How is space power useful to international relations?

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Abstract

A study of the different debates surrounding the use of space power. It argues that space power is a useful component of International Relations and that it is particularly applicable to realist theory.

Contents

Introduction

In this essay I will first show that current trends in space replicate established historical patterns, then I will compare these trends against the contemporary phenomenon of a 'new space race'. I will argue that this new space race exhibits common characteristics which can be explained from a neo-realist perspective, specifically the co-ordination of military and commercial efforts for the control of the space environment.

Throughout history there are periods when new environments have been introduced and world powers have attempted in various ways to control it. In the modern era the battle over control of new environments has coincided with the creation of military-industrial complexes.

For example, the strength of the British empire was to some degree predicated on its effective use of sea power. Britain's ability to control the world stemmed from her position as an island with access to Africa and the Americas via the Atlantic ocean. Halford MacKinder adds that the security of the mainland as well as the fertility of its soil made it an ideal base for expansion(Mackinder, 1919, pp.71–75).
Sea power gave Britain the ability to colonise distant territories; and these territories were in turn connected by a network of shipping lanes which had to be maintained to ensure its survival. A map of current shipping lanes shows that Britain remains a major hub in the network(Grolltech, 2012). Two trading companies operated along the shipping lanes; the East India Company and the Hudson's Bay Company, each gained unprecedented levels of power and ended up controlling entire countries. The companies were made up of merchant capitalists supported by the British military, they were typical military-industrial complexes.

My second example, the First World War was fought during the rapid development of air power. Martin Shaw explains that in modern industrial societies, economic competition becomes a significant factor in acquiring power, and as such the First World War included a 'war of production' which was fought alongside the main war(Shaw, 1991, p.21). The 'home front' of the war became a legitimate target and air power was suited to this as it allowed each side to strike behind an opponent's frontlines to hit strategic infrastructure. Like sea power, air power gave each side a wider reach, modifying the boundaries of the battlefield to include things like farms, railway lines, power stations, and anything else which contributed to the economy of the opponent.
Furthermore, it can be argued that the First World War was fought on behalf of competing business

interests. As noted by Eric Hobsbawm, “the development of capitalism inevitably pushed the world in the direction of state rivalry, imperialist expansion, conflict and war”(Hobsbawm, 1989, p.316). He develops this further later on, noting that “economic competition became inextricably woven into the political, even the military, actions of states”(Hobsbawm, 1989, p.317). Following his argument, a factor in the First World War was the existence of military-industrial complexes.

The interaction of military and commercial expansion into a new environment is a recurring trend, and I would argue that it repeats itself with the introduction of humanity to space. When asking under what economic and political conditions space activity will be organised, Schwarz and Stares identify commercialisation and militarisation as the two dominant dynamics(Stares & Schwarz, 1985, pp.4–5). The process of colonisation of a new environment is not new, yet literature surrounding space power separates military and commercial aspects, approaching each from very different theoretical perspectives.

Militarisation of space is explained from a strategic and realist perspective. Examples of space militarisation are largely drawn from cold war scenarios and explained in terms of state-centric territorial geopolitics. Commercialisation meanwhile is explained as a variant of globalisation. Like globalisation, commercial space power operates above national boundaries and state-centric politics. The dynamics of commercialisation and militarisation in space is what I want to explore in my essay, specifically asking why they aren't drawn together in the same way they were in previous historical periods. There is a third dynamic, the established tradition of civil-scientific space exploration. This is non-commercial and non-military in character, although new research arising from it can have commercial and military applications.

Militarisation in the 20th century

The history of space power in the 20th century is very well explained in terms of realism and militarisation, particularly as an adjunct to the cold war. International Relations theory has moved on since then but the period needs to be seen in its correct context. Realism is also still a valid theoretical framework, as noted by Frances Brown “while it no longer makes sense to reduce the examination of power solely to economics and high politics, or military strength, these factors are still of overriding importance”(Brown, 2013, p.221). This is a typically neo-realist position, which maintains the centrality of hard power to international politics while also recognising the influence of non-state actors and regimes. It is appropriate to engage with realism here as it's the dominant perspective from which early space power is analysed.

The space race from 1957 to 1974 as a period is also particularly interesting because the early development of space power was very strongly associated with the terrestrial cold war context. In itself it provided some achievements, for example the manned expeditions to the moon under the NASA Apollo programme. However, since Apollo 17 no human has ever returned to the moon and this can be taken as the end of the 'space age'. Siddiqi makes this link, that “the space age was [and still is] indistinguishable in many ways from the space race”(Siddiqi, 2000, p.876). The space race in turn is inextricably tied to the cold war and as such it's is an important period to study when researching space power.

Chris Davis points to the militarisation of space in parallel with the militarisation of the atmosphere, comparing the current development of space power with the early development of air power(Davis, 1989). Military aircraft such as observation balloons and biplanes were initially used for gathering intelligence, and in response the first anti-aircraft systems were built. Bomb-dropping aircraft were developed around the first world war and aircraft in general became weaponised from that point onwards. This theory is backed up by Golin Gray, who commented that the “strategic history of spacepower is likely to follow the pattern already traced by seapower and airpower”(Gray, 1999, p.258). That's to say that there's a pattern of linear development which begins with the involvement

of an environment as a passive accessory to warfare and ends in the exploitation of that environment to actively participate in war. Another description of this pattern can be found in the introduction of the US Space Command's 'Vision for 2020'(Anon, 1988).

The military application of spacecraft has followed a similar pattern to aircraft. Military spacecraft such as satellites were initially used for surveillance, and in response the first anti-satellite (ASAT) systems were built. This put space-faring nations in the position of either advancing weaponisation by developing ASATs to shoot down opponent satellites, or advancing weaponisation by developing weapons systems to defend satellites from ASATs. Matthew Hoey predicts this as weaponisation being initiated by “space asset protection systems”(Hoey, 2006). In other words, weaponisation occurs as increasingly sophisticated measures are deployed to defend satellites from ASATs.

Analysing this pattern also requires a return to classical geopolitics and an understanding of the features of space as an environment. The environment of space is unsuitable to human settlement and therefore it's difficult to control permanently, the comparison with sea and air is obvious. Halford MacKinder argues that control of the Indian ocean by British sea power relied on British control of all the major ports and coastlines which bordered that ocean(Mackinder, 1919, pp.74–75). He called it a 'closed sea', and it follows from this that a strategic goal in air, sea and space power is not to establish physical control over an environment but to deny such control to an opponent. This is where the real power of ASATs lie, and it fits well in line with the US strategic doctrine of 'full spectrum dominance'.

In terms of political theory, ASATs can be seen as highly undesirable as they contest the notion of space as a sanctuary, a sanctuary which remains one of the last demilitarised zones of Earth. There are pacifist arguments for this which are valid in themselves. Bertrand Russel for example described war as “mutual slaughter”(Russell, 1918, chap.6) and talks about the need for a 'changed moral atmosphere' to achieve peace(Russell, 1918, chap.6). It's a pacifism which appeals to a moral and ethical sense that war should be opposed simply because violence is unbefitting of a civilised society. It's one of the more simple arguments against militarisation in general.

From a strategic perspective, 'space as a sanctuary' is (or *was*) crucial to global stability because so long as satellites can freely “conduct reconnaissance within the boundaries of sovereign states”(Seedhouse, 2010, p.53) they keep state actors accountable. Satellite reconnaissance ensures compliance with various arms limitation treaties by making it very difficult to covertly build up arms without being spotted(Seedhouse, 2010, p.53; Hafemeister et al., 1985, p.40). Incidentally arms control is not the only area which benefits from satellite imagery, it applies to environmental treaties too(Aschbacher, 2002, p.176). This is by no means perfect as there are still means of evading reconnaissance by burying sensitive sites underground, using decoys and camouflage to hide their location(Sepp, 2000, pp.13–14).

In a broader sense, by clearing away the fog of war satellite imagery allows commanders to make more rational decisions with good intelligence. This is particularly relevant to the scenario of global thermonuclear war; satellites can detect ICBM launches early in their boost phase, thus giving the defensive power time to discuss a counter-strike. It takes about 16 minutes for an ICBM to fly from Moscow to New York(Kurzweg, 2012, pp.4–5) and this window of opportunity gives time for human agency(Bowman, 1986, p.8). Without satellites countries would have to rely on radar stations, and while most 'over the horizon' radar systems can detect theatre ballistic missiles at ranges of up to 3,000-3,500km, satellites can cover the entire planet with much greater levels of precision.

A late warning system by ground-based radar would place severe time constraints on any decision to launch a counter-strike, and this could only be overcome by an automated mechanism which launched on warning. However, this introduces the risk of computer error, giving a human a minute

or two to think before approving a counter-strike addresses this risk. For example, in 1960 the US Ballistic Missile Early Warning System mistook the rising moon for a missile launch(Borning, 1987, p.121), in 1983 the Soviet Union's Oко early warning system mistook the sun glinting off the atmosphere for a missile launch(Larrimore, 2007, p.174). There were a other false alarms in 1979, 1980 and 1995, all of which could have triggered an accidental nuclear conflict were it not for human intervention.

This is best illustrated by the 1983 film *Wargames*, the premise of which was that when faced with convincing evidence of a (simulated) nuclear attack, 22% of officers would refuse to launch a counter-strike. Patrick Ryan notes that the film “captured many Americans’ fears of imminent nuclear war, and [it] prophetically depicted people’s anxiety about personal computers”(Ryan, 2004, p.9), showing that, at the time, there were very real public concerns over the possibility of a computer-controlled nuclear apocalypse.

Unfortunately the concept of 'space as a sanctuary' is incompatible with the existence of ASAT systems. In order to explain why it's necessary to relate to the 'balance of power' theory. Kenneth Waltz refers to a balance of power which maintains stability(Waltz, 2001, p.161) on the condition of 'anarchy among states'(2001, p.208); parity must be maintained between states to prevent an escalation of conflict. To prove this it's easy to trace imbalances and periods of escalation through the early history of the arms race in space. For example, in 1959 the USA tested the Nike Zeus Anti-Ballistic Missile system to counter the Soviet R-7 ICBM(Bowman, 1986, p.14). In 1961 the Soviet Union started developing a Fractional Orbital Bombardment System with the GR-1 and later R-36 ICBMs. This orbital bombardment system was designed to evade the US Anti-Ballistic Missile defences by launching ICBMs into low-earth orbit. Waltz observed that “a balance, once disrupted, will be restored one way or another”(Waltz, 1979, p.128), and soon enough in 1964 the US began development of program 437, an ASAT system capable of destroying Soviet ICBMs in orbit(York, 1985, p.23; Hafner, 1980, p.45).

Events which take place in space can be seen as a result of terrestrial politics(Anon, 2013a, pt.1:10), so it's useful to note here that the early arms race in space took place against the background of the Cuban missile crisis. The US deployed Jupiter IRBMs in Turkey and Italy, then the Soviet Union deployed R-12 IRBMs in Cuba in response; at this point the two states had reached a balance of power and there was no further escalation. What happened was a swinging pendulum motion between the two sides, each countering the other until they reached an approximate balance.

It was for sure a volatile situation, demonstrating well how both nuclear weapons and ASATs can be very destabilising, but there was only one recorded casualty and no nuclear exchange actually took place. It's important that although a balance of power is a stabilising mechanic it should not be mistaken with a peaceful one because conflict is only suspended, not resolved. Waltz emphasises this, arguing that the bipolar situation of the cold war was very unstable but also remarkably absent from major conflict(Waltz, 1993, p.45). The opposite is also true of a multipolar world and this essay will discuss it later on.

Another important point is brought up by Robert Bowman that the introduction of ASAT systems has grave implications for missile defence(Bowman, 1986, p.10). We can assume that the opening move in a global thermonuclear war would be to knock out the opponent's warning satellites, that way the opponent would be blind and thus unable to detect a missile launch. The opponent could guess that their critical satellites had been deliberately knocked out, and a nuclear conflict has begun. In the absence of other evidence the only logical course of action would be to launch a pre-emptive counter-strike against all players in possession of ASAT systems.

Except imagine a scenario in which the opponent's satellites hadn't been knocked out deliberately, what if they had just been hit by some passing debris, or there was a simple malfunction? Space

weather can have a hazardous effects on satellites, for example in 1994 two communications satellites 'span out of control'(Bedingfield & Leach, 1996, p.1) due to electrostatic discharge(1996, p.5). A nuclear war could be initiated over such an accident, and while it's an unlikely prospect, ASAT systems nevertheless introduce that risk where previously there was none.

The most common form of ASAT systems today are ground-based kinetic interceptors. These are missiles launched from the ground which collide with a satellite in orbit. The force of impact is often enough to destroy or disable the satellite, and even if the satellite remains intact it will have been knocked off course. There's a lot of cross-over between these ASAT measures and missile defence as they both aim to destroy moving targets in low-earth orbit(Wright & Grego, 2002). It's a short technological leap to adapt the rockets which can shoot down missiles to shoot down satellites instead.

There is one example of an air-based ASAT/BMD system, the Boeing YAL-1 airborne laser, however this was discontinued in 2011. The Soviet Union maintained a ground-based laser ASAT system at Sary Shagan in Kazakhstan(Koplow, 2008, p.1213), however this was underpowered to the point where it posed virtually no threat to satellites or other spacecraft. The disadvantage of ground-based laser systems is that they can be weakened by the atmosphere or blocked completely by clouds(Hafner, 1980, pp.48–49), however they still pose a threat in that they are easier to acquire than conventional ASAT systems. This leaves them open to being adopted by non-state actors or less powerful states(1980, pp.48–49), meaning they could be used in the context of an asymmetric conflict.

One measure to protect satellites is to give them the ability to manoeuvre in orbit, allowing them to evade projectiles launched at them from earth. This is obviously limited by the amount of fuel a satellite can carry and is more likely to be used for course corrections, however as the technology develops it opens up new avenues, such as satellite capture. If satellites can make increasingly sophisticated movements, they can approach another satellite, latch onto it, and 'capture' it. This is what happened on 19 July 2013 when China launched three satellites in one Long March rocket(Anatoly, 2013a). According to some observers these satellites orbited in close proximity to one another(Anatoly, 2013b) and were involved in “rendezvous and capture/docking manoeuvres”(Anatoly, 2013c). Such precise orbital manoeuvres represent a new step forwards in the arms race as it's more valuable to take control of an opponent's asset than to simply destroy it.

Stephen Biddle argues that modern 'deterritorial' warfare using air, sea or space power requires “some degree of co-operation from the opponent”(Baylis, 2002, p.92). In contrast to simple land warfare an objective cannot be captured directly, instead it is achieved by forcing an opponent to withdraw, or at least to concede certain concessions. For example an aerial bombing campaign does not itself amount to the capture of a territorial position, but it would weaken a position's defences, thus making it easier to capture by ground troops. There are some exceptions to this where the actual vehicles of air, sea and space power become targets themselves. Vehicles can be captured, which is a dilemma because while piracy of ships and hijacking of planes is not a common occurrence it is a viable tactic. What if a satellite were hijacked? Because of its potential use by non-state actors, hijacking could be a tactic in an asymmetric conflict.

If the environment of space really is locked in an arms race and subject to weaponisation, then the most prominent aspect of this centres around missile defence. It's a move from merely observing and reporting a hostile missile launch to actually intercepting missiles in mid-flight. In the early 1990s the US government planned to add around 1,000 space-based interceptors to its missile defence programme(Steven, 2007, p.5). However, Brian Weeden states that space-based systems are impractical for missile defence, arguing that geostationary satellites sitting in high orbit are too far from the target to intercept it in time, meanwhile satellites in low orbit move too fast to intercept a slow missile(Weeden, 2008). If interceptors fly too low they cease to become effective due to the

“blinding of their onboard infra-red sensors, required for terminal tracking and guidance, caused by the intense atmospheric heating that results when the interceptor enters the atmosphere at high speed”(Weeden, 2008). The infra-red sensors are essential because the interceptor tracks the missile by detecting the heat from its thrusters in the boost phase(Anon, 2013c), and without tracking it cannot intercept. The atmospheric drag in low orbit also means satellites have to reduce their reliance on large solar panel arrays for energy as these slow them down(Downey et al., 2004, p.80).

There is some potential for space power to move from a defensive to an offensive position. Just as bi-planes were used to drop bombs on targets below, satellites could be used to engage in orbital bombardment. At face value there's a clear tactical advantage to this, a fleet of weaponised satellites in orbit could strike anywhere on Earth at any time, forgoing the limitations of ranged weaponry. There was a lot of discussion around it in the USA towards the end of the 1960s(Preston et al., 2002, p.40) as a way to match the Soviet orbital bombardment system. However this interest was brought to a close by the passing in 1963 of UN General Assembly resolution 1884. In this resolution both the USA and the Soviet Union agreed to “not to station in outer space any objects carrying nuclear weapons or other kinds of weapons of mass destruction”(Anon, 1963). Some text from this resolution was later integrated into article 4 of the Outer Space Treaty in 1967, calling upon states to not place into orbit any objects “carrying nuclear weapons or any other kinds of weapons of mass destruction”(Anon, 2013d, p.10). Resolution 1884 and the Outer Space Treaty showed a clear rejection on all sides of the weaponisation of space, yet both the USA and the Soviet Union were developing, and close to actually deploying, nuclear weapons in space; so why did they step back?

There are several reasons for this, as already mentioned the USA and the Soviet Union reached strategic parity, so they were at a stalemate from which a diplomatic solution was made easier. The psychological impact of the Cuban missile crisis doesn't seem to have changed public attitudes; in 1955 the US public was broadly confident about US nuclear superiority(Yankelovich & Doble, 1984, p.37) and they were still confident in 1964(Graham, 1986, p.13). What changed was the growth of a very outspoken peace movement throughout the world, in Britain it was expressed as the Campaign for Nuclear Disarmament. The peace movement also flourished in the socialist and non-aligned countries, particularly in the German Democratic Republic. A solution to the 'German question' was cited by Khrushchev as the key to peace in Europe(Khrushchev, 1962, pp.38–42); when the antifascist protection rampart was built East Germany was secured as the western frontier of the socialist bloc. Thereby the German question was solved, peace in Europe was won and there was no need for sabre-rattling in space.

Here it's useful to look at the broader international situation. The Soviet Union had an interest in promoting disarmament in the GDR so as to prevent another war in Europe, and it also wanted to avoid provoking a war with the USA. Looked at from an ideological perspective, Marxism-Leninism incorporates elements of anti-imperialism, and this makes it a natural opponent to US aggression and militarism. So in some respects the Soviet acquiescence to the demilitarisation of space was completely consistent with Soviet ideas. Unfortunately this would be a misrepresentation of theory as practice, because prior to the Cuban missile crisis Khrushchev had no qualms about openly threatening the USA and its puppet regimes with nuclear war(Hanak, 1972, pp.30–31). Various deceptions were put in place to exaggerate the size of the Soviet nuclear arsenal(Nogee & Donaldson, 1981, p.110) and in the end the Soviet Union engaged in the same militaristic posturing which characterised its opponent. Also in terms of ideology the same can be said for a liberal interpretation of the cold war which saw it as a struggle between capitalism and socialism. In this way the liberalism promoted by US policy elites can be understood as a natural opponent of socialist and anti-imperialist movements throughout the world. Interestingly both perspectives take a zero-sum approach to the strategic situation with neither side willing to settle on less than the destruction of its opponent, and so both ideologies share a key element of classical realism.

A more convincing explanation is that the decision to agree on peace did not emerge out of the blue in 1963 but was the result of a long-standing diplomatic effort. Beginning in 1959 the diplomatic process preceded the period of crisis and continued in various forms up to the diplomatic breakthrough in 1963 and beyond(Ponomarev, 1973, pp.430–452). If each nation had acted in their own self-interest the conflict would have escalated until one side played their trump card and initiated nuclear war. This is one of the win-states envisaged by the prisoners' dilemma(Kuhn, 1997); in a zero-sum game where communication is forbidden each player acts selfishly to the collective detriment of all players. That didn't happen because both formal and informal channels of communication were kept open between both sides.

It's also true that despite the high tensions neither side wanted a nuclear war(Nogee & Donaldson, 1981, p.110), and the actual deployment of an orbital bombardment system would have been tantamount to a declaration of (nuclear) war. It's difficult to achieve a perfect orbit, especially with the technology available in the 1960s; thus by placing nuclear weapons in orbit it is expected that, without correction, they would at some point either fall back down to earth or spiral out away from it. Keeping a missile in orbit is keeping a missile in flight, it's a suspended nuclear war in which the first shot has been fired but not yet reached its target. Neither side had a desire to see a nuclear war played out so they both refrained from deploying such a system.

When looked at from a purely strategic perspective, satellites have some disadvantages which can't be overlooked. They tend to have very little armour, which makes them vulnerable to collateral damage from a nuclear blast. They can also be very easily tracked along predictable orbits, for example the US Satellite Surveillance Network keeps a record of many satellite orbits. Amateur astronomers can follow the positions of some key satellites, such as the International Space Station, with commercial telescopes. For a real example, in 1986 'Captain Midnight' was able to track and jam a US television satellite using very basic equipment, and there were are two other cases of satellite jamming in 1977 and 1987. Such attacks expose severe vulnerabilities which make satellites undesirable for nuclear war when compared with ground-launched ICBMs. The story of Captain Midnight also shows how easy it is for non-state actors to interfere. As it happens he targeted a commercial satellite and it was a relatively harmless operation, but he could just as well have targeted a military satellite.

The last factor in preventing the full militarisation of space is the effect of Yuri Gagarin's spaceflight. The moment when he flew over the planet can be counted without exaggeration as a turning point in the 20th century and indeed in the history of humanity as a whole. It surpassed the arms race to spur on a space race, and of course there was competition between the superpowers but it was peaceful and civil. According to CIA estimates, Soviet spending on both civil and military space programmes experienced a dramatic rise from 1960-1970 but throughout that period ~7 times more was spent on civil programmes than military ones(Anon, 1971, p.22). The NASA budget for US civil space programmes saw a similarly drastic increase(Anon, 1999) although it's difficult to find comparable statistics for US military space programmes. The point is that the use of space as a military arena was overtaken by peaceful uses of space. This can be tied into a greater point about the value of a civil-scientific approach to space which will be discussed later on.

Interest in space-based weapons was rekindled towards the end of the cold war as the Reagan administration in the USA pursued the Strategic Defence Initiative. Numerous concepts and tested models were produced, but no fully-functioning weapons platform was ever deployed. This for the reasons I've already outlined, and because the ending of the cold war made them redundant. The SDI is set apart from earlier space weapon platforms because its focus was just on missile defence, which gave it a defensive rather than offensive character. This still has a destabilising effect because if the US had the ability to block a nuclear counter-strike it could act without repercussions, and that poses a great threat to the rest of the world.

Gerald Steinberg tries to make distinctions between the character of the US and Soviet space programmes with relationship to their military aspects. He argues that the US civil space programme is easily separable from the military one, whereas the Soviet programme had “no clear dichotomy” between its civil and military space efforts(Stares & Schwarz, 1985, p.34). He is correct in that the USA has NASA, its own government agency dedicated to purely civilian activities; meanwhile the Soviet Union denied the existence of a separate military space programme, instead incorporating military activities into its civilian programme.

One point cited by Steinberg is that Soviet cosmonauts were drawn from the ranks of the military, and while this is true it can't be used as proof that the Soviet space programme was more military-oriented than the US one. Of the current NASA astronaut group, 5 out of 8 have a military background, and this is generally indicative of the makeup of previous NASA astronaut groups. The simple explanation for this is that in order to be an astronaut one must have experience as a test pilot, and the career of test pilots usually involve rising through the respective US or Soviet air forces.

The last point by Steinberg which should be addressed is the ratio of military to non-military launches of each country. He mentions a congressional study by Marcia Smith which claims that between 1957 and 1980 58% of Soviet launches were of a military nature, compared with 42% for the USA(Smith, 1985, p.8)[1]. This appears to show that the Soviet programme was more military focused, although without the original source it's not a completely reliable statement.

The new space race

This essay will next discuss the 'new space race' which can be characterised by two developments, firstly the radically different international situation following the end of the cold war and secondly the increased activity of private companies in space.

During the transition from bipolarity to multipolarity at the end of the cold war, the US-Soviet arms race which accompanied it slowly died down, particularly on the Russian side. Defence spending as a percentage of GDP in the Russian Soviet Federative Socialist Republic/Russian Federation fell from 14.2% in 1989 to 5.3% in 1992(Solmirano & Ferguson, 2013)[2]. The nuclear situation de-escalated too, between 1989 and 1993 the Russian side reduced their stockpile of warheads by 10,706 or 48% and the US side reduced theirs by 10,675 or 30%(Kristensen & Norris, 2013, p.78). This greatly stabilised the international system, however during the same period a number of wars broke out, mostly centred around the fragmentation of the socialist bloc(Singer, 2004, p.51). This goes to show that despite differing circumstances Waltz's theory of balance is still applicable today(Waltz, 1993, p.45), he correctly observed that multipolar systems were more stable but also more prone to conflict.

More precisely, the theory of balance is still applicable to the scenario of ASAT weapons and space as a sanctuary. One of the more relevant outcomes of the ending of the US-Soviet arms race was that ambitious ASAT programmes under the US Strategic Defence Initiative were 'rolled back'(Gupta, 2006, p.202). In 1983 Yuri Andropov 'proposed a moratorium on space weapons'(Russell, 1984, p.190; Robinson, 1985, p.16A) on the condition that the USA and any other country did the same. In response the USA limited the testing of ASAT weapons as part of the 1985 Department of Defense Authorization Act(Price, 1985, sec.1), this testing ban included a similar clause making it conditional on no other country testing an ASAT system. The last ASAT test of the 20th century was in 1985(Moltz, 2003, p.63; Krepon & Thompson, 2013, p.133) and as a result space was a much more stable enviroment.

1 According to Marcia this report is not avaliable online anywhere.
2 The relevant information can be found in Table 6, Column D, Row 165.

The fall of the Soviet Union meant that there was no counter-balance to the USA, so what has been described here as multipolarity could be read as unipolar US dominance. This is a valid argument for much of the 1990s and early 2000s, summed up by George Galloway in his assertion that “if there was a Soviet Union today, we would not be having this conversation about plunging into a new war in the Middle East, and the US would not be rampaging around the globe”(Hattenstone, 2002). Galloway is right, without the protection of the Soviet anti-imperialist umbrella the non-aligned countries were vulnerable and there was a distinct disturbance in the balance of power. However since the global capitalist crisis of 2008 empire has been in decline and there's been a steady rise to power of developing countries, especially as part of the BRICS bloc(Martinez, 2013). As noted by Andrew Murray “the unipolar moment in international affairs has passed”(Murray, 2014) and this shows that if multipolarity wasn't taken seriously in the 1990s, it certainly is taken seriously today. Alongside this there's a 'return to realism'(Switzer, 2014) in Russian foreign policy, and Chinese foreign policy has always been tinged with realism of one form or another(Shiping, 2007, pp.15–20). Not only are the rising powers of the multipolar order challenging US hegemony, they're also refusing to conform to the liberal model.

So between the end of the cold war and the mid 2000s there was a period of peace in space, it's a period in which the doctrine of 'space as a sanctuary' can be invoked in practice. For some the changed mode of warfare meant there was a reduced need for grand counter-space and missile defence programmes(Kaldor, 2005, pp.494–496). Such projects were seen as irrelevant in a world where insurgencies and small wars were the primary security threat. Partly as a result of the relaxed international atmosphere there was much more co-operation on peaceful and civilian programmes. For example the 1990s saw the development and launch of the International Space Station along with a number of other joint missions[3]. This demonstrates a level of co-operation unheard of since the Apollo-Soyuz project[4] and to some extent it can be explained by a more relaxed international situation.
The situation changed in January 2007 when China tested its first ASAT system, destroying a Chinese weather satellite with a ballistic missile(Kan, 2007, p.1). The Chinese test broke the conditions of the DoD Authoriszation Act and as expected the USA tested an ASAT weapon the following year, using a missile to destroy a spy satellite which was falling out of orbit(Mineiro, 2008, p.322). According to Erik Seedhouse, the Chinese test in 2007 “tainted the space environment forever”(Seedhouse, 2010, p.53), though that's an exaggeration. It's still possible that the USA, China and other actors come together to cancel their ambitions for the weaponisation of space, there's still hope for a 'code of conduct'(Anon, 2013b). Nevertheless Seedhouse is right in that space is no longer safe from attack, its status as a sanctuary has been violated. Every space-faring state now knows that US or Chinese systems are capable of disabling their space-based infrastructure at any time, and that is not condusive to a stable or harmonious situation.

There are also problems with the behaviour of the Chinese administration, such as the fact that it didn't issue prior warning before carrying out the test(Tkacik, 2007, p.7). There is no legal obligation to do so, however it is a common courtesy to notify relevant partners of a launch, especially seeing as an unexplained explosion in Earth orbit could have been easily misinterpreted as an aggressive act. Blowing up the satellite also created a 'cloud' of around 2000 fragments of debris(Kelso, 2007, pp.2–3) which represented a danger to any satellites which might have passed through it. Still, it's worth pointing out here that the USA did exactly the same thing a year later, yet for the most part the literature on security in space focuses around the threat from China, not the

3 I photographed a collection of joint mission patches at the Toulouse space city including the Apollo-Soyuz, Soyuz TM-11, Soyuz TM-7 (Interkosmos), D-1 Spacelab and STS 79 missions, these are available online at http://gobblin.se/u/clagnar/collection/space-badges/

4 Apollo-Soyuz actually left a curious precedent for co-operation - not only was the linking of the two modules a symbolic representation of friendship and reconciliation, but the docking collar technology was later used on Shuttle-Mir missions and the ISS two decades later.

threat from the USA. There was some destabilising effect, for example giving India more motivation to develop the Agni V rocket(Anand, 2013). However, contrary to expectations the events of 2007-2008 did not trigger a full arms race, nor did they cause any major diplomatic outcry, and to some extent this shows how powerful China has become in relation to the US.

In his testimony to the US congress, Michael Krepon observed that “communication channels [between the US and China] are unsatisfactory”(Krepon, 2014, p.2) when compared with the communication between the US and the Soviet Union. Returning to the argument for accountability in international dialogue, the array of formal and informal links between countries helps alleviate tensions. During the cold war for example there were scientific exchanges, diplomats from either country were invited to inspect each other's sensitive sites, the motivations of each country's leadership were understood by the opposite side. There was even a famous 'red telephone' – a direct phone line between the Kremlin and the Pentagon. Meanwhile today NASA has been warned off excessive contact with Chinese citizens(Yan, 2011; King, 2013), leading to a rupture in scientific co-operation between the two countries. Similarly some commentators bemoan a “lack of transparency”(Kleiber & Gill, 2007, p.5) in the Chinese administration, leaving the US unclear of Chinese intentions. This is risky because it allows for a build up of mutual distrust which would in turn be exacerbated by potentially false or inaccurate information, leading eventually to either side making irrational decisions.

Partly as a result of the new international situation there is a renewed emphasis on the space programmes of some countries. While primitive, the Iranian and North Korean space programmes are impressive achievements in themselves. India and Japan have both launched lunar probes, and Japan in particular deserves special mention for its complete adherence to non-military projects. China is the furthest ahead with plans for its own space station the next decade, the Tiangong-3. There are also a small number of countries which build their own satellites and have them put in orbit by other countries with launch capacity(Wood & Weigel, 2011, p.113). Essentially this is a compromise of having a semi-independent satellite programme without the burden of building an independent launch vehicle.

What are these countries' motives for investing in space programmes? Kim Won Guk suggests that the objective of North Korea's efforts is to obtain better meterological data(Anon, 2012b), this in turn benefits the North Korean economy by giving Korean farmers better weather forecasts, thus helping them to raise their productivity. Here the justification for space-based infrastructure is that it has an economic value. The same broad economic argument is made by the European Space Agency, although phrased in much vaguer terms one of its objectives is to “improve the world-wide competitiveness of European industry”(Anon, 2010, p.3). There are two conclusions to be drawn from this: on one side these programmes are not driven by a purely scientific desire, they provide new research which gives national enterprise a technological advantage over others, and they provide infrastructure which is again useful to national enterprise. The emphasis here is that they give national businesses an advantage over foreign ones. On the other side these programmes have no explicitly military aspect, their projects are tied to universities and technical institutes, they are staffed by scientists not soldiers. In this sense one could argue that they represent a non-state movement which cannot be explained by realism alone, they replace the realist narrative of *inter*national co-operation between states with a more liberal narrative of *trans*national co-operation between civil society organisations.

An example of one such organisation is Surrey Satellite Technology Limited, it's a small British firm which was set up by the University of Surrey in 1985 from a group of researchers(Anon, 2011a, p.2). Since then the firm has been involved in building national satellites for Portugal, Thailand, Algeria and Nigeria amongst others(Anon, 2011a, p.9). It also participates in the International Charter Space and Major Disasters; in the event of a natural or technological disaster

an organisation can request satellite data to help deal with the disaster(Anon, 2000, sec.4). In one recent case of the floods in Britain the charter was invoked three times by the Environment Agency for satellite imagery of flooded areas. This gave the Environment Agency the information it needed to map the floods and target the areas in most need of help. Beyond that specific case the charter shows various organisations voluntarily donating free use of their satellite infrastructure for a humanitarian cause. Private groups making their satellite constellations available for disaster relief is the kind of activity which truly exemplifies the liberal notion of a 'global village'(Brown, 1990, p.33) and there is no realist explanation for it. Furthermore the foundation of SSTL in a university means it draws its staff and its overall character from a small academic community, and this sets it apart from large space programmes organised around the aims and objectives of individual states. Instead, if one were to follow the liberal understanding, civil-scientific initiatives such as SSTL form part of a global civil society network. Also, as shown by the International Charter Space and Major Disasters, these civil-scientific organisations act in accordance with a universal set of humanitarian values.

The European Space Agency does deserve greater scrutiny because on its own it appears to be a purely scientific organisation divorced from the politics of Europe, however its organisational mandate suggests otherwise. It has a relationship with the Airbus Group which oversees development of the ESA's Ariane rocket series and built an ESA laboratory module for the International Space Station. Around 22% of Airbus is owned indirectly by the French state through a holding company while the other major shareholder is Daimler AG – a German company(Anon, 2012a, p.103). Arianespace is responsible for launching the Ariane rockets used by the ESA, these rockets launch from the spaceport in French Guiana. 64.1% of Arianespace is owned by either the French state or French companies, meanwhile the next largest portions of shares are owned by two German companies(Anon, 2011b). The two largest contributors to the ESA budget are France and Germany(Anon, 2014). The point here is that these civil-scientific organisations are not neutral and they do represent the interests of certain states, specifically France and Germany. Even Surrey Satellite Technology isn't free of state aid, last year it received a £21 million grant from the UK Space Agency(Almunia, 2013, p.7). The fact that such organisations receive concentrated state funding somewhat undermines the view of them as transnational actors which operate above the concerns of individual states.
The origin of the European aerospace sector, and Airbus in particular, comes from an alliance between various major arms companies, however the European example has not been led by the military. For the primary actors in Europe space is not considered a national security priority. Instead the value of space comes in private investment which drives new research and the benefits of that feed back into the economy. Also, when a project doesn't directly generate enough profit to attract private investment then European states are willing to subsidise it, as is the case with Airbus and the ESA.

The US example of private sector investment in space is a little more simple to explain. Chad Anderson identifies the decline of NASA's Space Shuttle program as a “tremendous opportunity for private enterprise to meet the demand for cost-effective travel to and from the ISS”(Anderson, 2013, p.267). As the state retreats the market advances. The background to this is the strengthening of neoliberalism and austerity politics following the crisis of 2008 and while NASA's budget has remained constant it's clear that it wants to focus more on ambitious probe missions to Mars and the rest of the solar system. Funding provisions for commercial spaceflight from NASA are set to double from an actual spend of $406 million in 2012(Scoggin, 2013, p.1) to a requested budget of $848 million in 2015(Scoggin, 2014, p.1), leaving private companies to maintain current projects such as the ISS.

This should not be read as private companies encroaching on the mandate of a state agency, rather a partnership of mutual interests. The private sector gets privileged access to various state resources,

namely the accumulated expertise built up by NASA over the years, and in return NASA receives cheap launch vehicles. The private sector can concentrate on just sending satellites into near-earth orbit, meanwhile NASA can concentrate on sending probes into outer space. That's not to say that the US state isn't capable of dealing with the day-to-day maintenance of satellite infrastructure, but this has become a heavy responsibility to bear. It would not be an exaggeration to say that if US satellite constellations like the Global Positioning System were to fall into disrepair the world economy would be plunged into chaos. The same thing goes for telecommunications satellites. It also poses a national security dilemma, Theresa Hitchens claims that “a modern army could not operate in a satellite-free environment”(Hitchens, 2012) and the US army is heavily reliant on space-based infrastructure(Meteyer, 2006, pp.2–4). Add to this the fact that the US can no longer use the Space Shuttle, and the Atlas V and Antares rockets are both compromised by their use of proprietary Russian engines(Dean, 2014; Clark, 2013). This means that without Russian co-operation the US could have difficulty maintaining its space-based infrastructure, and this is a particular concern given that US-Russia relations are at a low point following the crisis in Ukraine. It also costs ~$72 million for NASA astronauts to have a seat in a Russian Soyuz rocket, so there's an economic case to be made for developing an independent launch vehicle as soon as possible.

It's in this context that Elon Musk made his comments to the US senate asserting that “there is absolutely zero dependence on Russia with [the Falcon 9] rocket”(Musk, 2014, p.4). The Falcon 9 rocket is being developed by SpaceX – a private company, and the increased NASA support for its commercial partners shows that the US state would rather trust its launch capability to private enterprise than to a foreign power.

Here it would be useful to comment on the nature of US imperialism and how it relates to previous examples of military-industrial complexes. Following Lenin's theory of imperialism, military-industrial complexes emerged as capital accumulated to large monopolies(Lenin, 1916, p.265), these monopolies then expanded to absorb non-capitalist regions to the point where they conflicted with other monopolies(Dickens, 2009, pp.66–67). In the 19th and 20th centuries the states of the time acted in tandem with an infant national bourgeoisie to create vast empires and thus sustain the early development of capitalism. This process was slowed down during the cold war era as the socialist and non-aligned countries resisted colonial tendencies. However following the global counter-revolution of the early 1990s monopoly capital has had free access to most of the countries on the globe. Arms industries tend to have a close relationship to the state, in some cases they're nationalised and taken under direct state control, and in other cases they're given special status as 'national champions'(Taylor, 1990, pp.59–50). Arms deals are essentially business transactions between private organisations, however they are often negociated on the state level between the foreign and defence ministries of different countries. The reason for this is that arms companies are a crucial component of the state's monopoly on violence and therefore it's reason for being.

The post-cold war situation puts into question the role of arms companies and the states they serve. SpaceX may soon be responsible for US access to space, and maintaining access is a priority for national defence, so to who is SpaceX loyal? To the *patria* or to profit? There is already some blurring of boundaries between national arms companies and their respective states. For example the two giants of the US aerospace Lockeed Martin and Boeing pursue contracts in Asia and the Middle East(Dowdy, 1997, p.99; Pap, 2012, pp.357–360), although they only trade with US allies so they're still constrained within the US foreign policy framework. Taking it further one could bring up the emergence of private military contractors, the new corporate warriors. Although in response one could point out that mercenaries were deployed in ancient Egypt in the army of Ptolemy III(Griffith, 1935, pp.117–118) and were commonplace in Europe in the 17th and 18th centuries(Shearer, 1998, pp.13–14; Dowdy & Mills, 1999, pp.110–111). The use of mercenaries is by no means a new phenomenon, nor is industrial arms production for profit. These things cannot be taken as the determining features of the new space race or the post-cold war situation.

China is an exception when discussing military-industrial complexes. It has a very large and diverse armaments sector(Dickens, 2009, p.77) which benefits from China's growing economy(Pap, 2012, p.214), yet it lags behind Russia and the USA in terms of arms exports(Wezeman & Wezeman, 2014, p.2). One explanation for this is that it has equipment gaps in its own armed forces which need to be filled by domestic production(Pap, 2012, pp.2013–214). Another explanation is that while capital in China is highly monopolised its imperial tendencies are moderated by a socialist government. The People's Liberation Army is the biggest standing army in the world, yet it operates mainly within China as a special reserve of labour. Whenever it is deployed outside China it is used in force projection or non-combat support roles. This can be explained by a desire on behalf of the Chinese state for stability around its borders and for non-interference in the affairs of fraternal nations. In these respects it does not follow the historical pattern of military expansion.

In strategic discourse one of the real features of the new space race is the concept of a revolution in military affairs. This is based on a technological shift which creates a new level of deterritorial information-led warfare, and this in turn alters how international relations are conducted(Freedman, 2006, pp.10–14). It's useful to compare the US regime response to the Pentagon papers leak during the war on Vietnam and the recent security breaches made by Edward Snowden and Chelsea Manning. The Pentagon papers were a political scandal and the whistleblowers were judged in an open court case which they won on the principle of freedom of expression. By contrast Edward Snowden and Chelsea Manning have both been charged as spies under the espionage act, their actions were treated as a threat to national security without regard for freedom of expression. This shows how important the control of information has become to the state.

The issue of space is often included along with cyberwarfare as part of the revolution in military affairs; both of these fields are peripheral to actual conflict but they exert a strong influence on it through their provision of information. Space and cyberwarfare are also linked in the sense that satellite constellations make up some of physical infrastructure of communications networks such as the internet. To some extent these networks can be explained by a liberal discourse which emphasises their globalising tendencies and their importance to global civil society. For example improved communication networks allowed disparate communities to connect to one another, and this is one of the conditions which made the 'Arab spring' possible. However it must also be acknowledged that despite their deterritorial nature these networks do have a physical presence in the form of satellite dishes and cables and servers. The cost and complexity of maintaining such infrastructure means their control is centralised in large organisations such as states or corporations. Non-state actors can modify information systems by shooting down spy drones, jamming satellite signals, and hacking computer networks, but many non-state actors still lack the resources to build their own systems. The revolution in military affairs certainly poses a challenge to strategic thought, but it's not an insurmountable one as states and their militaries are best placed to adapt to the new situation.

Conclusion

The purpose of this dissertation was to explore the various debates surrounding space power. It has covered close relationship between rocketry and nuclear conflict during the early stages of the space race; the debate over stability resulting from the introduction of ASATs; the concept of space as a sanctuary following the end of the cold war; multipolarity and the emergence of the new space race; and finally the role of commerce, the military-industrial compex and the revolution in military affairs. Comparisons have been made on a national basis between the positions of different states and on a historical basis between the 19th, 20th and 21st centuries. The dissertation showed the development of military-industrial complexes as a recurring historical trend, although reliant on specific national conditions.

There is some reference to liberal International Relations theory, although there's little available literature from that school of thought which directly addresses space power. Liberalism is also unsuitable to an analysis of space power as it does not adequately engage with how relative power dynamics affect the international situation. Throughout the research which has been presented the most coherent explanation of space power comes from realist, strategic, and geopolitical thought.

Word count

8,746 words

Acronyms

- ASAT – Anti-Satellite
- BRICS – Brazil, Russia, India, China and South Africa
- ESA – European Space Agency
- GDP – Gross Domestic Product
- GDR – German Democratic Republic
- ICBM – Intercontinental Ballistic Missile (with a range of greater than 5,500 kilometres)
- IRBM – Intermediate Range Ballistic Missile (with a range of between 1,000 and 5,500 kilometres)
- ISS – International Space Station
- SSTL – Surrey Satellite Technology Limited

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