

Space: the new battlefield

Courcy's Intelligence Service - Originated in 1938

July 2011

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Introduction

Space, it is rightly said, is the 'ultimate high ground'. It is its domination of space that most sets the United States apart from its rivals; but, conversely, it is precisely this domination that makes the US so vulnerable to a first strike against its space-based military-support assets.

The US's most likely serious military adversary is China, and the People's Liberation Army (PLA) openly asserts that the key to battlefield domination will increasingly lie in obtaining air, space, information, and electromagnetic superiority. Of these, the PLA believes that space superiority is the foremost objective. China's 'space force', combined with other services, are tasked to lead operations that would include space information warfare, space blockade warfare, space orbit attack warfare, space defence warfare, and space-to-land attacks.

China has begun developing and testing directed-energy weapons and it has carried out a successful strike against a low-earth orbit satellite with a direct-ascent kinetic anti-satellite weapon (ASAT).

But is it not just China that is of concern. All of America's potential adversaries know the importance of space to the US, and in an age when even Ethiopia has demonstrated an ability to jam satellites, the US's vulnerability in this sphere can only grow. But, as this paper will demonstrate, establishing a credible deterrent against space attack is uniquely difficult.

US dependency on space

The United States military depends on space to an ever increasing degree, and it depends on space to a far greater extent than any of its potential adversaries. The purposes of the systems now deployed in space go far beyond those of their forerunners in the 1960s which were largely dedicated to supporting nuclear warfare. In the 1970s, these capabilities expanded to satellite early warnings systems (SEWS) used to detect missile launches.

Now the US's orbital infrastructure is vital to US forces operating in distant theatres and relying for their effectiveness on advanced surveillance, reconnaissance, communication, navigation, and targeting. These capabilities give US forces a decisive advantage over all potential adversaries.

The 1991 Gulf War was the first war in which space-based assets were a key

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feature. Since then there has been the full development of the Global Positioning System (GPS) and its role in the use of precision weapons such as cruise missiles.

The further development of advanced space-enabled command-and-control systems has brought about the integration of near-real-time intelligence, surveillance, and reconnaissance (ISR) and GPS data which in turn has brought about a revolution in conventional warfare as demonstrated by US forces in the second Gulf War, Afghanistan, and elsewhere.

Offensive counter-space operations

Knowledge of US space assets is a prerequisite for a potential space aggressor, but the proliferation of non-governmental satellite observers (NGSOs) and the dissemination of their knowledge via the internet has made this knowledge widely available. Satellite-tracking websites provide extraordinarily accurate data about satellite over-flight times.

More sophisticated tracking systems are, of course, being developed by the US's most serious potential challengers such as China and Russia, while the proliferation of air and theatre missile defence radars have provided many countries with the means to locate objects in low-earth orbit (LEO). Many countries are also able to deploy networks of space-object surveillance and identification (SOSI) sensors to monitor satellites of particular interest.

Given knowledge of space-based assets and their ground-control systems, there are four types of offensive operations that can be employed: denial and deception; attack or sabotage of ground stations; direct anti-satellite attacks on space assets; and electronic attacks on communication links between the ground and the satellite.

Direct attacks on space-based assets could include, at the blunt end of the spectrum, the detonation of a low-yield nuclear weapon. At least China, India, Pakistan, and Russia have this capability, and Iran is not far away from having it. The detonation at high altitude of a nuclear weapon would have two serious effects for satellites. The first would be the creation of a high altitude electromagnetic pulse (HEMP) thus damaging electrical systems and communications with the ground, the second would be to increase ambient radiation sufficiently to severely damage nearby satellites.

It is calculated that exploding a multi-megaton nuclear weapon at 100km over Nebraska would cover a circular region with a diameter stretching from Kentucky to Colorado. At 500km, the HEMP electric field would cover the whole of continental United States.

Coming down the scale from nuclear weapons, countries are developing interceptor ASAT systems, either ground- or air-launched. Other concepts under development include space mines and space-to-space missiles. Stand-off ASAT weapons include lasers, radio frequency, and particle beam weapons. The jamming of communications satellites is also a well-developed technique, and for some years Russia has been marketing a handheld GPS jamming system.

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The consequences of such counter-space operations could include the impairment or elimination of:

- reconnaissance capabilities
- early-warning systems
- command-and-control capabilities
- navigation systems
- weather reporting and forecasting satellites

The first-strike calculus

That China and other potential adversaries see US space assets as a key military target is no secret. Over 10 years ago, China's Xinhua news agency was writing: “For countries that could never win a war by using the method of tanks and planes, attacking US space systems may be an irresistible and most tempting choice.” A recent study by the Rand Corporation on “Deterrence and First-Strike Stability in Space” has shown just how destabilizing the US's overwhelming lead in space has become.

What is destabilizing is the combined effect of the importance of space to the US military; its lesser importance to most potential adversaries; and the acquisition by potential adversaries of the US of capabilities to attack US space assets. As the Rand Corporation report puts it: “Efforts to deny adversaries the benefits of space aggression are hindered by the inherent vulnerabilities of some important US space systems and the high degree of US dependence on those assets.”

There is, in fact, near unanimity in the intelligence community that any future enemy will attempt to reduce the disparity in power between it and the United States by, in the first instance, striking at the US's space assets.

Additional incentives for a first strike in space include the fact that there would be little human damage (an important factor in the court of public opinion) and the fact that space defence is inherently difficult.

The first point provides an important distinction between space deterrence and nuclear deterrence during the Cold War. Once the survivability of second-strike nuclear capability was assured, it became impossible to launch a nuclear first strike. In the case of a space first-strike, any tit-for-tat exchange would benefit the lesser power (because of its lower reliance on space-based assets) and the human costs would be negligible (although the economic costs would be significant). The only exception to this might be if the first strike was against ground-based systems within the United States as this would provide the justification to the US for a far more aggressive response against the adversary's own territory rather than just in space.

Space defence is difficult because of the fragility of satellites, and because they follow predictable orbits with no geographical cover to hide behind, have limited ability to manoeuvre, and are vulnerable to physical impacts. Directed-energy weapons are also effective against satellites, and they are

vulnerable to jamming.

Consequently, notes Rand, "since space systems are so difficult to defend, an offensive advantage exists for states willing and able to attack them, and first-strike stability is at risk in any confrontation with such an adversary." Moreover, if an adversary were involved in a confrontation with the US and were to conclude that war had become inevitable, it might also calculate "that it would eventually have to pay a higher cost if it did not attack US space systems".

Reducing the US's vulnerability

That the US faces extraordinary difficulty in deterring a first strike in space is certain, but there are some measures that can be taken to mitigate the risk over time. The threat of overwhelming punishment will probably only be credible for deterring attacks against ground-based systems, particularly those on US soil. The attempt to establish an international taboo against space warfare is equally likely to prove ineffective, as would be the attempt to establish international legal restraints, not least because of the US's own stated policy to "oppose the development of new legal regimes or other restrictions that seek to prohibit or limit US access to or use of space".

Novel methods of defence could include the development of microsatellite escorts...

The more effective approach, therefore, is likely to be concentrating on measures to deny an aggressor the fruits of its aggression. The strategy would need to make vulnerable US space systems more resilient and defensible and to provide redundant capabilities.

Rand argues for the aggressive development of passive defences "such as shuttered optics, shields and filters...onboard subsystem redundancy, [and] antijam technologies...", particularly for high-priority military and intelligence satellites. Satellite manoeuvrability could also be increased, as well as the ability to detect threats. Concealment and deception tactics could play their part. And novel methods of defence could include the development of microsatellite escorts.

The US also needs to put more back-up systems in orbit and to disperse its assets across a larger number of platforms, including those owned by other nations or commercial interests. Additional back-up systems can be provided in the terrestrial sphere, with undersea cables, for instance, and the use of high-altitude lighter-than-air craft and long-endurance unmanned drones. Enhancing its ability to replace degraded space assets in quick time could also play a role in deterrence.