U.S. Space Security Priorities: War, Policy, and Spacepower 17

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Abstract

Space capabilities undergird the United States' military future and the national security policies for space guide development and procurement. As the future is never as clear as a planner wishes, the policies are necessarily broad and, to some, indefensibly vague or provocative. This article traces development in the American way of war and discusses several of the more contentious space policy issues that will come to the fore in the next decades. These include increasing congestion, contestation, and competition in outer space and assessments of rules-of-the-road initiatives, cooperative partnering, space situational awareness, deterrence, and planetary defense.

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17.1 Introduction

Even as the United States draws down its fixed military presence around the world, it continues a revolutionary military transformation designed to extend its capacity to act responsively. Space capabilities are the lynchpin of this transformation, enabling a level of precision, stealth, command and control, intelligence gathering, speed, maneuverability, flexibility, and lethality heretofore unknown. This twenty-first century way of war promises to give the United States a capacity to use force to influence events around the world in a timely, effective, and sustainable manner.

Russell Weigley described a long-standing American way of war that was based on an essentially isolationist preference to allow issues beyond its borders to sort themselves out (Weigley 1973). Only when events spilled out of hand and threatened US interests directly did America feel compelled to intervene. Only then did it mobilize for war. In the first half of the twentieth century, however, this model had to be substantially refined. It was predicated on taking the fight to the enemy's shores, away from American soil, but only after other means of influence had failed and the military option was deemed the only one likely to succeed. And then, when America finally chose to bring force, it was *overwhelming* force. The country braced for long buildups. American leaders made the public feel confident in its righteousness. Friendly casualties were to be limited to the extent practical, but damage to the enemy could be maximized. The strategy was suitable in an era when the US homeland was safe from attack, when its industrial production ensured the stockpiling of vital supplies and innumerable armaments, and excess resources could be provided to friends and allies to do the fighting where prudent. In these conditions, America could afford to wait for problems to incubate and mature before reacting with colossal expenditure and terrible force. For the most part, this way of war was effective.

But then came the debacle in Vietnam, where US forces won every battle but lost the war, at home as well as in Southeast Asia. Television had come to war; rampant carnage was available for viewing in every American home. Indiscriminant area bombing was particularly horrific, and from that time forward US leaders would not contemplate using such tactics except for desperate times, when the very survival of the state was at stake. In wars of lesser urgency, those characterized by international theorists as wars for less than the vital national interest, it would be incumbent on America to win the hearts and minds of not just the domestic audience, but of allies, potential allies, and erstwhile enemies as well. Overwhelming force on a broad scale would be ruled out in advance. Success would be achieved through the employment of high-tech means and weapons: by computers, satellites, and whole new classes of technological marvel. America's future wars would be less destructive. They would have far fewer casualties, both friendly and enemy. And they would be short.

That this transformation was well underway became evident in 1991, when US forces defeated the world's fourth-largest military in just 10 days of ground combat. The Gulf War witnessed the public and operational debut of unfathomably complicated battle equipment, sleek new aircraft employing stealth technology, and promising new missile interceptors. Arthur C. Clarke went so far as to dub Operation Desert Storm the world's first space war, as none of the accomplishments of America's new look military would have been possible without support from space (Burgess 1991). Twelve years later Operation Iraqi Freedom proved that the central role of space power could no longer be denied. America's military had made the transition from a space-supported to a fully space-enabled force, with astonishing results. Indeed, the military successfully exercised most of its current space power functions, including space lift, command and control, rapid battle damage assessment, meteorological support, and timing and navigation techniques such as Blue Force Tracking, which significantly reduced incidences of fratricide.

The tremendous growth in space reliance from Desert Storm to Iraqi Freedom was evident in the raw numbers. The use of operational satellite communications increased fourfold, despite being used to support a much smaller force (fewer than 200,000 personnel compared with more than 500,000). New operational concepts such as *reach back* (intelligence analysts in the United States sending information directly to frontline units) and *reach forward* (rear-deployed commanders able to direct battlefield operations in real time) reconfigured the tactical concept of war. The value of Predator and Global Hawk Unmanned Aerial Vehicles (UAVs), completely reliant on satellite communications and navigation for their operation, was confirmed. Satellite support also allowed special forces units to range across Iraq and Afghanistan in extremely disruptive independent operations, practically unfettered in their silent movements.

But the paramount effect of space-enabled warfare was in the area of combat efficiency. Space assets allowed all-weather, day-night precision munitions to provide the bulk of America's striking power. Attacks from standoff platforms, including Vietnam-era B-52s, allowed maximum target devastation with extraordinarily low casualty rates and collateral damage. In Desert Storm, only 8 % of munitions used were precision guided, none of which were GPS capable. By Iraqi Freedom, nearly 70 % were precision guided, more than half from GPS satellites (Testimony of Deputy Secretary of Defense Paul Wolfowitz 2003). In Desert Storm, fewer than 5 % of aircraft were GPS equipped. By Iraqi Freedom, *all* were. During Desert Storm, GPS proved so valuable to the army that it procured and rushed into theater more than 4,500 commercial receivers to augment the meager 800 military-band ones it could deploy from stockpiles, an average of one per company (about 200 personnel). By Iraqi Freedom, each army squad (6–10 soldiers) had *at least* one military GPS receiver.

What space-enabled forces could not do, however, was provide overwhelming support for a continuing occupation of foreign lands. Despite the high-tech advantages of increasing numbers of ground troops, a determined low-tech enemy kept conventional forces bogged down, and the so-called COIN (counterinsurgency) wars dragged on and on. To the extent that surveillance and tracking capabilities helped limit surprise attacks and enabled broad area surveillance, US casualties were probably far less than they might have been, but the inability of American military forces to quickly defeat irregular forces and politically stabilize these regions had severely detrimental effects. More than a decade of war has cost America more than 7,000 of its own young men and women killed and tens of thousands permanently maimed, hundreds of thousands of non-American lives lost, and trillions added to the national debt, contributing in turn to severe economic difficulties at home, stressed American military personnel and their families to unprecedented levels, and far from winning the hearts and minds of the people of those occupied lands may have engendered generations of resentment and mistrust.

As America withdraws, questions are already asked: what was gained? Is America better off now than a decade ago? Were all those lives and all that wealth spent wisely? History will judge, but the current public and administrative attitude appears to be leaning away from massive "boots on the ground" deployments and toward concepts such as Air-Sea Battle and Offshore Balancing. With its economy mirroring the world's, less will be spent on the military in the next decade, and while America will not give up its preeminent position in world affairs, it will be less likely to intervene abroad with the type of commitments it demonstrated in Iraq and Afghanistan. A return to lighter, faster, highly mobile and technologically advanced strike forces will be evident. Such a military force *needs* space power support.

Given the utility of and reliance upon military assets in space, there is no question the United States must guarantee space access if it is to be successful in future conflicts. Its military has stepped well over the threshold of a new way of war. It is simply not possible to go back to the violently spasmodic mode of combat typical of pre-space interventions. The United States must become highly discriminating in the projection of violence and parsimonious in the intended breadth of its destruction. It must do so with a smaller relative budget. Space is the crux of this transformation.

17.2 US Space Security Policy

17.2.1 Current US Space Policy

The National Security Space Strategy (NSSS) is subordinate to the National Space Policy (NSP), which outlines and defines the overall direction and emphases of America's space programs. The most recent NSP, published in June 2010, purports to chart a bold new course. It begins with a simple, declarative sentence: "The space age began as a race for security and prestige between two superpowers" (National Space Policy of the United States of America 2010, p 1). The implication is clear. What has been is now gone, and the future impetus for space development shall be different. Humanities' reliance on space for an increasingly interconnected global network of finance, trade, production, and security has changed the way we live, "and life on Earth is far better as a result" (National Space Policy of the United States of America 2010).

The previous focus of national space development, born of conflict and propelled by Cold War challenges, must give way to a new era of cooperation.

Much ink is spilt on a renewed commitment to international cooperation, the rights of all nations to pursue the peaceful exploration and use of space, and the continuing leadership role of the United States in these efforts. But "in this spirit of cooperation," within the five guiding principles put forth for all states to adopt and follow, is the recognition that among the peaceful purposes advocated therein the right of the United States to use space "for national and homeland security activities [and] consistent with the inherent right of self-defense, [to] deter others from interference and attack, defend our space systems, and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them" is maintained (National Space Policy of the United States of America 2010, p 3). Accordingly, the Secretary of Defense is charged with the development, acquisition, operation, maintenance, and modernization of Space Situational Awareness (SSA) capabilities; developing capabilities, plans, and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack US or allied space systems; maintaining the capabilities to execute the space support, force enhancement, space control, and force application missions; and providing, as launch agent for both the defense and intelligence sectors, reliable, affordable, and timely space access for national security purposes (National Space Policy of the United States of America 2010, p. 14).

17.2.2 The National Security Space Strategy

Consistent with 2010 NSP, the Department of Defense published the 2011 National Space Security Strategy (National Security Space Strategy 2011). This document "charts a path for the next decade to respond to the current and projected space strategic environment"(National Security Space Strategy 2011, p. i). That environment, state the authors, is driven by three trends; "space is becoming increasingly *congestive, contested*, and *competitive*" (National Security Space Strategy 2011, p. 1, Original emphasis). *Congestion* here refers to the increasing clutter in space, primarily in low Earth orbit (LEO) that has come as a natural result of space launches, satellite deployments, and, ominously, antisatellite (ASAT) weapons testing. The DOD tracks more than 22,000 objects in orbit, including more than 1,100 active satellites, to assist in payload identification and collision avoidance. Due to the limitations of tracking objects in space with current sensors, through the filter of the Earth's atmosphere, these are all larger than a human fist. Potentially hundreds of thousands of smaller objects also exist in orbit, where the kinetic impact of a pinhead-size bit of metal or ceramic could destroy a satellite or puncture a space suit. In recent years, two events have significantly increased the size of the debris field; a 2007 Chinese ASAT test that obliterated one of its own derelict weather satellites added approximately 3,000 trackable chunks of debris and the 2009 collision of a Russian Cosmos and an American Iridium satellite, resulting in 1,500 additional pieces of observable debris (National Security Space Strategy 2011, p. 2). Not only is this effective physical pollution of LEO expanding exponentially, but the useable radio-frequency spectrum is increasingly stressed, causing usually unintentional interference between satellites and reducing bandwidth-carrying capability.

Space is also increasingly *contested*. "Today space systems and their supporting infrastructure face a range of man-made threats that may deny, degrade, deceive, disrupt, or destroy assets. Potential adversaries are seeking to exploit perceived space vulnerabilities" (National Security Space Strategy 2011, p. 3). The emphasis here is on direct military intervention against US space assets that disrupt the stability and security of the space environment, though it includes unintentional interference through so-called irresponsible behavior.

Competition refers to the declining relative edge in space capabilities held by the United States. The NSSS maintains that America's competitive advantage in space access and market share is dissipating, and its lead in space technology is eroding as more states enter into the strategic environment. Assured access to space is challenging America's "abilities to maintain assured access to critical technologies, avoid critical dependencies, inspire innovation, and maintain leadership advantages. All of these issues are compounded by challenges in recruiting, developing, and retaining a technical workforce" (National Security Space Strategy 2011).

Accordingly, the NSSS articulates three objectives: (National Security Space Strategy 2011, p. 4)

- Strengthen safety, stability, and security in space.
- Maintain and enhance the strategic national security advantages afforded to the United States by space.
- Energize the space industrial base that supports US national security.

Consistent with the three objectives are five strategic approaches: (National Security Space Strategy 2011, p. 5)

- Promote responsible, peaceful, and safe use of space.
- Provide improved US space capabilities.
- Partner with responsible nations, international organizations, and commercial firms.
- Prevent and deter aggression against space infrastructure that supports US national security.
- Prepare to defeat attacks and to operate in a degraded environment.

These objectives and approaches are consistent with national policy guidance, and, while broad enough to allow for maximum interpretation, are also problematic for traditional means and methods of a martial organization to satisfy them. The NSSS affirms that presidential guidance will be the basis of future planning, programming, acquisition, operations, and analysis for space and that its own policies, strategies, and doctrine will follow suit – but also recognizes that in a fiscally constrained political setting, these will also be subordinated to "feasibility and affordability assessments and cost, benefit, and risk analyses" (National Security Space Strategy 2011, p. 12). Therein lays the rub: "our ability to achieve long-term goals for space depends upon our fiscal responsibility and making tough choices, such as between capability and survivability" (National Security Space Strategy 2011).

17.3 Issues and Challenges

No nation relies on space more than the United States – none is even close – and its reliance grows daily. A widespread loss of space capabilities would prove disastrous for American military security and civilian welfare. America's economy would collapse, bringing the rest of the world down with it. Its military would be obliged to hunker down in a defensive crouch while it prepared to withdraw from dozens of then-untenable foreign deployments. To prevent such disasters from occurring, the US military – in particular the US Air Force – is charged with protecting space capabilities from harm and ensuring reliable space operations for the foreseeable future. As a martial organization, the Air Force naturally looks to military means to achieve these desired ends. Specific to this mandate are guidelines in three core areas: congestion, contestation, and competition. Each is addressed in the following sections, with a fourth section focused on policy guidance not made – those issues and challenges conspicuous in their absence.

The overall mandate is broad – too broad, perhaps, for a military service traditionally constrained by tight political oversight. Nonetheless, the NSSS concludes with the overarching statement that "Active U.S. leadership in space requires a whole-of-government approach that integrates all elements of national power, from technological prowess and industrial capacity to alliance building and diplomatic engagement. Leadership cannot be predicated on declaratory policy alone. It must build upon a willingness to maintain strategic advantages while working with the international community to develop collective norms, share information, and collaborate on capabilities."

17.3.1 Congestion

> We seek to address *congestion* by establishing norms, enhancing space situational awareness, and fostering greater transparency and information sharing. Our words and deeds should reassure our allies and the world at large of our intent to act peacefully and responsibly in space and encourage others to do the same (National Security Space Strategy 2011, p. 13).

As near-Earth space becomes increasingly populated, it is in the interest of all spacefaring states to coordinate their activities to limit collisions and radio-frequency overlap and to adjudicate disputes. The optimum solution is an international traffic management system that fairly allocates positions, priorities, and operating parameters and has some capacity to enforce rules or sanction defections, but such a body is still many obstacles from fruition. In the meantime, the United States now supports diplomatic initiatives to achieve a common understanding or rules-of-the-road approach similar to coordination efforts for international air and sea operations. These widely accepted norms allow states and firms to anticipate the behavior of others and thus maximize their activities responsibly, peacefully, and safely. While the devil is indeed in the details, the overall concept is acceptable, and the NSSS supports diplomatic engagement and consensus regarding what voluntary data standards, best practices, transparency and confidence-building measures, and norms of behavior that should be included. This consensus can include arms limitation and control measures so long as they are "equitable, effectively verifiable, and enhance the national security of the United States and its allies" (National Security Space Strategy 2011, p. 6).

Several rules-of-the-road approaches are currently offered, foremost among them the European Union's Code of Conduct for Space and the US-based Stimson Center's proposal.[1] Both seek to regularize space operations by focusing on space debris mitigation, space traffic management, and collision avoidance. Adherence to the rules is voluntary, but it is presumed that if the top spacefaring states endorse one of these codes and abide by their principles, others would follow and cooperation in space would increase. Despite the essentially positive and widely acceptable intent of these coordinating efforts, significant opposition within the United States is evident. The Marshall Center is prominent among critics, arguing that the rules would be unnecessarily binding while decreasing overall US national security (DeSutter et al. 2011; Kueter 2011).

The critical issue for any effort to reduce the problems of an increasingly congested environment is the international capacity for space situational awareness (SSA). Currently, the United States is the primary provider of the location and movement of all near-space objects, and the DOD is the owner of most of the assets that track space activities. While all launching states are required to register the initial intended operating parameters of satellites placed into orbit, only the United States is able to monitor actual global satellite parameters, and as previously noted, these parameters are publicly and freely shared. They are, however, quite limited because all monitoring and observation assets are located on the surface of the earth. These include optical and radio-frequency observations and sophisticated over-the-horizon radar that, due to atmospheric distortion and other limitations, can provide only a partial picture. What is needed to increase visibility, highlight malfeasance or nonadherence to international norms and conventions, and develop collision-avoidance procedures that take into account the myriad of small but deadly detritus surrounding the planet is a robust space-based SSA. Without such a system, nations will continue to effectively fly blind in orbit.

Two problems persist in the fielding of such a capability, both related to the overall goal of increasing transparency. First, it would be tremendously expensive. Second, its transparency would always be in doubt.

A network of surveillance satellites that collect data of on-orbit obstacles and activity is needed, with visible and multispectral real-time imaging capability. So far, only the DOD, with its mandate to ensure freedom of access to space in times of peace and to deny that access to adversaries in times of conflict, has established the limited means to do so from the surface and is stretched too thin in its space

[1]For details, see Council of the European Union (2010) Krepon et al. (2007)

requirements to do so on orbit. Its output must be weighed against national security priorities, and so users of the data will correctly be concerned that full disclosure is unlikely – military secrets persist and critical sources and methods of intelligence gathering are always protected. If an international consortium were to somehow manage to fund and deploy a network of space-based SSA, it seems likely that only members would be assured of full access. But let us imagine that this UN or other large consortium-funded organization gave full access to all who requested it, states with critical space capabilities could be expected to develop countermeasures to cloak sensitive activities. But let us go further still and imagine that fully transparent activities in space is possible, would it be desirable?

Transparency as a confidence-building measure is a purely Western notion. To Eastern strategists, perfect knowledge of one's capabilities and intentions is sure to promote conflict, for it allows a clever adversary to plan the demise of an opponent in detail. Sun Tsu insists that one must always project uncertainty; never let another know how strong or how weak you are. Indeed, successful criminal activity is predicated on either perfect randomness or absolute knowledge of the victim's movements, capabilities, assets, and predilections.

Synchronization and coordination, possible through anticipations of future behavior and precise awareness of the environment, maximizes operational efficiency. But it also allows for free riders and otherwise overmatched actors to plan for and execute devastating attacks on the status quo. There is no panacea in policy where control is absolute. While behavioral norms, greater transparency regarding adherence and defection, and information sharing undoubtedly reduce problems of congestion, they do not necessarily reduce problems of contestation and competition and may unintentionally exacerbate them.

17.3.2 Contestation

> We seek to address the *contested* environment with a multilayered deterrence approach. We will support establishing international norms and transparency and confidence-building measures in space, primarily to promote spaceflight safety but also to dissuade and impose international costs on aggressive behavior. We will improve and protect vital U.S. space capabilities while using interoperability, compatibility, and integration to create coalitions and alliances of responsible space-faring nations. We will improve our capability to attribute attacks and seek to deny meaningful operational benefits from such attacks. We will retain the right and capabilities to respond in self-defense, should deterrence fail (National Security Space Strategy 2011, p. 13).

Deterrence is easy to announce and impossible to measure. It can only be reliably determined when it fails; its success is only ever implied. Its virtue is its relative cheapness (compared with defense). By threatening retaliation if an undesired action is taken, the key aspect of successful deterrence is credibility. Credibility has two vital aspects. *Can* the state fulfill its obligation should a transgression occur – that is, does it have the capacity to carry out the threatened retaliatory action – and is the state *willing* to fulfill its obligation should deterrence fail? Does it have the political and moral authority to do so?

The NSSS offers several means for establishing credibility. These are establishing rules and norms so that violations are clear and irrefutable; interdependence through strategic partnering with other states, in essence making an attack on one spacefaring state an attack on several; developing enhanced SSA so that violators can be identified and, presumably, held accountable for their actions; creating defenses and/or operationally responsive capabilities to add costs and deny operational advantage from an attack on space assets; and last, fielding and maintaining the capacity to carry out deterrent threats with force. All of these, if known to a potential aggressor, increase the credibility of the deterrent.

Unfortunately, deterrence in and for space is highly problematic. A recent Project RAND study concludes that "Deterring adversaries from attacking some U.S. space systems may be difficult due to these systems' inherent vulnerability and the disproportionate degree to which the United States depends on the services they provide" (Morgan 2010, p. ix). Given that loss of space support would be an asymmetric advantage for any nation potentially at war with the United States, the deterrent threat itself is weakened by the act of violation. The means for increasing deterrent credibility listed above are generally in line with the recommendations in the RAND study, but all are fraught with uncertainty.

Engaging multiple nations and corporations through strategic partnering in specific space systems would make those shared assets less lucrative targets to at least members of the consortium and increase the likelihood of an international response should those systems be negated by an outside force. But the types of systems that could readily be partnered are not those that tend to provide force enhancement. National assets for intelligence collection, precise real-time targeting and assessment, indications and warning, and other military support activities are not communally operated. This is unlikely to change in the near future. When military communications are carried on civilian or commercial payloads, they are currently dedicated transponders or purchased as exclusive buyers and are limited to overflow or excess capacity. The only reasonable deterrent today is against broad area or orbit-denying attacks, such as a high-altitude nuclear burst or a dirty engagement in LEO with the intent of making all satellites in the belt vulnerable through the addition of massive amounts of damaging debris. Such an attack is not likely from any state that currently relies heavily on space for its commercial or security infrastructure, but could be seen as highly lucrative to states that are generally cut off from the international community. Such rogue states are already outside the bounds of international norms and are generally perceived as atypical deterrence problems already.

The necessity for enhanced SSA to identify aggression and other violations of international norms has already been discussed and is absolutely necessary to enhance deterrent credibility. But also discussed are the current lack of enhanced SSA and the difficulties of extending SSA capabilities in the future. The DOD does not have sufficient funding to do so, and cooperative agreements with partner states to field such systems are notoriously inefficient. Enhanced public SSA, while a noble goal, is far from reality.

Increasing defensive capabilities for satellites, through hardened exostructures against kinetic impact, enhanced shielding against electromagnetic pulse (EMP) and other directed energy attacks, and high-speed shutter control or other anti-lasing defenses are expensive and heavy, adding enormously to launch costs (currently about $25,000 per kilogram of payload weight). A more efficient means of ensuring that an attack on space assets would be unlikely to achieve debilitating effects is to increase the number of satellites on orbit (redundancy in capabilities), reduce reliance on large, multiple-function single-node failure satellites with expensive-but-fragile components and extended 20–30-year life expectancies (replacing them with networks of small, single-function satellites that are replaced at regular intervals with the latest technologies), and commit to a responsive space-lift capability with the capacity to rapidly replace damaged satellites and to surge satellite populations in crisis. All of these would make limited attacks on spacecraft extremely unlikely to have meaningful positive results for the attacker and would clearly deter states who currently might view a loss of US space-based capabilities as an asymmetric advantage. All of the defensive options listed here would go a long way to enhancing deterrent credibility, but all are extremely expensive relative to business as usual and reliance on diplomatic promises and the hope that a deterrent threat will never have to be carried out.

Finally, fielding the capacity to carry out deterrent threats should they fail is the most critical and least discussed of the credibility enhancing factors offered. The United States has clearly stated that an attack on any of its space systems will be countered within the bounds of international law, treaties to which the United States is a partner, and in accordance with the inherent right of states to self-defense (National Security Space Strategy 2011, p. 10). No details are offered, but as the United States has no plans to deploy or field space-based weaponry, and its ground-based anti-space capabilities are extremely limited, any response would have to be land, sea, air, or cyber-based – called cross-domain response.[2] Indeed, committed anti-military space weapons advocates argue that a deterrent in space is unnecessary as sufficient retaliatory capacities already exist in other, terrestrial domains. Bruce DeBlois, Richard Garwin, R. Kemp, and Jeremy Marwell claim that "Even without space weapons, the United States could respond to an attack on its satellites with its unmatched terrestrial military capabilities. Adversaries would expect a heavy toll to be exacted as a result of any attack on U.S. satellites; that expectation alone would almost certainly suffice to deter any such attack" (Deblois et al. 2005). Echoing the sentiment, Yousaf Butt wrote in *The Bulletin* of *Atomic Scientists*, "A better way to deter attacks on U.S. satellites would be for Washington to make clear that any attack on its space assets would be considered an attack on U.S. soil and result in a heavy conventional retaliatory attack" (Butt 2008). At issue is credibility. Clearly the United States has the capacity to rain down *heavy* damage through conventional means, but would it do so? An unseen attack on a machine in space could have severe

[2]See, for example, Manzo (2012)

effects on the United States, no doubt. But these would not be direct; no human lives would be lost. Would the United States risk war on earth to retaliate for an attack on a machine in space? Would it bomb a launch site or control facility on earth, a factory that produces satellite components in another state, or some other terrestrial target to make good its deterrent threat? Really?

Of the four means of enhancing credibility – increased partnering, enhanced SSA, defensive countermeasures, and assured military retaliation – only the latter is available now, and its reliability is severely overstated.

17.3.3 Competition

> We seek to address *competition* by enhancing our own capabilities, improving our acquisition processes, fostering a healthy U.S. industrial base, and strengthening collaboration and cooperation. Our objectives are to improve safety, stability, and security in space; to maintain and enhance the strategic national security advantages afforded to the United States by space; and to energize the space industrial base that supports U.S. national security. Achieving these objectives will mean not only that our military and intelligence communities can continue to use space for national security purposes, but that a community of nations is working toward creating a sustainable and peaceful space environment to benefit the world for years to come (National Security Space Strategy 2011, pp. 13–14).

The heyday of space spending is long gone. Despite tremendous advantages and technical spin-offs from space research, the US taxpayer has little stomach for more spending on space capabilities that cannot be shown to immediately pay dividends. This is especially true for space exploration – NASA's budget relative to its peak in the 1980s is one-eighth of its former place (de Grasse-Tysen 2012) – and military space spending. Budget constraints forecast for the next decade make entering into new or potentially defining technological developments such as those suggested in the contestation section of the NSSS are highly doubtful (Office of the U.S. Air Force Chief Scientist 2010).

The current vogue is to move away from government spending on fundamental space research and transition military development to the private sector. This has two fundamental problems. First, the most pressing national security needs are rarely profitable without massive government backing. Currently, the United States has no follow-on heavy-lift commercial launch capability to geostationary orbit. Without government assurance of massive subsidies, no such system is likely to be developed privately. China and Russia already offer cut-rate services to geostationary orbit, and the European Space Agency's Ariane rockets are fully booked for the next half decade. The preeminent example of national security initiatives having enormous positive commercial impact is the USAF's Global Positioning System (GPS) satellite. In the 1970s, there was simply no economic forecast that showed profitability in any GPS system. The US military had a need for better standoff targeting and global location support, and so GPS became an Air Force need. Recognizing that a lower-grade capability could be advantageous to global commerce, GPS was initially deployed with a tiered availability and its lower resolution output offered freely to all users – with the caveat that it could be denied in times of crisis. Within a decade, GPS had transformed the global economy. Just-in-time supply and secure Internet financial transactions alone add billions of dollars in efficiencies to global commerce, and new applications for precise geolocation are developed on a daily basis. The commercial and security reliance on GPS today is such that the USAF simply cannot deny its benefits in any conceivable future scenario; it is a global good provided freely to all yet paid for entirely out of the USAF/DOD budget. If market forces had been the primary means to determine the profitability and thus feasibility of space-based geolocation, it likely never would have been developed.

Second, while free markets create the highest variety and quality of goods at the lowest possible prices – a contention that is undeniable in the aggregate – markets do not raise all goods nor participants in them equally. Indeed, it is the capacity of markets to create imbalances that is the engine of its potential. Poor products and performers are weeded out, and successful ones are rewarded by amassing capital. When enough capital is amassed, large (expensive new) ventures are possible. The problem, of course, is when a single participant gains so much advantage that he or she can exercise a monopoly. A monopoly is a market failure, because no internal mechanism exists to purge monopolies. Only an external force – government – can return the market to beneficial competition. For this reason, free market advocates including Adam Smith, Alexander Hamilton, David Ricardo, Milton Friedman, and Jagdish Bhagwati have insisted that states reject the market where national security is at stake. In a pithy analogy, surely it is not in the best interest of America or any other state to rely on the market to supply its nuclear deterrent needs.

There is, of course, a reasonable counter. A managed market can outperform a free market in providing security needs when carefully monitored and controlled. Alexander Hamilton's recommendations to place exorbitant tariffs on the import of guns from Europe were intended to spur domestic industry that otherwise could not compete. An inferior American-made weapon at a fraction of the price of a quality English flintlock would sell. In the twentieth century, such managed market economies outperformed centrally planned economies in times of peace – though not *in* war or when war was imminent. Even the United States moved to a fully managed economy for war materials from 1941 to 1945, the tendrils of which continue today. And this less-managed market system may be the model for moving to more commercially prompted innovation in the near future. Space war is not projected any time soon, and a managed market economy is more likely to follow promising new technologies than a government bureaucracy-driven one. But, should war that could include engagements in space become probable, the United States could find itself outmatched by others taking advantage of temporary imbalances that are sure to occur.

17.4 Challenges and Issues Not Addressed

The following issues are not adequately addressed in the policies above nor are they generally discussed in the majority of forums on the responsible use of space power.

The list is not complete or exclusive. They are simply issues or sub-issues that need to be given full consideration.

Rules of the Road: If the primary issue is debris contamination, then a treaty requiring signatories not to use kinetic strikes or any other form of satellite engagement that knowingly adds to the total amount of debris in space would be more than palatable to all spacefaring states. Unfortunately, these proposals currently make demands on signatories that cannot be agreed to with the intent of compliance. Limits on all weapons in space, requirements to renounce the first use of force, equal access to national intelligence collections, and the like are piled on to treaty proposals in the manner of so-called poison pill bills in legislatures. A rules-of-the-road approach does not have to insist that *all* rules must be hashed out and agreed upon before *any* rules can take effect. Start with low-hanging fruit. As compliance with generally acceptable rules develops, more cooperation can and should emerge.

For example, requiring transponders on all spacecraft is widely accepted as a reasonable measure and has precedent in air and sea law. Currently, satellites are tracked by optical means or military radar. This is ineffective for secure collision avoidance and finding satellites that are accidentally placed into incorrect orbit – or those the launching state simply does not want to be found. Just as transponders are required on all aircrafts, it seems a reasonable step to do the same for all spacecrafts. This issue does not need to be entangled with any others and could be agreed upon piecemeal as the start of comprehensive rules-of-the-road approach leading to a more stable and self-enforcing body of international space law.

Debris Mitigation: While there is a great deal of effort to limiting new debris in orbit, very little attention is paid to eliminating the debris already there. It is generally acknowledged that debris, left alone will eventually decay into the atmosphere or in other manners naturally be expunged, but this is expected to take many thousands – if not hundreds of thousands – of years. Limiting additional debris is a start, but the vast majority of dangerous contamination happens from routine rocket launches and satellite operations. Unless some form of cleanup is foreseen, or human space activities come to a halt, the debris field will increase.

Unfortunately, debris in orbit is a global problem. This makes it unlikely that a single state or consortium will altruistically take on the job unless it can be shown there are additional benefits or profit in doing so. Here is a reasonable entry for the US military. Terrestrially, the US Navy clears hazards and ensures access to international waters as a routine function. This is usually when human-made hazards including deliberately scuttled ships, mines, or other anti-access detritus is evident or when pirates or international criminals (human trafficking, drugs, etc.) restrict safe passage. The US Air Force could receive the go ahead to do so, but to be able to remove debris from orbit would be tantamount to a weapons capability and will likely be opposed internationally. Lasers or directed energy beams could eliminate small particles and push larger bits into the atmosphere. Such a capacity could also target adversary space assets in times of conflict. A tug pulling a debris sweeper, similar to minesweeping operations, would have to be extremely powerful and highly maneuverable to be effective. Such systems would also need to be robust – stronger than current capabilities and able to withstand greater stresses than the current space-fleet – and thus would have inherent defensive capabilities that may be unacceptable to many states. Such capabilities would also require a tremendous increase in SSA and greatly increased heavy launch capacity. These will be expensive, and the advantages in transit and upgraded military capacities in space may well be unacceptable to the American public.

But, the capacities needed to give America a robust and responsive space architecture may be palatable to those who advocate a global space infrastructure to defend the earth from meteors, comets, and other non-terrestrial threats.

Planetary Defense: Loosely allied in their concern for an eventual (probably assured) collision with a cosmic body that could wipe out life as we know it, an increasing number of scientists, academics, and popular writers are pushing for an international space defense capability. While war in space seems far more likely than a planet-killing or even city-destroying event in the next half century, creating the capacity for deflecting a cosmic collision would provide any entity doing so the ability to target the earth with extraordinary force. All of the components for an earth-dominating space force are the same for planetary defense: deployment of extremely comprehensive and detailed SSA for indications and warning, development of high-power kinetic weaponry (strong enough to deflecting kilometer-wide asteroids or comets) or high-output-directed energy-beaming satellites (or possibly a lunar or other fixed point installation), and launch on demand or routine heavy-lift earth-to-space capability supporting the vast network of space capabilities deemed necessary. The United States must either lead these efforts or at minimum ensure that no other state can control this ability should international support become evident. Regardless of one's opinion on the validity of planetary defense, it is important that space policy account for it.

Weapons in Space: Although every national space policy since the first one issued in 1958 under Eisenhower has reaffirmed America's right to self-defense and reserved the option of weaponizing space should the national interest require it, little detail on how or why space could or should be weaponized has been provided. America and the world need an open debate on the merits of military action in, through, and from space.

17.5 Conclusions

The world economy is so intrinsically linked to support from space that should a major outage of satellite capacity occur, financial and trade markets could collapse. A recession spanning the globe would ensue, and security tensions would exacerbate. The increasingly chaotic international environment would be further destabilized by the disastrous incapacitation of US military power. Without the assuredness of space-based surveillance, communications, and navigation support, American and allied military forces would be ordered to hunker down in defensive crouch while preparing to withdraw from dozens of then-untenable foreign deployments.

Such a scenario is not only possible – given the growing investment and reliance on space as a national power enabler – it is increasingly plausible. An attack against low Earth orbit from a medium-range ballistic missile adapted for detonation in space could cause inestimable harm to the national interests of developed and developing states alike. Deterrence may forestall such an attack, but without a space-based defense, any decision by an adversary to disrupt space capabilities on orbit is likely to succeed.

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