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Perspectives on Civilian Space Policy

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The National Aeronautics and Space Administration (NASA) is the United States’ civilian space agency. It has a budget of about $18 billion, and employs (directly) about 18,000 in its field centers and headquarters. Indirectly, it supports many more jobs through contracts with universities and private industry. In 2011, 81% of its funds went to procurement contracts. It receives about four-tenths of one percent of the U.S. Federal budget each year, though its public image is that of a much larger agency. Founded in 1958, it was built out of a predecessor agency, the National Advisory Committee for Aeronautics, and facilities acquired from the Army, Naval Research Laboratory, and Air Force (see Figure 1).

NASA has three primary activities. About half of its budget goes to its human space flight program and related activities—astronaut training, human-rated launch vehicle development, space station operations—and the remaining funds are split between science, aeronautics, and advanced technology development functions. Its science directorate budget is about 70% that of the National Science Foundation at $5 billion, and its aeronautics and technology areas are generally funded at about a tenth of that level.

Administratively, the agency’s functions are divided into Directorates. The Science Mission Directorate funds and manages all of the agency’s space and Earth science robotic missions. Two directorates, Exploration and Space Operations, dominate its human space flight activities. And two others, Aeronautics and Space Technology, encompass its technology development functions.

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With the exception of technology development, these functions are largely separate geographically. NASA's human spaceflight activities are carried out at its Johnson, Marshall, Stennis, and Kennedy centers in Texas, Alabama, Mississippi, and Florida, while its science missions are carried out by the Jet Propulsion Laboratory and Goddard Space Flight Center, respectively in California and Maryland. A few NASA missions have been carried out by other organizations as well, most notably by the Applied Physics Laboratory of Johns Hopkins University in Maryland. Aeronautics research continues to take place at the agency's four research centers, Langley, Glenn, Ames and Dryden, in Virginia, Ohio, and California, respectively (see Figure 2). Technology programs exist throughout the agency. And as national priorities have shifted, some redistribution of tasks has taken place. The U.S. performs far less aeronautics research and testing than it once did, and the agency's aeronautics centers have gained some space-related assignments to ensure they have a sustaining workload.

**NASA’s challenges**

A recent report of the NASA Office of the Inspector General outlined a series of management challenges facing the agency. A “Culture of Optimism” pervades its program and project management, leading to underestimates of both cost and technical complexity. As a result, large cost overruns in approved projects result in fewer and fewer new projects being funded. Funding instability exacerbates this problem. Congress rarely passes the agency’s budget on schedule (a problem affecting most federal agencies), and when Congress does not produce a budget on schedule, managers have to re-plan their programs and projects to fit within the previous years’ funding allocation (see Figure 3). That need for nearly continuous re-planning is itself a source of increased costs. Finally, the Inspector General contended that the current lack of small projects and new missions left no way to re-build a cadre of experienced managers, jeopardizing the agency’s future performance.

NASA has another set of challenges, too, related to space access. It’s widely understood that with the retirement of the agency’s beautiful, but antiquated, Space Shuttles, it no longer has a U.S. based, human-rated launch vehicle. So NASA depends on its former enemy, Russia, to ferry its astronauts to the International Space Station. The Obama administration intended to contract astronaut launches into low Earth orbit to private industry, via a program called Commercial Crew Development. Congress prevented it from relying entirely on private industry, though, requiring it to develop a government-owned and operated heavy-lift launch vehicle known as the “Space Launch System” that is supposed to be completed late in the 2010s. It’s
important to note that NASA has failed repeatedly to successfully develop a crewed launch vehicle since the Reagan administration first announced a Shuttle successor in 1986, the National Aerospace Plane. Thus, both the commercialization effort and the SLS development represent substantial challenges.

Less well understood among the general public is that NASA’s science directorate also faces a space access challenge. The most commonly used launch vehicle by NASA’s science missions was the Delta 2, a medium-class rocket. But NASA became the only customer during the 2000s, and the manufacturer chose to discontinue it. The Taurus XL was expected to replace it, but has demonstrated poor reliability and was decertified by NASA, leaving the agency (temporarily, one hopes) with no way to get some of its payloads into orbit. This outcome is itself the result of the Reagan administration’s decision to commercialize procurement of launch vehicles for scientific missions rather than relying on the Space Shuttle.

Finally, a more prosaic challenge faces the agency: aging facilities. Over 80% of its facilities are more than 40 years old and beyond their design life. It also has about $2.5 billion in deferred maintenance for those facilities. Many facilities are no longer used, and many more do not attract sufficient use to justify retaining them. This problem of insufficient usage is particularly acute for its aeronautics facilities. The U.S. once designed and built many more aircraft than it does now, and NASA bears that legacy in disused test facilities. It has slowly been closing and tearing down old wind tunnels and other kinds of excess infrastructure (but this costs money). It has also occasionally sought authority from Congress to close some of its Centers (Glenn and Ames Research Centers, JPL, and Marshall Space Flight Center have all been viewed as potential closure targets in past decades), but to date only one, the Electronic Research Center in Boston, has been closed, and that during the Nixon administration.

**Arguments over roles and missions**

NASA is also often said to be in need of a new “Mission.” Advocates of this view insist that NASA was most successful when focused on a single goal, with the Apollo lunar landing program as the totemic example. They mourn that NASA no longer has such an overarching Mission. Instead, its different directorates pursue their own agendas largely

![Figure 3: Number of days before or after the beginning of the fiscal year that the NASA budget was approved, with zero representing the start of the fiscal year. Points above the zero line represent a late budget, while days below it represent a budget passed early—which is the desirable situation, from NASA’s perspective.](http://reilly.nd.edu_rcr)
independently. Its Science Mission Directorate carries out astrophysics, planetary, and Earth science missions with little regard for the needs of its human exploration program. These critics generally seem to believe NASA’s mission should be human expansion through the “endless frontier” of space, and that scientific research that does not contribute directly to that mission should not be done by NASA. Because, in their view, NASA lacks focus, it is adrift and should be set on a new course.

The flip side of this argument is one largely made by scientists, that the human exploration program is not scientifically productive and should not receive the lions’ share of the agency’s funds. This argument is heard most loudly when the human program’s funding needs result in the termination of planned science missions, as has happened twice in the last ten years to plans to conduct a sample return mission to and from Mars. But the critique goes back to NASA’s founding. The Eisenhower administration had intended NASA’s focus to be on science, not on human space flight, due to President Eisenhower’s own acceptance of his science advisor’s arguments and a personal reticence towards large, centrally planned technological projects. The Kennedy administration’s refocusing of NASA on human spaceflight via its commitment to land astronauts on the Moon led to what is now a half-century-long conflict between advocates of science and advocates of human expansion into the solar system.

A third argument, rarely heard in public but very important, regards NASA’s role as a scientific agency. Agency officials have generally seen NASA’s role as pioneering new measurements, in order to foster new knowledge. They don’t believe that it is NASA’s job to sustain measurements, considering long-term data collection to be “operational” in nature and the proper purview of other agencies—the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey in particular. NOAA, for example, is responsible for weather forecasting in the U.S., and operates the civilian weather satellites. But NASA has been forced to sustain several long-term measurements (ocean surface altimetry, ocean winds, land surface, stratospheric ozone chemistry) due to the inability of those agencies to acquire sufficient funds from Congress to take those measurements over. Repeated efforts to commercialize the Landsat land imaging satellite system have also not been successful. Thus if one views the NASA budget as a fixed quantity, then the agency’s inability to hand off these older measurements reduces its ability to undertake new ones. For this reason, a number of measurements currently being made by the NASA Earth Observing System are unlikely to be continued so that new measurements can be developed.

Policy issues

The following section is intended to present the big policy questions that face the civilian space community. It will not answer them. Rather, it’s intended to provoke thought and discussion with examples. And it will make clear that policy decisions are not separable from political considerations.

What is NASA’s purpose? The agency’s original purpose, space science, is well established, and its second major function, winning the space race, was long ago achieved. Should the agency continue in its current, or some modified, form?

What should its focus be? If the answer is “space science,” should it still retain the human space flight and aeronautics functions? Alternatively, if NASA’s purpose is to be an “extension of the human presence in the solar system” (quoted from the 2013 President’s budget), should it retain its scientific and aeronautics functions or be refocused by transferring them to other agencies? In fact, the Space Foundation has recently called for redefining NASA’s purpose as “pioneering,” and divesting it of its aeronautical and earth science functions. In thinking about this, recall that NASA carried out its historic Apollo mission while also supporting aeronautics research and planetary exploration—it never was a single-mission agency in the past.

If NASA is to retain its human spaceflight function, does it need a new destination? The current administration is planning to send astronauts to a near-Earth asteroid sometime in the 2020s, but other destinations have strong advocates:

- construction of a cis-lunar space station
- a scientific Moon base
- an industrial Moon base (to produce fuel)
- Mars orbit
- Mars landing and / or colonization.
A counter-argument to focusing on a single destination is that it may lead to another “point design,” a rocket that is only really useful for reaching that one place—and will be discarded like the Saturn 5 was after we reached the Moon. Instead, in these advocates’ minds, the agency’s goal should be the development of a launch architecture that can support many possible destinations.

Should it continue to develop and operate its own launch vehicles, or rely entirely on the private sector? The decision to entirely commercialize space access has strong political implications. Because the NASA centers in Alabama, Mississippi, and Texas primarily develop and operate NASA’s astronaut launchers, they would lose their functions and thus many, though not all, of the jobs they currently provide for their communities. That lost business is why their Congressional delegations wrote the requirement to develop the Space Launch System into the 2010 budget. (One can imagine, of course, the same thing being done by California and Maryland should a future administration try to force NASA to exit space science, too). Thus this policy decision is also a political decision.

Should NASA continue to support Earth sciences? If so, how should the challenge of handing off operational responsibilities to other agencies be resolved? While the Space Foundation advocates removing Earth sciences from NASA, one event in 2012 suggests that NASA might wind up with greater responsibilities in the Earth sciences. The Senate committee responsible for NOAA and NASA budgets recently tried to remove NOAA’s authority to procure weather satellites and assign it to NASA (along with the funds), due to NOAA’s inability to control costs in the next generation polar orbiting weather satellite program. This transfer did not happen, ultimately, because the NASA budget was never approved (NASA has operated on a series of what are called “continuing resolutions,” not formal budgets, since 2009.) But this is one possible resolution to the challenge. What are others?

What about aeronautics? One could envision transferring NASA’s remaining aeronautics functions to the U.S. Air Force, which already operates an equivalent aeronautics research and development establishment (its Arnold Engineering Development Center in Tennessee is a near-clone of NASA’s Langley Research Center, and the two have a history of collaboration.) Or it could go to the Federal Aviation Administration, which is not currently a major supporter of aeronautics research. An argument for retaining aeronautics in NASA, though, is that space vehicles returning to Earth, or landing on other planets, have to pass through atmospheres and so NASA should retain aerodynamics knowledge within itself. But it’s clear that NASA no longer has sufficient funds to maintain the aeronautical research infrastructure that it has. So what should be done about it?

Finally, if NASA is to remain as it is currently structured, with its current roles and missions, how should the management issues summarized above be addressed? One possibility that has been suggested is multi-year budgeting. Politically, this would be very challenging due to the way the Congressional budget process is structured. Proposals to put NASA on a two-year budget have, to date, gotten nowhere.

Any major policy initiative is likely to experience political repercussions, as the above suggests. These could be positive or negative, depending on the specific details. So answers to the above questions should be seen through the lenses of both public policy and politics.

**Highlights**

- NASA has four primary activities: (1) the human space flight program and related activities, (2) science, (3) aeronautics, and (4) advanced technology development functions.

- NASA faces funding challenges created by internal management failures as well as those imposed by political factors. Space access and aging facilities are also challenges.

- Several competing goals and a limited budget have led to conflict over NASA’s roles and missions.

- There are several big policy questions that come into discussions about NASA’s future and each resolution should be seen through the lenses of both public policy and politics.
About the author


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