Viewpoint

The Normalisation of Anti-Satellite Capabilities

By Alexandra Stickings

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Introduction

The 2007 destruction by China of one of its own defunct weather satellites brought to the fore discussions about the dangers of anti-satellite (ASAT) weapons,[1] recently fueled following the test by India in March 2019, in which it also destroyed one of its own satellites.[2] Although both the United States and Russia (both at present and during the Cold War) have long-established research and development (R&D) programmes for ASAT technology, the entrance of a new actor, and one with well-publicised space ambitions, into this small group caused global concern.[3] As well as creating a significant amount of debris, a potential danger to all satellites, China's test was seen in many quarters as an overt demonstration intended to signal capability to destroy a satellite belonging to an adversary. India's test was similarly seen as a demonstration of capabilities, and although it also created significant debris, it was not met with such a strong reaction within the international community.

Such ASAT capability is, at present, primarily limited to these three major space powers – the United States, Russia and China – with India still not considered to be a major space power, albeit with ASAT capability. Traditionally, ASAT technology involved direct-ascent missiles used to destroy a satellite kinetically – it was this method used in the 2007 test. Yet states have recognised that other methods make proving attribution in space is difficult. There has therefore been a move towards the development of non-kinetic capabilities that can disrupt or disable a satellite while leaving it physically intact. This not only negates the resulting debris creation of a kinetic strike but also allows the operators of such platforms to function beneath a retaliatory threshold. Such capabilities include lasers that can be used to dazzle optical sensors and the use of microwave frequencies to interfere with electronic circuitry. Similarly, recent years have seen the development and trial of technologies to remove debris from orbit, and commercial companies are looking to exploit the benefits of on-orbit servicing, where satellites are used to fix or extend the life of others. While these will be developed with the primary purpose of ensuring the sustainability of orbit, they could potentially be used to damage or remove from orbit satellites belonging to another actor.

As a result, the democratisation of space and the proliferation of technology is increasing the number of actors who could potentially develop or acquire ASAT capability, whether purely as an offensive means or of a dual-use nature that could be used for adversarial purposes. Yet with the focus, particularly in the United States, on the activities of the Russian and Chinese space programmes and the potential dangers therein, there is little evidence that Western militaries have looked at the possibility of other actors, including rogue states and terrorist groups, of acquiring these capabilities. The purpose of this viewpoint is to assess the various types of ASAT capability within the context of the changing space environment and attempt to answer the question of whether this is leading to what may be termed the normalisation of ASAT capability, and, further, how this may affect the strategic balance in space.

A brief history of ASAT Capabilities

The concept of ASAT capabilities goes back to the beginning of the first Space Age. Both the US and Soviet Union, fearing the actions of the other and the potential strategic advantage of orbiting satellites and space-based nuclear weapons, began researching and developing methods to destroy satellites. Indeed, as early as 1957 the US Army had proposed converting an anti-ballistic missile into an ASAT weapon,[4] and by the 1960s the Soviets had developed the Istrebital Sputnikov (IS) co-orbital system consisting of a launch vehicle and a kill vehicle.[5]

As a result of the technologies available at the time, ASAT capabilities initially were limited to kinetic missiles, either ground- or air-launched or co-orbital. There is an obvious drawback to kinetic attacks, however, and that is the creation of space debris. It is estimated that the 2007 Chinese demonstration created an additional 3,000 pieces of debris in Low Earth Orbit (LEO).[6] The Indian test, carried out at an altitude of 282 kilometres in part to minimise debris, (in comparison to the 865 km of the Chinese test), nevertheless created approximately 400 pieces of debris reaching as high as 2,222 km; some of which is estimated to remain in orbit for one to two years.[7] Such debris is an equal danger to all satellites within a particular orbit, regardless of ownership. Any state or commercial operator that wants to benefit fully from the opportunities that space presents will have a desire to protect the sustainability of orbits through the minimisation of debris and avoid contributing to what could become a worst-case scenario – the Kessler syndrome, in which orbital debris creates a cascade of further collisions, leading to the orbit becoming unusable.[8]

Yet there is a further drawback to kinetic strike that is more closely related to how states view the role of space in military matters. Space is a unique environment, and its relative inaccessibility and remoteness mean that attribution to some activities can be difficult to prove. It is clear that if a state were to use a direct-ascent or other kinetic ASAT missile to destroy another's satellite there would be little hiding place. Retaliation would be expected, as would international condemnation and accusations of 'weaponising' or even starting a new conflict in space. However, if a satellite simply stops functioning, it is not always possible to determine the reason, let alone discover the responsible actor even if there is sufficient evidence to suspect a deliberate action rather than a natural hazard. There has consequently been a move towards the development of non-kinetic counter-space capabilities which exploit technologies that allow for a satellite to be disabled (either permanently or temporarily) or its communications disrupted while leaving it physically intact. These capabilities include lasers that can be used to dazzle optical sensors, the use of high-powered microwave frequencies to damage electrical components, cyber-attacks and the jamming of frequencies. Despite its public ASAT missile test, evidence suggests that it is this area in which China is focusing its efforts.[9]

There are many benefits to states in developing these non-kinetic methods, particularly in terms of desires to deny adversaries' access to their satellites. The potential ability to interfere

with a satellite with little to no risk of getting caught but with the opportunity to cause a significant amount of trouble allows states to operate in what is often known as 'grey zone' or 'sub-threshold' warfare.[10] This type of warfare is associated with destabilisation of a state through affecting its critical infrastructure or political processes and is achieved by operating beneath the level of actual conflict. It is these methods that also lead to the use of the term 'counter-space', where, in addition to ASAT activities, they also affect the usage of space and the information that is derived from it.

The way that these capabilities are used also brings into question the definition of a 'weapon' in space. It has often been said that in space, anything can be a weapon. Although this phrase has become somewhat overused, there is a ring of truth to it. It is because of this that when compiling a list of all types of ASAT capability, it is important to include those technologies that have dual-use applications. Many actors, including states and commercial companies, have recognised the dangers of orbital pollution and have been working on technologies to remove debris and repair and extend the lives of satellites through on-orbit servicing.[11] These are, of course, beneficial in nature but do provide operators the capability of acting in an adversarial manner. For example, a satellite that can manoeuvre to a defunct satellite or piece of space debris, attach to it and drag it into the atmosphere to burn it up could also do the same to a functioning satellite. Similarly, satellites with the same manoeuvring capability that are intended to repair or refuel satellites can equally use their abilities to break one. It is because of this that there has recently been much worry over the proliferation of these developments.[12]

The rendezvous and proximity operations (RPO) that these programmes use have been seen in other ways. In August 2018, a US government representative highlighted concerns over the 'abnormal' behaviour of a Russian satellite.[13] Such manoeuvring capabilities could, as well as the uses described above, allow satellites to approach others with the intention of jamming or intercepting their communications, disrupting their abilities and performing surveillance.

It is clear, then, that the nature of ASAT capabilities is diversifying and adding confusion and complexity to what is already a complicated topic. The three major space powers are seeing these developments as potentially threatening the already precarious strategic balance in space. However, it is important also to note that this diversification of ASAT capabilities may also lead to their acquisition by additional actors. The question, therefore, will be what impact this will have on international space security.

New Actors, New Threats?

As has been noted, ASAT capabilities are primarily associated with the three major space powers. There is potential, however, for others to develop in this area. India, for example, has decades of experience in space, and although this has been for civilian purposes, this could potentially be repurposed for ASAT capabilities.[14] The nascent space programmes of Iran[15] and

North Korea[16] have also been under the microscope in recent years, particularly because of the technical crossover with ballistic missiles. Should these states prove capable of developing fully functioning counter-space programmes, this will have a significant effect upon the balance of power in space as well as on considerations regarding terrestrial relationships. The ubiquity of space support to military operations is leading other states to create sovereign capabilities, even if these are limited at present. More and more countries are developing national space programmes and will be looking to ensure their assets are protected, including some sort of counter-space capabilities if they feel under threat.

It is important to think about why these states would look to develop such programmes. With smaller military budgets, and consequently less funding for space programmes, one might think that available resources would be best placed being spent on programmes that reap the benefits of space, both in terms of information and possible economic gains. This is not to say that such programmes are not going ahead. Smaller states see great advantage in becoming space actors and becoming part of this new, more democratic space; there is a fear, in part, of being left behind and missing out on the benefits. There is also the issue of national pride, with recognition of how the 1969 Moon landing by the United States made it the true leader in space. As such, many countries without indigenous space programmes are procuring satellites from others or joining international partnerships. For example, a number of Latin American countries now have satellites in orbit through partnerships with China.[17]

Of course, any space activity is also a demonstration of technological capability. This indeed can be seen as one of the reasons there was such a strong international coverage of the January 2019 landing by China of a rover on the far side of the Moon.[18] Although presented as a mission principally concerned with exploration and scientific advancement, it also led to claims that China was now at the forefront of a new 'Space Race' and had become the dominant country in space.[19] Interestingly, while indeed an impressive feat, the reaction far outweighed those associated with the European Space Agency-led mission that successfully landed on a comet in 2014[20] or the more recent Japanese mission to an asteroid,[21] both of which were covered primarily in the science sections of media outlets. Neither of these provoked commentary of space dominance or military space capabilities, which seems in the West to be reserved for countries considered to be adversaries. The success of the Chinese mission has had an impact on space defence discussions and it is likely that similar will happen with the future activities of others who are deemed to potentially pose a threat through their space activities.

There is, of course, nothing definite that more states will actively pursue ASAT or counter-space programmes. They will need to balance these activities with their more general space ambitions. However, their increasing usage of space for military and national security and ability to gain technical knowledge through international partnerships does raise the possibility that such capabilities could proliferate.

Of course, it is not just states that should be of concern when thinking of the proliferation of ASAT capabilities. Non-state actors have already thought to have been involved in cyber-attacks against US satellites.[22] These, however, are likely linked to states. What may be more worrying is non-state actors with no links to countries and more importantly with no space assets of their own to protect. Despite the differences in national regulatory frameworks, it would be nearly impossible for such a group to operate its own satellite. They would therefore be most likely focused on cyber-attacks or attacks against ground stations.

The International Legal Framework

Any concerns with the proliferation of ASAT capabilities need to be looked at within the international legal framework for space. The 1967 Outer Space Treaty (OST)[23] is the bedrock upon which international space law sits, with perhaps its most well-known proclamation being the ban on placing weapons of mass destruction (WMD) in orbit, specifically nuclear weapons. However, the OST is also a creature of its time. Created during the Cold War, when the fear of nuclear weapon proliferation and use was at its height, it was written at a time before technologies such as RPO and debris removal were thought of, not to mention cyber. It is therefore determined to be limited in its ability to prevent states from developing and deploying new technologies that could threaten satellites, and as such there have been calls to update, replace or add to the treaty to ensure that 'weaponisation' of space does not occur.[24] It is interesting, however, that those pushing for new treaties, laws or regulations are also those who are most associated with possessing ASAT capabilities. Russia and China have together proposed language for a new treaty through the discussion on Preventing an Arms Race in Outer Space (PAROS) negotiations, a move not supported by the US.[25] It can be argued that because the OST does not take into account new technologies, it provides cover for states who want to develop ASAT capabilities without fear of sanction or other punishment.

It has been argued in some quarters that should there be no agreement on a new treaty it would be possible to turn to customary international law (CIL) to impede the development of ASAT capabilities and ensure space security.[26] For example, the international laws of conflict and international environmental law may be useful when considering kinetic strikes and the creation of space debris, respectively. While this does provide another option to the international community it may be limited in the case of non-kinetic attack when attribution is not easily identified. Discussions are therefore occurring in some parts that look at creating a set of norms of behaviour for states to follow that would include the development and use of technologies with ASAT potential. The difficulties, of course, are in developing language that covers the current situation as well as future potentialities and ensuring that the norms are adopted by all (or even most) space users. Any new language must also take into account that ASAT capabilities may be developed by additional actors who may see norms as stifling their ambitions.

While there is no doubt benefit associated with the development of new treaties, agreements and norms regarding activities in space, the possibility of covering all eventualities and finding

a way to limit ASAT capabilities of proliferating both technologically and in terms of number of users is slim. It may be that a better path is to accept that ASAT capabilities will become normalised and instead develop language that covers their use, both in limiting that use and in what those users can expect in terms of reaction.

Conclusion

The security and sustainability of space is currently finely balanced upon the actions of the three Tier 1 space powers. The common pronouncement that space will play a central role in the next Great Power conflict[27] means that the focus when considering space and military activity continues to be on the activities and capabilities of the United States, Russia and China and the extent to which they are provoked by each other's activities. Yet, as has been shown, notwithstanding the hazards such as debris and space weather, the threats to satellites are diversifying, as are the actors who may eventually possess these capabilities. It is therefore essential that states take these potential eventualities into consideration when creating space policies and looking at the protection of their space assets.

There is another consideration, however. The current international legal framework moves towards the creation and implementation of norms for responsible behaviour,[28] as well as the proliferation of dual-use technologies and the vulnerabilities of space systems to other forms of attack, suggest that finding a way to fully account for all ASAT capabilities will be practically impossible. This is also because some actors with ASAT capabilities will not be operating within the international framework and either unwilling or unable to become parties to treaties or other agreements.

It can therefore be concluded that the near-term will see a normalisation of ASAT capabilities, where such technologies are able to be developed or acquired by a range of actors. The question is what Western militaries need to do to counter these potential threats and ensure their continued access to space. The first step could be to accept that this will happen regardless and that there is little chance of creating a situation where ASAT capabilities are limited to a few states and if used, within the construct of Great Power competition. It is likely that space systems will more frequently come under attack from a range of actors whose motivations will be more varied. Protecting existing assets and ensuring continued access should therefore be the primary goal with regard to space, but the West should also use this as an opportunity to think carefully about its relationship with the space environment. The normalisation of ASAT capabilities means that space cannot be seen as a sanctuary, if, indeed it ever was – one must not forget that the first ventures into space were driven by military competition and as such space has since been a militarised environment. Countries can no longer expect to be immune from attacks against their space infrastructure. These additional vulnerabilities and associated costs suggest that more is needed to diversify the infrastructure and ensure that reliance on space is matched by resilience and mitigation. As ASAT capabilities normalise, the balance of power in space will likely shift. It is essential that space strategies are shifted to match this new paradigm.

Notes

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