# Re-architecting Our National Security Space Strategy

Fred Kennedy

January 2021

## Summary

The current Administration has adopted a high-profile approach to space issues. It established a National Space Council, chaired by the Vice President and including various senior members of the Executive Branch. The Council authored multiple Space Policy Directives for Presidential signature on a variety of topics—NASA's exploration efforts, bolstering the commercial space sector through regulatory streamlining, space traffic management, and the establishment of a Space Force. These efforts were individually laudable but lacked the cohesion of a grand strategy for envisioning America's future in space.

Several cases illustrate this point:
- A proposal to return to the Moon by 2024 electrified the imagination of many, but if the only acceptable path to success lies through such inordinately expensive and perennially delayed projects as the Space Launch System or Orion crew vehicle, how could such a challenging schedule goal conceivably be met?
- An ever-increasing population of orbital debris threatens commercial, civil, and defense spacecraft alike, yet the obvious agency choice for dealing with the issue—the Federal Aviation Administration—was passed over in favor of the Commerce Department's Office of Space Commerce, which has little experience or historical association with the problem.
- While a space-focused arm of the Defense Department can act as an advocate and steward for critical national space priorities, the new U.S. Space Force has focused almost exclusively on operations and protection of legacy satellites and systems at the expense of fielding a new, more resilient space architecture.

## Challenge and Opportunity

Despite recent attention to space issues in US policymaking, the overarching problem has not been addressed. The national security sector owns a collection of twentieth-century space programs, constellations of satellites, launch vehicles, ground systems, and regulatory entities which served us well enough when we were the pre-eminent users and developers of space capabilities. But what worked last century is not likely to allow us to retain a competitive edge into the future.

Our space architecture—what we build, how we use it, and how various sectors collaborate and cooperate—will be critical to our national security and economic prosperity throughout the remainder of the twenty-first century. There is intensifying global competition for space-based products and services, and our government's inability to innovate and deploy new capabilities on faster timelines hinders us in every sector. The Space Council has selectively addressed elements of the problem but has not tackled the primary issue.

The creation of the Space Force is a marquee development that should not distract from the primary dilemma. Our space-based defense assets remain mostly extremely elaborate, expensive and inevitably deployed on lengthy timelines, making them difficult to upgrade as technology evolves and adversaries advance. While it is important to consider means to protect these legacy capabilities in the short term, this can only be a stopgap measure. We must move quickly to replace our status-quo space architecture. Our potential adversaries can and have developed countermeasures to deny or defeat our space-based systems, negating our advantage in future conflicts. The Department of Defense (DOD) has adopted a halting "hedge" strategy for space that fails to prioritize the need for a new toolkit. We have effectively established a space service before understanding the things that service needs to build and operate to be effective. By analogy, this would be equivalent to standing up an Air Force before the development of the airplane. In many ways, our space capabilities resemble Civil War-era hot-air ballooning more than the comprehensive architecture of today's Air Force. When reconnaissance is possible, but not true force projection, and when costly protection of existing assets is our principal strategy, we will be forced to fight continual rearguard actions. This approach cedes forward progress in the name of maintaining legacy capability and is a long-term drain on resources and morale. Instead, we need to give the nascent Space Force the tools it needs not just to hold its ground, but to be pre-eminent into the future.[1]

We must find ways to incentivize the Space Force to undertake this transformation. Creating the Space Development Agency (SDA) – an organization chartered to rapidly field the new space architecture, directly addressing threats before they can fully materialize – was a positive step in disrupting the status quo, but antagonized the Air Force, its legacy industrial base, and some in Congress. This PR blunder was compounded by the failure of DOD to offer a consistent, clear narrative as to how this future can practically be achieved. This lack of clarity must be addressed, and key stakeholders won over, in advance of any future initiatives. The SDA - as a defense "startup" - can be a locus for future space innovation, but only if it is offered the autonomy and resources it needs and is not buried inside an impenetrable acquisition bureaucracy. Like all startups, it will require "runway."

The intelligence community was an early adopter of space capability; established in 1960, the National Reconnaissance Office (NRO) has provided exquisite imagery and signals intelligence to the national security community for sixty years. Like its counterpart organizations in the "white world" (other than intelligence-gathering) defense establishment, it operates extremely elaborate expensive space systems that require years—and sometimes more than a decade—to field. The NRO has only belatedly realized that it must augment its stable of large, complex systems with small, mass-reproducible ones, and is looking for opportunities to demonstrate its allegiance to agility and innovation. The culture of the NRO (and many of its intelligence community counterparts), however, is still stuck on "exquisite" and it will be difficult to make much progress without external prodding.

---

[1] Developing doctrine in the absence of real or projected force projection elements is problematic. See Worden, Simon P. and Shaw, John E. 2002. Whither Space Power? Forging a Strategy for the 21st century. Air University Press, Maxwell Air Force Base, AL. https://media.defense.gov/2017/May/05/2001742912/-1/-1/0/FP_0008_WORDEN_SHAW_WHITHER_SPACE_POWER.PDF.

Much has been made over the past five years over a rapprochement between "black" (intelligence community) and "white" space, owing to collaborative activities such as the National Space Defense Center (NSDC), among others. Legacy defense space and intelligence space activities share strong similarities, and a relatively clear and agreed-upon partition between their respective mission areas. This is changing as new user communities and their requirements mature—for example, Army units demanding real-time tactical imagery—driving the NRO to look outside its normal strategic intelligence customer base. But the NRO's culture of reliability and risk aversion hampers its ability to satisfy these fast-evolving requirements, so a more responsive solution might be procured organically within the service or within the Space Force. This is not a bad thing; historically, the NRO's insistence on being the sole space-based provider of geospatial intelligence (GEOINT) and signals intelligence (SIGINT) has impeded innovation in DOD – these missions were "no go" areas. But with the advent of small satellites and commercial remote sensing services, this no longer need be the case. And we should welcome, not discourage, a diversity of capable sources. There's a common refrain of late within the national security space community: "it takes sixty different organizations to say yes." But that doesn't mean sixty organizations that build capability. Let's build more – and grant appropriate authorities to those that do. The "sixty" can be slimmed down appreciably, driving accountability back to operators and acquirers.

## Plan of Action

China and other global players are moving forward with their own plans in space—some of which directly threaten the efficacy of our own systems. Yet the U.S. is fortunate to have at our disposal a burgeoning commercial space industry that—before COVID—was making great strides in building systems to support low-cost, flexible launch; low-latency, broadband communications; and ubiquitous remote sensing. With the right incentives, this community could become a strong partner to the defense space community. Innovation on compressed timelines, frugality, and a practical focus on developing only what is needed ("perfect is the enemy of the good") are lessons that DOD can draw from the "New Space" community. Issues that have given representatives of the current Administration pause—including cybersecurity and individual "New Space" business case viability—are surmountable. A compromise must be achieved between the rigid, bureaucratic validation approach levied by DOD and the perceived "wild west" of private sector offerings. Resilience through multiplicity (multiple vendors and systems) also provides an opportunity for mitigating both cyber and business case failure risks.

## 1. *Opportunities to pursue in the next presidential term.*

The federal space policy community must set aside its risk-averse mindset and focus on the kind of space ecosystem the government would wish to own and operate throughout the rest of the twenty-first century. Amazon's Kuiper, SpaceX's Starlink, Telesat, and others are deploying or will soon deploy large constellations of small satellites and associated ground and user systems at unprecedentedly low unit cost and built on timescales of days, not years. These "smallsats" are the vanguard of a new way of doing business in space: mass production, incorporation of cellphone and microcomputer innovations as they arise, and rapid iteration/innovation to support competitive fielding (i.e., decreasing "time to market"). The characteristics of New Space offerings address the shortcomings of the defense space community perfectly. We need to engage with key players to not simply transfer their lessons to the defense industrial base, but to make these companies part of that base by purchasing satellites directly off production lines and integrated services provided directly to DOD users at the tactical edge (e.g., "sensor to shooter" data products) featuring validated data integrity, resilience against cyber threats, and assurances regarding foreign use and ownership.

The Space Force should be the department's focal point for delivering these systems and services. The Space Development Agency, explicitly re-chartered to maximize commercial/defense sector cooperation, can lead, explicate, and coordinate the details of the re-architecture. But for the Space Force and SDA to be effective, there must be extraordinarily strong Administration support for SDA to assume such a steering role. The Air Force fought the establishment of SDA right up to the end, and there will be constituencies within National Security Space that will continue to fight attempts to change what they acquire and how they acquire it. One option might be to place "detachments" of SDA-affiliated personnel inside key space acquisition organizations such as NRO, the Space Force's Space and Missile Systems Center, and others, and designate them as focus points for "re-architecture," with budget authority to match. These detachments would not drive pre-existing acquisition plans but would be responsible for executing pilot programs that would phase in after the current crop of satellites reaches end of life (decommissioning).

Natural allies in the drive to re-architect are innovative organizations such as the Defense Advanced Research Projects Agency (DARPA) and Intelligence Advanced Research Projects Agency (IARPA), which could work in concert with SDA by creating their own space-focused offices. DARPA, for example, could charter a Space Innovations Office and fund it to support technology developments that advance the new architecture in conjunction with other players such as SDA. Both the Navy (Naval Information Warfare Systems Command, or NAVWAR) and Army (Space and Missile Defense Center, or SMDC), organizations that advocate for and use space-derived products, but which tend to play a small role in defense space, would welcome recognition of their specific concerns and elevation to the first tier of space developers; this could be achieved with modest funding increases to both. The NRO, National Security Agency, and National Geospatial-Intelligence Agency can help drive this agenda: putting money in their R&D budget lines to encourage exploitation of commercial innovation and partnerships can help

move their cultures away from big, dedicated systems.  Allies (Five Eyes, or FVEY) and other partners also offer opportunities for progress.  "New Space" innovation and investment is hardly confined to the US. Europe, Asia, and the Middle East are investing heavily in innovative space systems, and we should look for ways to engage with these players to defray costs and create natural alliances against potential adversaries.

## 2.  Goals.

Goals should be formulated with respect to foreign countermeasure development timelines, and with an eye to achieving multiple generations of redesign and replacement in the time required for a peer or near-peer adversary to successfully implement a countermeasure. One to two years per iteration should be sufficient to achieve the multiple generation target. This is a reasonable goal based on commercial sector progress now occurring in the satellite broadband arena.

Cost targets should be drastically lower than current "Big Space" projects—perhaps by an order of magnitude, or more. Since cost correlates strongly with system development time (and labor needs), reducing that time from a decade to just 1-2 years should allow this order of magnitude reduction.

## 3.  Overcoming conflicting interests and objections.

Current defense industrial base partners will fear displacement and will strenuously defend the status quo. The Administration must be prepared to address legacy players' concerns; if not, they can be expected to fiercely defend their programs (and implied cashflow), enlisting support from Congress and sympathetic members of the DOD establishment. Some in the space community have offered up compromise solutions such as "hybrid space architectures," which is effectively coded language for "make everyone happy": Large spacecraft builders continue building and small satellite constellation builders continue alongside, as they address different requirements. But this misses the point. Low-cost, mass-producible small spacecraft offer agility and flexibility of response, and they have matured over the past several decades into formidable competitors to large satellites. The national security space community needs to evolve to a more agile model—our adversaries are doing so. There will be a transition period during which legacy vendors can decide if they wish to learn a new way of doing business or cede business to new players.

A declarative policy statement from the National Space Council – one that clarifies the transition to monolithic, expensive space systems to proliferated small satellites and commercial partnering—is essential.

Transition operations between current and future architectures must be addressed. The Space Council can get ahead of likely objections by clarifying how long a transition period is required (e.g., when DOD stops acquiring large systems, when those systems are decommissioned). A realistic transition period is probably on the order of 7-10 years, which will allow for decommissioning of most existing systems and replacement by commercially derived constellations. Each mission area will have to be explicitly addressed, since each has its own challenges. For example, the "protected communications" community, which provides command and control connectivity over the spectrum of conflict, including nuclear, may suggest that their technologies are unique to their mission and unlikely to be replicated by a commercial player. The Council should reject such "stovepiping" and ensure that commercial entities are advised of solicitation opportunities and encouraged—not simply permitted—to bid on such efforts. These communities have erected classification and other barriers that artificially prevent new vendors from coming forward with innovative solutions and, as a result, the systems and supporting technologies have stagnated for decades.

As noted above, "hybrid" architectures—featuring large, overly-elaborate systems complemented by smaller, less capable assets—has been suggested as a compromise which offers end users the flexibility of small satellites coupled with the exquisite performance of large, complex spacecraft. This point should be addressed through a comprehensive analysis of alternative architectures to illustrate cost, schedule, and performance implications of adopting various options.

Cyber-hardness (i.e., immunity to attack/exploitation) of leveraged commercial architectures (or perceived lack thereof) has been raised by some members of the community as a risk – that commercial entities do not understand DOD and intelligence community security requirements and will pay them short shrift. This is a red herring. The banking and securities trading industries, which are viewed by satellite broadband providers as a significant market opportunity, are hardly newcomers to security—their business models depend on it. Achieving rapprochement between national security and private sector companies regarding appropriate levels of security onboard spacecraft and on the ground (i.e., in data processing centers, command and control centers, and on user terminals) should be a top priority, but we should not allow the security apparatus in DOD to dictate terms. We will need to consider "good enough" measures that can be implemented by commercial companies – this could be done in concert with a drive to root out "over-classification," a product of the space community's risk aversion (when in doubt, classify). In truth, there is no perfect set of measures that can be taken to avoid information spills; we should strive for "good enough," and assert that our security policies (in DOD and in the intelligence community) will be rewritten to permit acceptance of commercial-grade or equivalent cybersecurity.

Detractors have noted that many "New Space" business proposals (e.g., Starlink) appear wildly optimistic in their projections for consumer adoption and downstream revenue. Members of the national security community have suggested that it would be better to "wait and see" rather than sign collaborative agreements and contracts with these companies now. This is precisely wrong. Now is the time to push for broad-based defense-commercial cooperation, to pursue needed technologies (e.g., low-cost optical communications and small-form factor antennas for mobile users on the ground, in the air, and at sea) that benefit both defense and commercial users, and to ensure that commercial users are aware of and can address defense-specific needs that could be "engineered out" if they are not properly understood in advance. Will there be winners and losers in the New Space race? Yes, of course – but collaboration will improve individual companies' ability to thrive by offering an additional customer base and revenue source to the mix.

There is also a need to consider how the White House could provide a degree of high-level leadership, engagement, and accountability to achieve this vision. This can be done through policy declarations similar to the last Administration's, but they must be accompanied by budgetary mandates to be effective. Funding the SDA, its proposed detachments in organizations such as the NRO or the Air Force's Space and Missile Systems Center (SMC), and innovative agencies such as DARPA and IARPA, will go a long way to laying the groundwork for a re-architected defense space construct. This needn't be billions of dollars; pilot projects can be selected for their low-price tag—which would demonstrate the value of moving away from expensive, multi-year satellite builds to leveraging small satellite production lines at commercial entities. But this selection must proceed in very carefully, and it must be consistent with the objectives of the re-architecture.

## About the Author

**Fred Kennedy** is the President of Momentus, a space transportation startup located in the San Francisco Bay Area, and a member of multiple space company advisory boards. Dr. Kennedy served as the inaugural Director of the Defense Department's Space Development Agency during 2019 and led the Defense Advanced Research Projects Agency's Tactical Technology Office from 2017 to 2019. He also served as a senior advisor for space and aviation in the White House Office of Science and Technology Policy during the Obama Administration (2016). Dr. Kennedy retired from the Air Force as a colonel in 2016 after a 23-year career in space and airborne systems engineering and acquisition. He received his Ph.D. from the University of Surrey for work on small satellite propulsion systems and has multiple degrees in Aerospace Engineering from MIT. Following his departure from the government, Fred worked as an executive at Astra, a small rocket company in Alameda, California. Fred is also an active Forbes contributor; his interest areas include the accelerating pace of technological change, the impact of the private sector's primacy in technology investment, and how civil, defense, and commercial interests can work together over the coming decades to build new ecosystems on earth and in space.

## About the Day One Project

The Day One Project is dedicated to democratizing the policymaking process by working with new and expert voices across the science and technology community, helping to develop actionable policies that can improve the lives of all Americans, and readying them for Day One of the next presidential term. For more about the Day One Project, visit **dayoneproject.org**.