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Proposing a 'Coast Guard' for Space

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America's space sector is unlike any other sector of its economy. Thanks in large part to contingencies of history, its structure is an anomaly and its operations are profoundly dysfunctional. The single biggest consumer of services in the space sector is also involved in every aspect of offering those services: the United States government, both military and civil. The civil-government activities are dominated by a single agency with an unusual breadth of functions—the National Aeronautics and Space Administration (NASA). This unusual structure means that the U.S. space sector does not enjoy the beneficial effects of competition, like pressure to innovate and reduce prices. Worse still, in large part for political reasons, the history of the space sector is strewn with plans, programs, and initiatives started but abandoned, often before actual hardware has been built or flown. Cost overruns are the norm, as are substantial scheduling delays.

Fundamental reforms will be necessary if the U.S. space sector is to be effective and affordable, and if it is to contribute to the nation's prosperity and growth. In order to determine what reforms are necessary, we must understand the origins of the space sector's anomalies and dysfunctions—starting with the strange ways that we think and talk about that sector in the first place.

The Evolution of the U.S. Space Sector

For far too long, Americans have used the term "*the* space program" to refer to American space activities in general. The United States has not had a single, unified space program since 1958, when a distinct civilian space program was created independent of the military space program. Certainly by the end of the Apollo program in the early 1970s, the concept of "*the* American space program" had become entirely inappropriate, as America had begun pursuing a wide range of activities in space, including military, civil government, and commercial.

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Yet the notion that there is *a* space program—a set of activities unified toward an overarching goal, organized and executed by a single, all-encompassing public agency—continues to color public discussion of space activity. It serves to channel debate into questions that are limited in scope: Should the Moon or Mars be the goal of the next expedition? Should NASA develop a large booster to get there, or develop orbital refueling capabilities to allow smaller rockets to carry out the mission? Each of these questions, individually, is useful and deserves debate. Indeed, the advocates of the various options are sometimes so ardent that their arguments can easily overshadow the more fundamental questions facing us, such as: What are the national and civilizational goals of space activity? Is our aim to advance science, to enhance national prestige, to stimulate science and technology, to explore the solar system, or to develop space for commerce and settlement?

Also left undebated has been the matter of how best to organize the government side of these activities. In the decades since NASA was designated the lead agency for civil-space activities and the U.S. Air Force (USAF) for military space activities, little serious discussion has been devoted to the question of whether those entities in their present forms are well suited for discharging the government's space interests. The closest we have come to such discussion has been the occasionally recurring proposal to spin off a military Space Force from the Air Force (much as the Air Force was itself spun off from the Army). On the civil side, the model of NASA as a unified agency has been largely immune from scrutiny. This arrangement ought to be reconsidered—but before we can assess whether or not it makes sense, we must understand its origins in the peculiar history of America's efforts in space.

Space activity in the United States was almost entirely military in origin: During the early years, most space launches were military—initially reconnaissance satellites, and later weather and communications support systems—and until the early 1980s, even non-military payloads were mostly sent into space on rockets based on military missiles. The civilian space agency, NASA (initially standing for National Aeronautics and Space *Agency*), was created in 1958 by vastly expanding the existing National Advisory Committee for Aeronautics (NACA), a small research organization that supported the aviation industry. When NASA was started by the Eisenhower administration, it was envisioned primarily as an overtly civilian shell that would take selected spinoffs of military programs and operate them as a visible civilian program for prestige and demonstration purposes. Meanwhile, the *real* space program, run by the United States military,

would continue to operate in secret as it had since its 1954 authorization. Since NASA's expected role was minimal, the old administrative structure left over from NACA was deemed adequate—even though the organization had almost no significant experience with large systems management.

In 1961-62, NASA (renamed the National Aeronautics and Space *Administration* to reflect its upgrade) was repurposed by the Kennedy administration to take on a massive development task: creating the Apollo system for manned lunar exploration. The agency also began conducting unmanned planetary exploration, prototyping satellite communications and other commercial activities, launching privately-funded commercial satellites on legacy military-derived launch vehicles, and a variety of ancillary aeronautical and space functions. More or less by default, NASA became a space transportation utility, a *de facto* regulator, and the *de facto* American interlocutor in any international space activity.

Apollo-era NASA was effectively an emergency governmental mass-mobilization effort, comparable to Germany's wartime V-2 program and the Cold War "missile race." (Indeed, veterans of those undertakings played prominent roles in the Apollo program.) In the case of Apollo, as in the other instances, the head of state was committed to the project, time was more of a constraint than was cost, and the effects of success or failure were quickly felt. However, as NASA moved from the era of Apollo to the era of the space shuttle, the agency's mode of operation changed dramatically. The primary driver for NASA's work became institutional self-preservation. Political pressure from Congress and the White House made job preservation a priority. Resource constraints consistently trumped schedule and performance. Shifting goals and pressures made clear accountability difficult to attain.

The cumulative legacy of these transformations—from NACA to NASA, followed by the turn to Apollo, followed by the switch to the space shuttle—is an agency that dominates its sphere in a manner unlike any other in the executive branch. The agency also has unusual lacunae in its management capabilities, with a span of responsibilities always outmatching its span of attention and control; ultimately, these lacunae have harmed the agency's technical capabilities as well. The agency's bureaucracy is characterized by very powerful entrenched internal fiefdoms with their own external political patrons giving them effective vetoes over administrative decisions, and a strong sense of privileged authority over large areas of national space activity.

Meanwhile, small and less glamorous portions of the U.S. government's space responsibilities have ended up in, or were devolved to,

other agencies—so the Federal Communications Commission regulates communications satellites; the Department of Commerce regulates operational weather and remote sensing satellites; and the Department of Transportation regulates the private space-launch industry. Each of these entities contains a small nexus of capability regarding aspects of space operations. But none of them is large enough to counterbalance NASA in the civil space arena; even taken collectively, their manpower and budget are miniscule compared to NASA's.

In Search of an Analogy

If we are to undo the dysfunctions and distortions caused by the tortuous history of the U.S. space sector, we must study other sectors that have similar characteristics but seemingly higher levels of functionality. Examining their organizational structures and incentives may help us to better understand how the space sector can move away from the status quo—dysfunctional government agencies and struggling private entities—to a balanced mix of private and public actors supporting a diverse and growing set of capabilities for defense, science, Earth applications, and the exploration and development of the solar system.

Within this mix, we can assume that government will be a substantial actor, and that it will continue to pursue longstanding governmental interests like national defense and the projection of power. Certain other functions with a substantial (but not exclusive) state interest, like scientific research and the provision of such public goods as weather reporting, may be pursued by a mix of public and private actors. Still other functions, like commercial communications, may be provided primarily by private actors but with government encouragement, assistance, and protection. And yet other activities, such as space tourism, media production, and advertising, may be undertaken entirely by private actors with no government encouragement. It is appropriate to ask which government entities have been succeeding and which have been failing in space activities, and whether the public-private division of functions requires rethinking. Indeed, as we will see, there are some functions that are today carried out purely or primarily by government that ought to be moved to an increased or entirely private mode.

For guidance on how best to organize the space sector's public and private functions, we can turn to the two other sectors that are most comparable. Long before space travel was a reality, both maritime and aeronautical analogies were used to describe it. The very term space*ship*, of course,

immediately called forth a complex set of maritime analogies; a spaceship naturally has a space captain, and a crew, and operates from a spaceport. This is similar to what happened with aviation, which also adopted nautical metaphors (e.g., air*port*), at least in English-speaking countries. The analogies came naturally, as all three domains—sea, air, and space—can involve operations beyond national borders and lack the geographical constraints of land travel. Additionally, air and space travel used novel technologies in novel physical environments, and the two overlapped in both their technologies and their zone of operations.

Yet space activities at orbital altitudes and beyond have more in common with maritime activities than with aeronautical activities. Aviation has no unique destinations: no aircraft reaches a destination that cannot also be accessed by land or sea. The advantage of flight is in getting to its destinations more quickly and sometimes more directly. Economically, air travel exists to connect two destinations that already exist.

Space transportation, by contrast, serves to take people and devices from Earth to points in space or on other heavenly bodies. For the most part, the transportation vehicle also carries the means of conducting the economic function in place at the destination—a communication satellite, for instance. In this, space resembles specialized maritime activities such as the offshore oil industry, where the destination is an artificial structure serving an economic purpose, which was emplaced and for the most part serviced by maritime transportation. Even when permanent destinations someday come to exist elsewhere in the solar system, space travel will by definition be the only way to travel between them, as was the case for much sea transportation before the development of aviation.

Space travel beyond Earth orbit also resembles maritime transportation more than aviation in that it is conducted in "voyage mode" rather than "sortie mode." Aircraft operations are typically timed in hours rather than days or weeks. Passengers and crews are not expected to be on board for extended periods, and accommodations typically reflect that. Oceangoing ships, on the other hand, can stay at sea for weeks or even months, and so their accommodations are designed to be habitable, and their crews able to operate autonomously for extended periods. Maritime crew practices, traditions, and rules have evolved over centuries to preserve effectiveness under such conditions. This suggests that for operations in near-Earth space, in which vehicles are in sortie mode, organizational culture ought to be similar to that of aviation, whereas for extended operations in deep space, an organizational culture derived from maritime practices would be preferable.

Finally, the commercial space-launch industry resembles the maritime sector more than the air-transport sector in that a large part of its business is fully exposed to international competition. The U.S. aviation industry enjoys a very large protected domestic market—this being a continental nation that needs the speed of air travel—and is further protected by international aviation agreements. The U.S. maritime sector is not protected from international competition—in fact, it is handicapped by an unfavorable wage structure, resulting from regulations and unions. The U.S. space-launch industry is similarly disadvantaged in the international marketplace: it must compete against foreign operations that enjoy substantial structural advantages (subsidies, non-market wage structures, manipulated currency levels) even while it copes with burdensome U.S. regulations (especially export controls). As a result of this international competition, the American space-launch industry is dependent on the U.S. military as a customer—which means that government procurement policy has become a *de facto* regulatory system for the industry.

To be sure, the space sector does not perfectly parallel the maritime sector. As a mature industry, the maritime industry is more sensitive to the cost of labor. And it is less able than the space industry to innovate to reduce the cost of labor because of the inflexibility imposed by the Jones Act, the 1920 law that regulates maritime commerce in U.S. waters. If something similar were to happen to the burgeoning space-launch industry—if regulations were to freeze it at something like present levels of technology and labor-use—it would be perpetually stuck as a small industry serving primarily governmental markets.

But the past decade's emergence of a new wave of entrepreneurial launch companies—including the successful flights of the suborbital SpaceShipOne in 2004 and the orbital Falcon 9 in 2010—shows that the space-launch industry is still young and still has plenty of flexibility to innovate to drive down costs substantially. These cost reductions may be sufficient to keep non-market or quasi-market actors like Russia and China from entirely dominating the world space-launch market—which in turn opens up the prospect that the American space-launch industry will grow to become more than an appendage of the U.S. government.

This, in turn, would permit us to start restructuring the government institutions involved in America's space sector. Since the dawn of the space age, the assumption has been that the U.S. government would either have to operate space launches itself or would have to finance and closely oversee contractors that would be utterly dependent on it. But now that it is feasible to expect the emergence of a set of launch and

orbital operations by serious private actors, we can consider how best to reorganize the American-government space establishment.

Creating a Coast Guard for Space

Over the years, analysts have proposed several alternative schemes for organizing the American space sector. Most of these proposals have related specifically to the nation's military space activities. So, for instance, some proposals call for the creation of a Space Corps that would relate to the Air Force in much the same way that the Marine Corps relates to the Navy: autonomous, but under the control of the Secretary of the Navy, and relying on the Navy for various functions such as legal and medical services. Other proposals would adopt the model of the historical Army Air Corps or the later U.S. Army Air Forces, making space a quasi-autonomous service within the parent service.

There is another proposal, however, that would restructure not just military but also civilian space activities. This proposal would create a U.S. Space Guard on the model of the U.S. Coast Guard, charged with carrying out a variety of infrastructure, support, constabulary, and regulatory tasks. The Space Guard would assume some functions now performed by the Air Force, NASA, and the Federal Aviation Administration (FAA).

To understand whether such a maritime model for space makes sense, we must examine the structure of the U.S. maritime establishment and bureaucracy. Major components of the U.S. government's maritime establishment include the Navy, an internally distinct naval aviation component of the Navy, the autonomous Marine Corps within the Naval Service and under the Navy Secretary, a Coast Guard that is part of the Department of Homeland Security but can be transferred to the Department of the Navy, the Merchant Marine Academy, the ships and uniformed corps of the National Oceanic and Atmospheric Administration (NOAA), and the Voluntary Intermodal Sealift Agreement (VISA) program. Maritime regulation of civilian activities is divided between the U.S. Coast Guard and the Department of Transportation's Maritime Administration. When the U.S. government's science establishment (the National Science Foundation, etc.) requires maritime transportation, it uses commercial providers whenever possible—but when necessary, it also relies on the Coast Guard's (and secondarily, the Navy's) fleet of icebreakers and other vessels specialized for extreme environments.

The maritime sector does not, of course, give us an exact model for restructuring the space sector. But our aim is not to create a one-to-one

equivalent for every institution in the maritime sector. Rather, by trying to understand the different types of organizations with different structures, statuses, and personnel practices in the maritime sector, we can better understand what might work well (or badly) in the very similar space sector. One thing the litany of maritime institutions above makes clear is the bewildering variety of government maritime activity. Space, too, involves a very wide range of government activities, including many activities that do not have an appropriate organizational home in either the Air Force or NASA: the maintenance of routine technological and administrative competencies; the operation of routine infrastructure that is deemed to be a public good; the regulation of nongovernmental activity for public safety and compliance with international obligations; and the encouragement of private activity though supportive research, development, and education. To the extent that either the Air Force or NASA performs any of these functions for space, they are seen by those organizations as more of a burden than a rightful responsibility. They are not carried out in the most cost-effective or useful manner and are often given the lowest priority in resources, personnel, and attention.

In a thoughtful article published in the *Aerospace Power Journal* in 2000, USAF Lt. Col. Cynthia A. S. McKinley proposed the creation of a Space Guard on the Coast Guard model. Her proposal was framed primarily in terms of Air Force functions, needs, and force structures: she called for moving the space functions of the Air Force that were not primarily or directly related to warfighting into this new service. The Space Guard—which, like the Coast Guard, would be armed and under military discipline—would be viewed as having a "guardian" function (to use the terminology proposed by Jane Jacobs in her classic work *Systems of Survival*). While a warfighting service spends peacetime training for and (hopefully) deterring war because of its capabilities, a guardian service during peacetime is not waiting for anything; its daily activities are its justification, and in that respect, it is more like an ordinary civil government agency. Yet it is also expected to be able to carry out its functions under battle conditions in wartime, and its members understand that facing death is part of what the uniform means. In that respect, they are like first responders and military service members. This attitude is well represented by the informal motto of the Coast Guard's lifeboat service: "You have to go out; you don't have to come back." As we shall see, this mix of military and civil characteristics may be particularly appropriate for space missions.

Although Lt. Col. McKinley's article did include some non-Air Force functions in her Space Guard proposal, it did not explore that possibility

in depth. It would be useful, therefore, to consider whether some of the problems resulting from NASA's peculiar history, organizational culture, and mixed functions might be mitigated by transferring some of those functions into a Space Guard. Other space responsibilities of the U.S. government, particularly the remote sensing and weather functions of NOAA and the regulatory functions of the FAA, should also be considered for transferring to the Space Guard, since they are close analogues of the maritime functions of the Coast Guard in infrastructure, weather, and regulation. And beyond the formal responsibilities that would be assigned to the Space Guard, it is worth considering some of the possible informal advantages that would flow from replacing today's arrangement with a model including a Space Guard—including much improved relations between the U.S. government and the commercial space sector.

We turn next to a brief sketch of what such a Space Guard might look like. What follows is offered not as a perfected final proposal but rather as an initial attempt to start a public discussion.

1. General organization and formation. The United States Space Guard (USSG) would be an agency of the U.S. government at the subcabinet level, consisting of a uniformed, armed service along with its civilian employees and auxiliary organizations. It would be established by an act of Congress and attached to a civilian Cabinet department (probably Transportation, or possibly Commerce). It would be headed by a uniformed commandant appointed by the president, confirmed by the Senate, and reporting to the secretary of the relevant department. During times of war or specified national emergency, the Space Guard would be integrated into the command structure of the U.S. Air Force, on the model of the Coast Guard's operations with the Navy during the Second World War.

The uniformed personnel of the Space Guard would be subject to the Uniform Code of Military Justice; this would permit USSG personnel to serve in the field alongside USAF personnel with minimal adjustments, just as Coast Guard personnel and ships have historically been used interchangeably with the Navy when needed. Civilian employees of the USSG would be treated as normal civil-service employees, although consideration should be given to granting the USSG certain exemptions on hiring and firing similar to those originally granted to NASA. The ranks, grades, and pay scales of the Department of Defense can provide a point of departure, but if a different policy toward promotion, retention, and length of tour is adopted, then it might be desirable to define pay structures that permit Space Guard personnel to receive additional

compensation for mastery of skills while still in lower ranks. The benefit, retirement, and pension provisions of the USSG would be those of the other armed services.

During the creation phase, former Air Force uniformed personnel would probably constitute the uniformed part of the USSG. Former NASA and Department of Transportation personnel would remain civilian employees at first, but over time those allocations would change, particularly as new personnel enlisted or commissioned into the uniformed USSG began to be assigned to the civilian-legacy areas. Air Force personnel in units transferred to the Space Guard would be given the opportunity to elect either USAF or USSG affiliation without penalty; Air Force personnel in other units would be permitted to apply for transfers to the Space Guard, but such transfers would only be granted based on the needs of the Space Guard.

2. Responsibilities assumed from other agencies. Several components of the Air Force, NASA, and other government entities would be transferred to the USSG and combined. These components might be transferred simultaneously or gradually over time. Exactly which components of these agencies should be transferred would require substantial study, but the criteria for such assignments would be along the following lines:

(a) United States Air Force responsibilities. The USSG should assume those USAF components, facilities, personnel, and functions that are i) primarily space-related; and ii) not directly related to warfighting; nor iii) ones whose customer is solely or primarily warfighting components of the USAF. Some functions, such as space situational awareness, might remain formal responsibilities of the USAF while using substantial numbers of USSG personnel integrated into operations, in the same manner that Canadian personnel historically have been integrated into the North American Aerospace Defense Command (NORAD).

(b) National Aeronautics and Space Administration responsibilities. NASA operations that are primarily routine space operations or infrastructure-supporting operations would be transferred to the USSG. NASA would retain functions that are primarily concerned with R&D, exploration, or space science. The McKinley article anticipated transferring the space shuttle program from NASA to the USSG, but it was written before the loss of the space shuttle *Columbia* and the subsequent scheduled termination of the shuttle program. Given the short remaining life expected for the International Space Station, it may make sense to leave that program in NASA. Going forward, the rule of thumb would be that operations

(manned and unmanned) to Earth orbit would become Space Guard functions; operations beyond would be deemed "exploration" and would remain NASA functions until they are reduced to routine. Such a division would be consistent with the Obama administration's policy mandate that operations in low-Earth orbit, including crewed missions, be primarily contracted from commercial operators. The astronaut corps and its training would become a Space Guard operation, but NASA would retain a Test Astronaut Office and training facilities for testing experimental vehicles, as well as crews for deep-space exploration. Another way of thinking about this new division of responsibility is that NASA would come to focus on a small number of large projects while the USSG would focus on a wide variety of relatively small projects that tend to get shortchanged for attention and resources at NASA.

(c) Department of Transportation responsibilities. The space-regulatory functions of the Department of Transportation under the Commercial Space Launch Act of 1984 and successive acts are currently embedded in the FAA's Office of Commercial Space Transportation (referred to as FAA/AST). Those functions will now be transferred to the USSG. Unlike the current FAA/AST, the USSG would have the in-house expertise to review technology-related questions. Moving these regulatory functions to the USSG would also resolve the mismatch in the present system, in which FAA/AST, a civil regulatory body, oversees a field with many opaque military-generated aspects. If left unresolved, this anomaly in regulatory practice, one that violates the spirit if not the letter of the Posse Comitatus Act, will be a sore point as space commerce grows. In general, this space regulatory function has been searching for an organizational home since the Department of Transportation was assigned the role in the 1980s. Commercial space regulation has, until now, been too small to merit a separate subcabinet agency of its own, but it has suffered from inattention at the FAA. Today's FAA/AST arrangement is also anomalous insofar as the office is trying to administer a regulatory regime founded on one philosophy and specified in one set of statutes, while being embedded in a much larger agency founded on a quite different philosophy and set of statutes.

(d) Other agencies' responsibilities. Routine space operations that are part of other U.S. government agencies might also be moved over to the Space Guard. So, for instance, the operation of weather satellites, now a function of the Department of Commerce, could be transferred pending a review to determine the degree to which functions other than the actual launch, control, and procurement of weather satellites would be better run by

Commerce or by USSG. (Of course, if USSG is housed in the Department of Commerce rather than Transportation, then the transfer of these functions would be an internal matter.)

***3.* New responsibilities.** In addition to these transferred functions, the USSG would use its competencies to serve the following functions not specifically housed elsewhere in the United States government:

(a) Space-transportation contracting. USSG would serve as the routine transportation purchasing and contracting agent for all government space-transportation requirements other than active warfighting capabilities. This function would exclude test flights for research and development items developed by NASA, but would, for example, include launching NASA-developed scientific research payloads, as well as exploration flights for which the launch requirements are not exotic. For example, a research probe might be developed by NASA as an exploration project since the environment to which it is being launched is exotic—like a robotic mission to Pluto—but its launch from Earth and acceleration to velocity would be deemed routine tasks, since they can be accomplished with a variety of existing systems. In such a scenario, NASA might propose that its research and development centers develop a new launch vehicle for launch missions, but it would be treated only as one source of capabilities and it would have to compete against other options, with the USSG making the final decision.

(b) Space-transportation engineering. USSG would maintain an in-house space-transportation engineering competency capable of evaluating specific systems, overseeing the development of systems needed for government use where the market does not provide adequate capability, and serving as an independent external reviewer of NASA and USAF projects.

(c) Space situational awareness. The task of tracking objects in space, whether satellites or debris orbiting the planet, weapons systems launched by other countries, or manmade or natural threats to U.S. assets in space, is called space situational awareness (SSA), and it is currently the responsibility of the U.S. Air Force. But those functions perennially suffer from a shortage of skilled analysts, and Air Force personnel policies and attitudes discourage the accumulation of analytical competence in officers (as opposed to managerial skills). Going forward, the new USSG would serve as the responsible agency for non-military SSA capabilities and would act as the official U.S. governmental representative in international SSA cooperative efforts that are not primarily military in nature. The USSG's status as an armed service would render it more acceptable as an interface

with the USAF-run military side of SSA; its status as a non-DOD agency with a civil regulatory function would render it more acceptable as an international interface with civil agencies.

(d) Space debris reduction and mitigation. Given USSG's combination of engineering and infrastructure capabilities, SSA capabilities, and regulatory authority, it would provide a natural lead agency for reducing and mitigating space debris, and ultimately for protecting the Earth against other potentially hazardous space objects. This would be a clear analogue to the Coast Guard's responsibility for hazards to navigation.

(e) Space reserve capacity. The United States has the ability to surge its sealift capacity thanks to the Voluntary Intermodal Sealift Agreement (VISA) program; it has the ability to rapidly step up its aviation capacity thanks to the Civil Reserve Air Fleet. A similar program will someday be necessary to ensure the ability to quickly expand the nation's capacity for space activities; given the close ties to the U.S. space transportation and orbital operations industry being envisioned for USSG, it would naturally be suited to administer such a program.

(f) Enforcing order. It is worth pointing out that USSG officers would be, like Coast Guardsmen, officers of the U.S. government capable of operating as a constabulary. This is in contrast to NASA personnel (who are only employees, not officers, of the government) and military personnel (who are forbidden under the Posse Comitatus Act from exercising police powers over civilians). To date, there have been no instances of needing to exercise police powers in space. However, as the number and duration of missions increase, this will inevitably change: At some point, having constabulary officers with civil authority and training available will be useful. The USSG could also provide its own physical security at launch sites and other ground infrastructure.

(g) Search, rescue, and recovery operations in space. Again following the Coast Guard model, a USSG would be the logical agency to make responsible for search, rescue, and recovery operations. To date, there have been no active space-rescue missions; rescue operations have been more a matter of backup and contingency plans. But as the level of activity in space increases, permanent rescue capabilities, and staff dedicated to such functions, will probably become a necessary part of the national space establishment.

4. New supporting institutions. Modeling itself upon the U.S. Coast Guard would permit the USSG substantial flexibility in its operations that neither a regular military service nor a purely civilian agency can

enjoy. A small service along USCG lines might use some of the following organizational tools:

(a) A space service academy. The USSG would develop a sense of organizational identity and *esprit de corps* if it operated a small service academy along the lines of the U.S. Coast Guard Academy in New London, Connecticut or the U.S. Merchant Marine Academy in King's Point, New York. A U.S. Space Guard Academy could offer an aerospace engineering curriculum as its core, but also have tracks for management and administration, and possibly pre-law with a concentration in space law. For the purposes of the USSG, it might be desirable to combine the functions of the Coast Guard Academy and Merchant Marine Academy, with the expectation that some graduates, after serving out their obligation, would go into space-related businesses. It might also be worth imitating the "co-op" study program of universities like Rensselaer Polytechnic Institute, in which students spend part of their upper-class years as interns in related industries. One of the strengths of the USCG as a regulatory agency is that its graduates are familiar with the sea, with seafaring, and with the realities of the maritime world. The Coast Guard is not always loved by those it regulates, of course, but there is a sense of "mariners regulating mariners"; an academy that emphasizes industry experience could contribute to a similar sense of the USSG as "spacefarers regulating spacefarers." It might even be feasible for a space service academy to maintain some small, crewed suborbital or near-space vehicles in order to ensure that its cadets are familiar with spaceflight and spacecraft operations.

(b) Reserve and auxiliary organizations. The Army, Navy, Marine Corps, Air Force, and Coast Guard all have associated reserve forces—service members who generally perform part-time duty and who sometimes rotate to full-time (active) duty. The USAF has had some success using the Air Force Reserve for space functions; this example could serve as a model for the USSG Reserve. Such a reserve force would permit a wide range of flexible arrangements to retain organizational knowledge even after uniformed personnel leave active, full-time service. NASA in particular has suffered from the dispersal of trained personnel due to stop-and-start funding; a Reserve program could, among other things, preserve access to specific operational knowledge of systems or environments by retaining team members on reserve status and bringing them together periodically. It would also allow for the rapid expansion of capability in times of need.

The USSG could also organize an auxiliary program, with civic and educational entities analogous to the U.S. Power Squadrons (a maritime

safety organization) and the Civil Air Patrol (an aviation service organization). A space auxiliary could generate enormous enthusiasm and participation, particularly among students—undertaking such activities as amateur rocketry operations or asteroid watches with amateur astronomers participating in the tracking and cataloguing of potentially hazardous asteroids.

(c) Other civil-society organizations. The existence of a USSG would also likely produce a penumbra of organizations, not officially affiliated, that would connect it to both the political system and to the wider emerging space industrial and commercial field. Indeed, an advocacy and support organization analogous to the Navy League or the Air Force Association, dedicated to making the case for the service and its role in national life, might even be created before the USSG. Other organizations might include retirees' associations and an alumni organization for academy graduates.

Political Feasibility of a Space Guard

Creating a Space Guard on this model would involve substantial change in the structure and organization of the U.S. government. Change of this magnitude would require the expenditure of political capital, not least because the U.S. Air Force, NASA, and their political patrons could be expected to resist ceding funds, functions, and personnel to a new organization. Indeed, the McKinley paper elicited a substantial negative response from parties related to the Air Force. Therefore, in proposing such a change, we must ask not just what problems it might solve but also which political actors might benefit sufficiently to justify the expenditure of their capital.

For starters, if the Space Guard were proposed in such a way that it is neutral in terms of congressional districts, members of Congress would be far less likely to oppose it. When Wernher von Braun's rocket team at the U.S. Army's Redstone Arsenal in Huntsville, Alabama was transferred from the Army to NASA, it did not cause federal dollars to leave Huntsville—in fact, just the opposite happened. Similarly, NASA functions transferred to the USSG would remain physically present in the same location, probably as tenants in the same NASA facilities. This would likely diminish congressional opposition to the creation of a Space Guard.

There are also ways in which the budget changes associated with the creation of a Space Guard could be understood by the Department of

Defense to be a political winner. A Space Guard created in (for purposes of discussion) the Department of Transportation would move a substantial sum of funding to a civil agency, which would allow the Department of Defense to represent it as a "defense cut" while still enjoying access to the functionalities it would provide. As McKinley pointed out, space support currently represents a substantial portion of inflexible, "must-fund" resource commitments of the USAF that do not contribute directly to warfighting operations. The Navy has been comfortable with the Coast Guard from the beginning; it has been useful to the Navy to be able to draw upon Coast Guard capabilities whenever needed and to ignore the Coast Guard when they aren't. If the Air Force could be convinced that a similar relationship with the Space Guard would be equally useful, the USAF brass might switch from reflexive opposition to support.

It is worth noting that the creation of a Space Guard would also well serve the professional interests of many current Air Force and NASA personnel. Some space personnel now in the Air Force might find a separate service a better place in which to pursue their ambitions for a professional life dedicated to space. Just how many would be difficult to determine, but even a small number of intelligent, vocal, and dedicated people can make a difference in politics. Similarly, personnel working on those functions in NASA currently getting shortchanged on resources (and professional advancement opportunities) might also support the Space Guard concept. So, too, might the private space enterprises that find today's regulatory arrangements inhospitable. These constituencies have incentives to not be very publicly vocal—at least while still employed in the Air Force or NASA, or while still overseen by today's regulators—but they might nonetheless be able to help sway members of Congress.

And not all of the political winds would necessarily blow against the creation of a Space Guard. An ambitious Cabinet secretary heading a department that might become the peacetime home of the USSG could lobby aggressively on behalf of its creation. During the Reagan administration, the Secretary of Commerce and Secretary of Transportation both strongly vied for control of the nascent space regulatory function, even though it was insignificant in terms of budget and personnel. A Space Guard would have a high profile and substantial allure for such a political figure, and a much larger budget than the space regulatory role.

Broadly speaking, there are two scenarios that could describe the emergence of a Space Guard. In what we might call the "Big Bang" scenario, the service would be formed in a single action, taking several major components from other agencies and combining them in a new command

structure. (A recent example of such a reorganization was the formation in the last decade of the Department of Homeland Security, an example that surely suggests lessons both positive and negative.)

By contrast, in the "Gradual Accretion" scenario, a small entity with some space responsibilities is identified or formed within a Cabinet department. It would have as its end goal the formation of a Space Guard, but it would only gradually expand its scope toward that goal. It would seek to acquire responsibilities that are unwanted or conspicuously underserved within existing agencies, following the path of least resistance. The agency would opportunistically look for situations in which a small function was being deprived of resources at a large agency. As it acquired capabilities, it would position itself to acquire further responsibilities. It might initially seek to become a small non-military commissioned and uniformed service, along the lines of the Public Health Service or the Commissioned Officer Corps of NOAA. It would thus become the nucleus of something that could be combined with other functions and agencies when the political climate is finally right. As described above, this strategy would benefit from the support of a Cabinet secretary who would see it as a means of increasing his department's turf.

The formation of the USCG was actually a hybrid of these Big Bang and Gradual Accretion scenarios. It began with the 1915 merger of the existing Revenue Cutter Service and the Life-Saving Service into a Coast Guard. This combined the constabulary function and the maritime service function into a single organization. This new Coast Guard then continued to accrete functions, most noticeably with the acquisition of the Lighthouse Service (1939), giving it a role in navigational aids, and the Bureau of Marine Inspection and Navigation (1942), giving it a maritime regulatory role.

In the long run, political change usually results from some combination of crisis and opportunity. If a Space Guard concept is defined, studied, discussed, and circulated, preferably by a group organized to advocate the idea among those who would benefit from it and those who have the power to make it happen, the proposal could be waiting in the wings, ready to be implemented should a suitable moment arise.

Securing America's Future in Space

This proposed reorganization of the U.S. space sector offers a number of potential improvements over the status quo, while presenting a relatively gradual and evolutionary path for achieving the transition. It would

preserve NASA as an organization and maintain institutional continuity as well as knowledge in such core areas as aeronautics, space science, space technology R&D, and deep space exploration. At the same time it would transform NASA's identity and culture, freeing it from some of the dysfunctions that are rooted in its unusual history. The agency's scope of responsibilities, while still broad, would nevertheless be reduced sufficiently to alleviate its chronic span-of-control issues.

The creation of a Space Guard to carry out routine infrastructure and support functions, regulatory and constabulary functions, and much of the primary interface with the private launch industry would establish a separate and distinct organization accustomed from inception to using commercial services. To the extent that the new NASA would retain the capability to design and develop launch vehicles, the agency would no longer be subject to the conflicts of interest that now crop up when it has to decide whether to build its own launch vehicle or buy launch services from a private provider. Since those build-or-buy decisions would be in the hands of the Space Guard instead of NASA, such conflicts of interest would be averted.

The Space Guard would be modeled after some of America's most successful governmental organizations: the small, dedicated, and (sometimes) uniformed service—large enough to have its own academy, identity, and culture, yet small enough to allow reputation and face-to-face personal contact to play a large part in management. Such agencies have often been, person-for-person and dollar-for-dollar, the most effective entities in the U.S. government.

Aside from the prospect of spinning off non-core space tasks into a Space Guard, there remain questions about how best to organize the space activities that would rightly remain in the Department of Defense—those most closely related to warfighting. This is a large question, and difficult to resolve at this point because it is not clear what role space will have in warfare, what missions might emerge, and what weapons might be used in carrying out such missions. It does seem likely that any near-term missions will be near-space missions, probably carried out in sortie mode; therefore, the culture, organization, and tactics of the Air Force will likely be appropriate. The notion of military missions more distant than, say, the Moon belongs to a future too far off to practically speculate about—although we can imagine that future planners of long-distance military missions in space will benefit from the wisdom and guidance found in naval practices developed over centuries.

The Space Guard proposal outlined here aims to fix what's ailing the U.S. space sector by learning what works in other, similar sectors,

and reorienting its efforts along their lines, both in its public and private modes of operation. Moreover, it is a proposal in keeping with some of our nation's greatest traditions and successes. We are a people mindful of the limitations of government bureaucracy and confident in the resourcefulness of private enterprise. For too long, the United States has followed a path in space development that is fundamentally inconsistent with our country's values. It is time that our space sector was reconceived and restructured to reflect those values—as well as the finest examples of American practical success.