would have followed.[107]

There is a body of opinion that believes that space weaponization will have a destabilising effect on the world. These *sanctuary internationalists* do not follow the idealist line of opposing new weapons and new weaponized environments in general, but believe that the particular characteristics of space weapons disturb the balance created by international deterrence and create the conditions for an arms race in space. Part of the argument is that space strike weapons are an offensive asset that can be used with little or no warning and thus without a build-up of forces. The build-up phase of a military operation is often one that sees intensified diplomatic activity to prevent conflict; with space strike capabilities the chance of a military action is thus increased. In addition, space weapons could be used to target 'deterrence weapons' or conduct BPI of ICBMs; therefore it is argued that space weapons could enable a 'first strike' nuclear policy.

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[102] Maj Cady USAF, quoted in Belote, Maj Howard, 'The Weaponization of Space – It Doesn't Happen in a Vacuum', Aerospace Power Journal, spring 2000, p.48.
[103] Mueller, op. cit., p.6.
[104] Robb, Charles, 'Star Wars II', Washington Quarterly, vol22 no1, winter 1999, p.85.
[105] Gray, Colin S, 'Another Bloody Century – Future Warfare', (London: Phoenix 2005); p.61.
[106] The Antarctic Treaty, 1959; accessed from http://www.state.gov/www/global/arms/treaties/arctic1.html#2.
[107] See Gray, op. cit., p.304-306.

So if a nation looks to place these capabilities in space, it will lead to a similar response from peer rivals and potentially acceleration in WMD capacity and change of WMD usage strategy from non-peer adversaries.

Sanctuary internationalists would encourage restrictions on space weaponization not through high moral ideals but because of the risk of world instability. However, it is interesting to ponder their response once 'the altar is defiled' and weaponization occurs; would they in this instance advocate a unilateral stance? A hypothetical analysis of this matter might lead to a circular argument but perhaps it is useful to examine the moral and ethical dilemma that this question poses. For example, let us imagine that the US had the capability to launch a space strike constellation but due to concerns raised by the international community regarding instability and a space arms race, had elected not to deploy it. However, a rival nation, perhaps China, tests and deploys an orbital ASAT capability. Perhaps a nation is acting *immorally* if it elects not to field a capability that will reduce friendly casualties and increase its chances of success. Therefore, in the face of space weaponization one may argue that to not respond is immoral. Of course the idealist view of the preceding situation would be very different but their method of prevention is the same, international treaty and convention.

The final category of the pro-sanctuary movement is one that is most readily understood from a US perspective.[108] The *sanctuary nationalists* note that the US has the most to lose from space weaponization and a change to the status quo. They argue that the US should pursue a policy of non-weaponization, or at least delay weaponization for as long as possible, because the margin of increased capability offered by space weapons would be far greater for any rival than for America: 'Although everybody loses if the heavens become a shooting gallery, no nation loses more than the United Sates…'[109] In many ways this offers a classical realist perspective in that the eventual costs of leading the way in space weaponization would outweigh the benefits, not that space weapons are in themselves intrinsically bad.[110] This argument gives no particular moral judgement regarding space weapons but offers a rational argument for why weaponization should be prevented or at least delayed. However, the perspective hinges on space weaponization being viewed as a taboo that is difficult for the first nation to break; if one were to extend the realist perspective then it is a logical to suppose that eventually one nation would consider that the benefits of weaponization outweigh the costs and pursue such a path. Perhaps, as shall be shown from the final section of this paper, the *sanctuary nationalist* argument is a hopeful delaying action and little more!

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[108] Indeed, all of these groupings were considered by Mueller from a US perspective although most are relevant to any major nation state and also help to explain the behaviour of minor states and non-state actors.
[109] Krepon, Michael, 'Weapons in the Heavens: A Radical and Reckless Option', Arms Control Association, Arms Control Today, Nov 2004.
[110] ibid., p.8-10.

There exists a complex and elaborate framework of international treaties that seek to regulate space activities[111] but there is no single treaty that clearly addresses space weaponization in the context of the current debate. A number of treaties refer to the 'peaceful' use of outer space, but the term has been interpreted in different ways. Initially the widespread interpretation of 'peaceful' was 'non-military', but the US moved away from this soon after the launch of the first satellites. So whilst the Soviet Union outwardly described 'peaceful' as 'non-military', the US began to claim that the term meant 'non-aggressive'. Incidentally, however, throughout this period the USSR was pursuing an increasing policy of space militarisation.[112] Eventually the ambiguous nature of the term 'peaceful' was clarified by the UN[113] and it is widely accepted that the military use of space does not contradict with peaceful use. Before considering the possibility of extending arms control treaties to limit or prevent the weaponization of space one must consider the treaties that are already in place and therefore what is and is not currently considered legal in international law.

The Outer Space Treaty (OST)[114] bans placing nuclear weapons in space (either orbiting the Earth or elsewhere)[115] and the establishment of military bases / installations on the moon and other celestial bodies; it also forbids military manoeuvres on the moon or other celestial bodies. Additionally, intentional physical interference with the space assets of another state (whether or not damage is caused) is also prohibited by the OST.[116] The Biological and Chemical Weapons Conventions[117] forbid the celestial placement of other WMDs and the detonation of nuclear devices (including weapons) is forbidden by the Limited Test Ban Treaty.[118] Space weapons might not be fully addressed by international law but some of the effects that they might produce are; for example, general international law forbids 'any hostile act, committed by a device designed to operate in outer space, that [sic] causes damage to the assets of another state located in outer space.'[119] Thus the development, testing and deployment of an orbital ASAT device are not prohibited but its use would be; however, the use of force in space could be permitted by the UN

[111] '"Peaceful" and Military Uses of Outer Space', op. cit., p.11.
[112] ibid., p.3.
[113] UN CD/1165 12 Aug 1992.
[114] ST/SPACE/11 UN 2002.
[115] Article IV, OST.
[116] General International Law, Article III, VI, VIII and XI OST; this could also include the unauthorised inspection of another nation's satellite!
[117] Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons; accessed via http://www.opcw.org/docs/cwc_eng.pdf. and Convention on the Prohibition of the Development and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction; accessed from http://www.state.gov/www/global/arms/treaties/bwc1.html.
[118] Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, Article I.1(a); accessed via http://www.state.gov/t/ac/trt/4797.htm#reaty.
[119] '"Peaceful" and Military Uses of Outer Space', op. cit., p.13; UN Charter, Article 2(4); UNGA Resolution 3314(XXIV) 4 Dec 1974, on the Definition of Aggression, Articles 3&4.

under Chapter 7 of the UN Charter or because of self defence.[120] In the case of a non-nuclear orbital missile defence system, the use of the system to target ICBMs as they transitioned space would be viewed as permissible; however, if that system was used to attack other space assets, (notwithstanding the exception described previously) then that would appear to be prohibited. There does not appear to be any relevant exception to a space-to-Earth weapons system.[121] All of these prohibitions and treaties are open to interpretation, indeed, the US position was made clear by the Space Commission report, 'There is no blanket prohibition in international law on placing or using weapons in space, applying force from space to Earth or conducting military operations in and through space.'[122]

The words of the Space Commission report serve to highlight a potential pitfall of attempting to use treaties and laws to prevent space weaponization, that the laws are open to interpretation. At the same time as Eisenhower was saying, 'Should not outer space be dedicated to the peaceful uses of mankind and denied to the purposes of war?'[123] the US administration was interpreting 'peaceful' as non-aggressive rather than non-military. A short time later, the USSR whilst apparently interpreting 'peaceful' as non-military and helping to frame what would eventually become the OST, was considering ASAT devices and developing a fractional orbital nuclear bombardment system. Hence treaties are not only subject to interpretation but they rely on the signatories staying true to them. In 2002, the US abrogated the Anti-Ballistic Missile (ABM) Treaty[124] seemingly paving the way for the deployment of space-based elements to a BMD programme. These examples illustrate that international law is not a reliable means to prevent the weaponization of space, what they don't do is to explain just how difficult it is to bring about such treaties in the first place.

The pro-sanctuary movement might have laudable goals, but it is difficult to imagine that any amount of lobbying will be successful in extending existing treaties or creating new ones to prevent the weaponization of space. Currently, there are two major international organisations (both are UN bodies) that concern themselves with the peaceful use of space and related possible future international treaties. 'The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) deals with civilian space traffic issues but excludes arms control problems'[125];

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[120] Article 51 of the UN Charter (self-defence) can be invoked in space; Wolff, Johannes, '"Peaceful Uses" of Outer Space has Permitted its Militarization – Does it Also Mean its Weaponization', Disarmament Forum, p.8.
[121] The summaries of what is and is not prohibited by international law were taken from '"Peaceful" and Military Uses of Outer Space', op. cit., p.12-13; with cross references to the original documentation.
[122] 'Report of the Commission to Assess United Sates National Security Space Management and Organization' (11 Jan 2001), p.17.
[123] President Eisenhower (1958) as reproduced in '"Peaceful" and Military Uses of Outer Space', op. cit., p.4.
[124] 1972 ABM Treaty between US and Soviet Union obliged the two countries not to develop, test or deploy ABM weapons that were space based.
[125] 'Safeguarding Space for All: Security and Peaceful Uses', Conference Report 25-26 March 2004; UNIDIR/2005/20 (2005).

commentators have observed that there is no official dialogue between COPUOS and the UN Conference on Disarmament (CD). CD is responsible for the key international discussion regarding treaties that would seek to limit the weaponization of space, the Prevention of an Arms Race in Outer Space or PAROS. This paper argues that the process and output of PAROS is indicative of the ability of the international community to seek broad consensus to limit or prevent the weaponization of space.

PAROS is an agenda item that has been discussed by CD since 1981. Some considered that PAROS was initially fairly successful, even suggesting that in the early 1990s progress had been made in drafting a treaty that banned space weapons; however the US and China had a disagreement and PAROS has been stalled through lack of consensus since 1995.[126] In 2002 China and the Russian Federation submitted a paper to CD that suggested a prohibition on space weapons.[127] This paper was consistent with the public line that China had followed since at least 1985. However, the paper and other submissions that followed were received with what can most generously be called 'a lukewarm' response from the US. Jon Bolton, then US under-secretary of state for arms control and non-proliferation stated, "…the current international regime regulating the use of space meets all our purposes. We see no need for new arrangements."[128] The 'disarmament press' and CD have been highly critical of the US and some suggest that Bolton's assertion is clearly wrong since, 'No existing treaties effectively prevent the testing, deployment and use of weapons other than those of mass destruction in outer space.'[129] But that critic in particular has missed the point, it is not the effectiveness of the treaties that Bolton was commenting on, he was simply stating that the US does not want to be bound by any further restrictions that will limit her actions should she seek to pursue weaponization in space. It is unsurprising then that the US was one of only four states to abstain from the last two UN General Assembly votes regarding space legislation.[130] Bolton was not being an overconfident liberalist but a rational realist! Finally, the Chinese line was dealt a credibility body-blow in Jan 2007 with the test of an Earth launched ASAT device, a device that would have been banned by the 2002 Chinese sponsored proposal to CD. The positions of China and the US regarding PAROS give a thoughtful insight into the behaviour of states that will be examined more deeply by the last section of this paper.

The US has a clear lead in the exploitation of space and would be well placed to reap the military advantages of space weaponization before any rivals. This leads to a morality question regarding

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[126] '"Peaceful" and Military Uses of Outer Space', op. cit., p.5-6.
[127] "Possible Elements for a Future International Legal Agreement on the Prevention of the Deployment of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects", (CD/1679 27 Jun 2002); it was a working paper co-sponsored by other states.
[128] Zhang, Hui, 'Action/Reaction: US Space Weaponization and China', Arms Control Association, Arms Control Today, (Dec 2005).
[129] ibid.
[130] Israel also abstained from both and Micronesia (under pressure from the US) from the last.

so-called asymmetric advantage. Concerns have been raised that considerable asymmetric advantage, particularly when the lives of serviceman are not put at risk, can be a dangerous situation. It has been postulated that the shared sacrifice between two combatants who are similarly equipped makes war less likely, as belligerents 'think twice' before entering into hostilities. However the evidence from the last century contradicts this, 'shared sacrifice and loss have not made people more adverse to war and have not made the world a kinder, gentler place.'[131] Additionally there is a stance that argues that it is morally wrong not to seek as large an advantage as is possible since a state's responsibility is to its own citizen soldiers; in fact, a state that does not seek to reduce the cost in 'blood and treasure' of a conflict can be said to be acting immorally. Man has always sought technological advantage, from the longbow to gunpowder and the use of tanks & aircraft in the First World War, this will also be the case if and when space weapons provide increased military utility. The moral argument for not weaponizing space is highly questionable and, in any case, has the same fatal flaw as all moral arms limitation arguments: it is fine in a utopian world but, as the final section of this paper will demonstrate, it runs contrary to human nature.[132]

Three main groups against space weaponization have been identified. The *sanctuary idealists* oppose most arms proliferation as well as, specifically, the deployment of space weapons. *Sanctuary internationalists* fear that space weapons could destabilise international security, weakening deterrence and provoking conflict. Space weapons, it is argued, can promote 'first strike' postures or have a speed of response that does not allow crisis prevention to function as it would during a traditional build-up to hostilities. The considerable relative advantage enjoyed by the US over any potential rival means that *sanctuary nationalists* oppose weaponization because they say that the US has the most to lose. Those who hold 'sanctuary' views would seek to delay or prevent space weaponization by international treaty since the existing laws do not adequately address the issue. However, the difficulty of gaining international consensus is highlighted by the continuing PAROS agenda item at CD and the behaviour of the US and China. Moral and ethical arguments regarding space weaponization can be admired for their good intentions, but they fail to address the realities of human nature and state behaviour and it is this final point that is crucial to understanding why the moral, ethical and legal arguments will not prevent the weaponization of space.

THE LOGICAL INEVITABILITY OF SPACE WEAPONIZATION – A TRIUMPH OF REALISM

"Many people believe that the now longstanding absence of weapon deployment in space can be made permanent, both by treaty and culturally by taboo. This is nonsense. It is foolish on two

[131] Hyten and Uy, op. cit.
[132] ibid.

lethal counts. First, it disregards the strength of the strategic incentive to contest space denial…While second, it is technically absurd because space weaponization is an unduly general conflation of all sorts of means of waging space warfare."

- Colin Gray.[133]

Thomas Hobbes offered an early and pessimistic description of human nature. He argued that the natural condition of man was one of perpetual strife and war, a situation so terrible that, "In such condition, there is no place for industry…no culture of the Earth; no navigation; no commodious building…no arts; no letters; no society; and which is worst of all, continuall feare [sic], and danger of violent death; and the life of man, solitary, poore [sic], nasty, brutish and short."[134] However, he argued that when banded together as a nation and with a so-called Leviathan[135] to keep order then the condition of war could be replaced by peace. Others have been less pessimistic about the natural human condition, Rousseau and Locke both disagreed with "…the horrible system of Hobbes."[136] But Rousseau, in particular, agreed that complex states and societies would be formed and their competitive formation would be likely to promote war between these states, "One has either to join it or unite to resist it; to imitate it or let oneself be swallowed up by it."[137] The problem is that then[138] as now there is no Leviathan in the international community, states are rational actors in an anarchic (or at least semi-anarchic) system. So regarding space weaponization, states will act in their own interests: in the case of the US that could be to proceed with weaponization and in the case of China and Russia that could be to ally with one another to attempt to delay weaponization through international treaty until they were able to field space weapons of their own. This follows the pattern explained by Thucydides in his history of the Peloponnesian War, "…the strong do what they have the power to do and the weak accept what they have to accept."[139]

The logical continuation of this argument is that, in this case, the US is powerful and thus the US will weaponize space when it is in her national interest to do so. But there is a counter-argument that wonders why, if weaponization is inevitable, has it not occurred to date? After all, less than a decade passed between the Wright Brother's first flight and the advent of air combat; only a decade and a half after the events at Kittyhawk, virtually every modern air mission had been

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[133] Gray, op. cit., p.310.
[134] Hobbes, Thomas *Leviathan,* ed. Tuck, Richard (Cambridge: Cambridge University Press 1991) p.89.
[135] The metaphorical representation of the state or ruler.
[136] Reichberg, G.M., Syse, H & Begby, E, *The Ethics of War, Classic and Contemporary Readings* (Malden: Blackwell 2006), p.480.
[137] Luard, E (ed), *Basic Texts in International Relations* (London: Macmillan 1992), p.44-6, from Rousseau's *The State of War*.
[138] Hobbes and Locke were seventeenth century contemporaries and Rousseau was writing some one hundred years later.
[139] Thucydides, Warner, Rex (trs), *The Peloponnesian War* Book 5, Chapter 7 (London: Penguin 1955). Text used here reproduced in Luard, op. cit., p.120.

attempted or considered.[140] But the acceleration of air power was fuelled by a major international conflict, a war of national survival.[141] Thankfully no such conflagration has been inflicted on the planet since the launch of Sputnik I and the beginning of the space age. Liberalists might argue that the lack of world conflict in the last half century has, in part, been due to the successful development of an international community and that future arms proliferation can be countered through the UN. But as has been described in previous sections, this hope is tissue thin.

The US and the Soviet Union pursued ASAT technology and researched fractional orbital bombardment systems whilst publicly declaring that space should be used for peaceful purposes. China has been one of the most vociferous proponents of revised international agreements to ban space weapons but is the only nation to have recently tested an ASAT device. Whether China was acting because she sought to protect herself against a growing fear that the US would weaponize space, or whether previous Chinese calls for treaties were smokescreens to bide time for her own programmes is frankly irrelevant. The point is that nation states act to protect their own interests, be that by banding together in alliances or pursuing independent policies because they have the strength to do so. National power politics continue to dominate the international system and the 'UN can behave no more effectively than its leading members permit.'[142]

Therefore, this paper argues that since war is a part of the natural human condition and that no Leviathan exists in the international community, space weaponization is inevitable. International treaties cannot be relied upon to limit weapons since signatories to those treaties will only abide by them if it is in their national interests to do so. When the perceived costs of space weapons are outweighed by their benefits then the proliferation of arms to the fourth military environment will be a logical inevitability. The decision to do so will be a rational one even if it forms a depressing new chapter for the peaceful commons of mankind.

CONCLUSION

"…we know from history that every medium – air, land and sea – has seen conflict. Reality indicates that space will be no different. Given this virtual certainty, the US must develop the means both to deter and to defend against hostile acts in and from space. This will require superior space capabilities."

- Report of the Commission to Assess United States National Security Space Management and Organization (11 Jan 2001).[143]

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[140] Mueller, op. cit., p.14.
[141] ibid, p.14.
[142] Gray, op. cit., p.394.
[143] US Space Commission, op. cit., p.10.

Space and space assets are of vital strategic importance. The increasing globalisation and interdependence of states within the global economy is empowered by the communications facilities provided by satellites. But space too has helped to bring about a revolution in military affairs where knowledge and decision superiority allow faster kill chains and rapid concentration of force. As the hunger for imagery and increased communications bandwidth increases then space will continue to be increasingly militarised and the western powers, with the US pre-eminent, will become more reliant on the fragile assets that enable the 'western way of war'. It has already been argued that space war has happened, but despite the reliance on space assets for C4ISTAR as well as the guidance of weapons, this paper has offered a definition of space weapons thus: '…those things that are intend to cause harm that are wholly or partially based in space.' It is only one of a number of definitions but it allows this paper to describe space as militarised but not weaponized.

Definitions for the space environment have also been suggested by this paper noting that in the near term, weaponization is most likely to concern Terran Space and influence Terra. It has become clear that space has become the so-called fourth environment of war, but clear too that despite its apparent similarity, space is far more than an extension of the air environment. Space is a complex topography with features that are defined and bounded by gravity and radiation rather than the oceans and continents of Earth. Terran Space, with its CLOCs and choke points might be said to resemble a maritime environment that Corbett or Mahan would be comfortable in applying strategy to. CLOCs are more concentrated, congested and predictable than the SLOCs that they resemble with particularly high traffic density in LEO and GEO. The predictability and vulnerability of traffic has led to concerns over the security of space assets and the possibility of a so-called space Pearl Harbour.

For the third time since the dawn of the first space age, a vigorous debate is being conducted regarding space weaponization. The two main bodies of opinion have become increasingly polarised and this is probably because the world is closer to space weaponization now than ever before. At a time when the growing commercialisation of space, in parallel with its militarisation, is reducing the cost of space access, the military utility of space weapons is apparently growing. The US, as the dominant world power and leading space faring nation, is the most likely to weaponize but other states and potentially non-state actors could also choose to do so. Non-peer adversaries of the US might seek a low cost ASAT strategy that employs gravel warheads or HAND delivered by BM technology to target satellites in LEO. This sort of threat coupled with the increasing proliferation of BMs and WMD has encouraged the US to pursue a BMD strategy that could one day have a space-based element.

Directed energy weapons such as a hydrogen fluoride laser could provide a BPI BMD device but there are other possibilities for space-based BMD such as the now defunct Brilliant Pebbles programme of SDI vintage. Directed energy weapons also have utility against other target sets but lasers optimised for BPI are not of an optimal wavelength for targeting through the Earth atmosphere to the surface. Global power projection from space is probably best achieved through mass-to-target weapons such as kinetic energy rods or conventional weapons released from a satellite. Space is often described as the ultimate high ground and since the dawn of warfare, the high ground confers advantages to those who utilise it. Space assets have an unrivalled view of the Earth and because they enjoy freedom of passage ignoring international borders and out of the reach of most terrestrial defences, they have an unprecedented ability to reach and strike any target on the surface of the planet. The right sized and positioned weapons constellation might offer a space strike capability against any surface target within half an hour of the decision to attack being made. But this capability would come at a cost, space weapons are more expensive (in terms of fuel and finances) to deliver than those from the air or sea. Notwithstanding their cost and apparent fragility, this paper argues that they offer considerable military utility against a range of targets and that military utility is the most convincing argument for why a state would weaponize space.

Of the pro-sanctuary groups, the *sanctuary nationalists* are interesting not because they view all weapon proliferation to unsullied regions as wrong (as do the *sanctuary idealists*) but because they believe that the US has the most to lose from space weaponization since it could erode the military advantage that America currently enjoys. The *sanctuary internationalists* believe that space weapons would lead to greater international instability since, it is argued, these weapons encourage a 'first strike' posture as well as reducing the time from the start of a crisis to military action; a time that is traditionally used to diffuse crises. All of the pro-sanctuary groups would seek to prevent space weaponization by extending existing and creating new international treaties, probably through the medium of the UN. But in the words of Gray, "Efforts to control, limit, and regulate war, and therefore warfare, by international political, legal, and normative-ethical measures and attitudes are well worth pursuing. However, the benefits from such endeavours will always be fragile, vulnerable to overturn by the commands of perceived belligerent necessity."[144] In short, it is difficult enough to reach an international consensus that leads to a treaty but a treaty will be ignored if a nation deems it necessary to protect national interest. Interestingly, in the future it may also be difficult to establish nationality of space objects and thus apply existing international law.

Quintessentially, states behave as usual in the semi-anarchic international system. The US and the Soviet Union pursued ASAT and fractional orbital bombardment systems whilst purporting to

[144] Gray, op. cit., p.394.

support the notion of space as a peaceful commons for all. Treaties are open to interpretation and the UN can find itself a hostage to its strongest members. The CD has a longstanding agenda item in PAROS but finds that all meaningful progress regarding a treaty to ban space weaponization has been stalled. The US has openly stated that it sees no need for further treaties to regulate outer space but this is not because the US finds existing treaties satisfactory but because future law might constrain her actions. In this semi-anarchic system, where there exists no Leviathan, national interests and the balance of power are the keys. One only has to consider the stance of China, lauded as a paragon of space weapons non-proliferation,[145] who signals great concern over the issue of space debris but performs a surface launched ASAT test that destroys a redundant Chinese satellite in LEO. Additionally, there are reports that China is developing parasitic micro-satellites and other orbital ASAT devices. The actions of Beijing may have been provoked by the hawkish Bush administration or a growing fear of the US hegemony extending to space; perhaps the Chinese always intended to weaponize space, the reasons are irrelevant it is the behaviour of states that is crucial.

Rational actors, be they nation states, trans-national organisations or the leaders of terrorist groups, act in their own or their organisation's interests. Thus it is that this paper has argued that space weaponization is inevitable. This is not because warfare and the paraphernalia of war follow man wherever his interests are at stake, but because of the basic human condition. Man might not be in a constant state of war without the state or a Leviathan, as Hobbes suggested, but man's propensity for conflict should not be underestimated. Space weaponization did not immediately follow the exploration of space as air weaponization followed man's first foray into the skies; but, until now, there has not been the imperative to do so. There will come a point soon when the cost of space weaponization, be it financial or political, will be outweighed by the benefits. When that time comes, as it surely will, the weaponization of space will commence and no amount of moral, ethical and legal arguments will prevent it.

[145] Grossman, op. cit., is the most complementary regarding the Chinese position, but note also Zhang, op. cit., and Lewis, op. cit.

BIBLIOGRAPHY

BOOKS

Allward, Maurice, *Timothy's Space Book* (London: Collins 1963).

Bracken, Paul, *Fire in the East, the Rise of Asian Military Power and the Second Nuclear Age* (New York: Harpur Collins 2000)

Dolman, Everett C, *Astropolitik – Classical Geopolitics in the Space Age* (London: Frank Cass Publishers 2002).

Gray, Colin S, 'Another Bloody Century – Future Warfare', (London: Phoenix 2005).

Grossman, Karl *Weapons in Space*, (New York: Seven Stories Press 2001)

Handberg, Roger and Li, Zhen, *Chinese Space Policy – A Study in Domestic and International Politics* (London: Routledge 2007)

Hobbes, Thomas *Leviathan,* ed. Tuck, Richard (Cambridge: Cambridge University Press 1991).

Klein, John J, *Space Warfare, Strategy Principles and Policy,* (London: Routledge 2006).

Krepon, Michael and Clary, Christopher, *Space Assurance or Space Dominance? The Case Against Weaponizing Space* (Washington DC: The Henry L Stimson Centre 2003).

Lambakis, Steven J, *On the Edge of Earth, The Future of American Space Power* (Lexington, Kentucky: The University Press of Kentucky 2001).

Lambeth, Benjamin S, *Mastering the Ultimate High Ground – Next Steps in the Military Uses of Space* (Santa Monica CA: RAND 2003)

Luard, E (ed), *Basic Texts in International Relations* (London: Macmillan 1992).

Preston, Bob et al, *Space Weapons Earth Wars*, (Santa Monica CA: RAND 2002).

INTERNET SOURCED DOCUMENTS

Hays, Lt Col Peter and Mueller, Karl, 'Going Boldly – Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space', previously published in the Aerospace Power Journal, spring 2001, accessed from www.armscontrolwonk.com. 19 Apr 2007.

Hitchens, Theresa, 'National Space Policy: Evolution Stealth?', Arms Control Association, Arms Control Today, (Nov 2004) accessed from http://www.armscontrol.org/subject/space/ 27 Nov 2006.

Hudgins, E, 'Should the United States "Weaponize" Space?' (2002), Cato Institute. Retrieved 23 November 2006 from Columbia International Affairs Online http://www.ciaonet.org/pbei/cato/pec05/index.html.

Krepon, Michael, 'Weapons in the Heavens: A Radical and Reckless Option', Arms Control Association, Arms Control Today (Nov 2004), accessed from http://www.armscontrol.org/subject/space/ 27 Nov 2007.

Lewis, Jeffrey, 'What if Space Were Weaponized – Possible Consequences for Crisis Scenarios', (Washington: Centre for Defence Information 2004) accessed from www.armscontrolwonk.com. 19 Apr 2007.
Lewis, Jeffrey, 'False Alarm on Foreign Capabilities' and 'Programs to Watch', Arms Control Association, Arms Control Today (November 2004), accessed from http://www.armscontrol.org/subject/space/ 27 Nov 2006.
Shah, Anup, 'Arms Control – Militarization of Outer Space' (23 May 2005). Accessed Dec 2006 from http://www.globalissues.org/geopolitics/ArmsControl/Space.asp.
Sirak, Michael, 'Space Weaponization: Battle for Space', Jane's Defence Weekly, (5 Oct 2005). Accessed 23 Nov 2006 from http://www8.janes.com.
'United States Space Command Vision for 2020' (Feb 1997). Accessed Dec 2006 from www.spacecom.af.mil/usspace.
Wolff, Johannes M, '"Peaceful Uses" of Outer Space has Permitted its Militarization – Does it Also Mean its Weaponization?', Making Space for Security?, Disarmament Forum. Accessed Nov 2006 from www.undidir.org/pdf/articles/pdf-art1883.pdf
Zhang, Hui, 'Action/Reaction: US Space Weaponization and China', Arms Control Association, Arms Control Today, (Dec 2005), accessed from http://www.armscontrol.org/act/2005_12/Dec-cvr.asp 27 Nov 2006.
'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies'. From United Nations Treaties and Principles on Outer Space (ST/SPACE/11 2002) Accessed 17 Apr 07 from http://www.unoosa.org/pdf/publications/STSPACE11E.pdf.

PAMPHLETS AND REPORTS

Weiss, Leonard, (Chairman, Federation of American Scientists [FAS]), 'Ensuring America's Space Security – Report on the FAS Panel on Weapons in Space' (Draft), (FAS 2004).
'Report of the Commission to Assess United Sates National Security Space Management and Organization' (11 Jan 2001)

PAPERS AND DEFENCE RESEARCH PAPERS

Background Paper, '"Peaceful" and Military Uses of Outer Space: Law and Policy', Institute of Air and Space Law, Faculty of Law, McGill University, (Montréal: McGill University Feb 2005).
Brown, Maj Kendall K, 'Technology Challenges for Operationally Responsive Spacelift', Research Paper 2004-02, Airpower Research Institute.

Bell, Lt Col Thomas D, 'Weaponization of Space: Understanding Strategic and Technical Inevitabilities', Jan 1999, Centre for Strategy and Technology, Air War College, Maxwell Air Force Base.

ARTICLES

Baum, Lt Col 'Defiling the Altar: The Weaponization of Space', Airpower Journal, spring 1994
Belote, Maj Howard D, 'The Weaponization of Space – It Doesn't Happen in a Vacuum', Aerospace Power Journal, spring 2000, p.46-52.
Hyten, Col John and Uy, Dr Robert, 'Moral and Ethical Decisions Regarding Space Warfare', Air & Space Power Journal – Summer 2004.
MacAskill, Ewen et al, 'Western Protests Flood in Over Chinese Satellite Killer', The Guardian, p.18-19 (20 Jan 2007).
Robb, Charles S, 'Star Wars II', Washington Quarterly, vol 22 no 1, winter 1999, p.81-6.
Sample, Ian, Science Correspondent, The Guardian, p. 19 (20 Jan 2007)
Watts, Jonathan, 'Denial and Disbelief as Government Stays Silent', The Guardian, p.19 (20 Jan 2007)
'Air Force Seeks Bush's Approval for Space Weapons Programs', New York Times (18 May 2005).

MOD SOURCED DOCUMENTS

DCDC Global Strategic Trends Programme (2006).
Future Air and Space Operational Concept (2006).

UNITED NATIONS PUBLICATIONS

'Outer Space and Global Security' – UNIDIR/2003/26 (United Nations Institute for Disarmament Research 2003)
'Safeguarding Space for All: Security and Peaceful Uses (Conference Report 25-26 March 2004)' – UNIDIR/2005/20 (United Nations Institute for Disarmament Research 2005)