

Why Running NASA is Hard

Remarks by

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Thank you, Dean Gupta for that nice introduction. You were so kind that I'm not sure I recognize myself, but thank you all the same.

I am pleased to be invited back to Johns Hopkins, and to the Carey School of Business, to speak with you today on the theme of "improving government processes". Of course, I am shocked to find that you believe, somehow, that we're not already functioning optimally within the U.S. Government – that there is some need to consider process improvement. But once I get over that shock, I might be able to offer a few thoughts.

I'll begin by stating that I offer no claim of expertise concerning the United States government generally. I *can* talk about some of the things that make running NASA difficult, and that may provide some insights applicable across the broader range of government, or possibly even within your home institutions, government or otherwise.

In some ways NASA is like other government organizations, and in other ways it is different. Let me begin by highlighting some of the ways in which we are different, and note how those differences add to our challenges in ways that other federal entities might not experience.

The first of those, of course, is our visibility. NASA lives in a fish bowl, and NASA's senior managers live in a fish bowl, to a degree that is qualitatively different than for many much larger entities.

For example, NASA currently receives about \$17.5 billion in annual appropriations, or about half of 1% of the federal budget. That can change, of course, but in inflation-adjusted dollars, it has been remarkably constant for a couple of decades.

An interesting poll was conducted a couple of years ago by "Wired" magazine. I don't know what their polling technique was, so I can't say how statistically valid it was, but they published the interesting result that the average American thinks that NASA receives just under 25% of the

federal budget. If that were true, then NASA would be comparable in size to DoD. NASA's visibility is such that people impute to it a level of funding that we just don't have.

To see this in another way, I would ask how many of you know the name of the Secretary of the Air force, or the Army, or the Navy? The Secretary of the Air Force controls more money than does NASA, and so do the other service secretaries. They receive very little public attention. I wish that I could say the same!

Because of what we do, our level of visibility is far out of proportion to our actual size within the government. It's not one of the things that makes life easier, but it's easy to understand why it is so. If we have a good day, we might appear in the press with the first pictures of one of Saturn's moons, or the first landing at the north pole of Mars, or in an article about robotic rovers running around on mars, or with high-definition video of human beings in space suits engaged in the largest construction project ever undertaken, the International Space Station. If we have a good day, you get to see those things.

If we have a bad day, the best it gets is that a billion dollars worth of taxpayer-funded hardware is destroyed. If we have a really bad day, we lose people. That has happened three times in the agency's history. Each time it was a national tragedy, with repercussions lasting for a generation and beyond.

So, it's easy to understand why we have the visibility that we do. For us it is just a fact of life, but it is something different from that with which most other government agencies have to deal.

There are other things that make running NASA difficult.

More so than with most other agencies, we have difficulty maintaining stable goals. What is it that we are trying to do with the limited funding that is allocated to the space agency? Is it to expand the range of human action and capability? Is it to do more science of the kind that NASA does? Is it to develop new technology? Is it to provide full employment at key NASA centers, or in certain regions of the country? Or is it just, don't make waves? Don't do things, like retiring the space shuttle fleet, that cost jobs in Florida or otherwise upset the stable pattern of the industry? Or maybe just, don't fail? Do whatever it is that you do, but don't fail, because it's so messy.

Now, while I'm obviously being a bit cynical with my comments, every one of the things I mentioned above is important to powerful people, often many of them, who can affect what it is that NASA does. These various goals aren't all compatible, and there isn't any single authority to prioritize them, not even the president. Certainly, the administrator of NASA isn't allowed to do it. Yet, our many and various stakeholders in Congress, the Executive Branch, our scientific and industrial establishments, and the public at large all expect their goal to be the one on the top of the pile. That's an expectation that is impossible to realize, but I assure you that it exists within each of our key stakeholders.

What emerges is in some sense the "best" mixture of goals, but it varies with the identity of those who are in charge in the political arena at any given time. This is an area where, again, I'm not

sure that we have a lot in common with other federal entities. NASA is very visible, and so our goals are very visible. I have said in the past that we need a civil space program where we don't debate, every four years, what the purpose of the agency is.

After all, we do not debate every four years whether we're going to have a Navy, and what its purpose is. We don't debate every four years whether we're going to have an Air Force, and what its purpose is. The FAA knows what it does every year, irrespective of Congressional and presidential electoral cycles. So does the Social Security Administration. And so on, across most of the U.S. government.

At NASA, that's not the case.

Until and unless we can achieve a stable purpose for our agency, in our little piece of the federal government, it will continue to be difficult to manage that piece, because if the goal posts move on time scales that are short compared to the pace of our activities, then success is a very elusive target.

I refer to all of this – with tongue firmly in cheek – as democracy in action. It is a by-product of our form of government. I think most of us have heard Winston Churchill's famous assertion that democracy is the worst known form of government, except for all the others we've tried.

But in technical areas, there exists an inherent tension between the highly undemocratic autocracy of expertise, and the fact that technical problems in whatever field do not yield to majority opinion, and do not yield results on schedules that are compatible with electoral cycles.

I find it useful in running a federal agency to remember, and to remind people from time to time, that we live in a representative democracy rather than a direct democracy. The people in our system of government do not decide issues. The people decide who will decide. Through several levels of delegation, it has been determined that on matters regarding the implementation of civil space policy, NASA officials will make the decisions.

This is a forum about leadership in government. So, this is a good place to say that, in my opinion, the best compromise between the autocracy of expertise and the need to be open and transparent in the spending of federal tax dollars occurs when the leaders and managers are of demonstrated character and expertise. I think that is the best hope that the lay public can have that their tax dollars will be well and wisely spent.

In any agency where special expertise is required, the lay public, or even highly educated professionals from other fields, cannot realistically expect to understand in any depth the factors that go into making a particular decision. For example, the lay public will not understand why the FAA must revamp the nation's air traffic control system, and what role NASA has in that work. In another example, whether one approved or did not approve of the Mideast war, the general public cannot hope to understand the battle plan by which the operation was carried out. The expertise required to conduct an educated critique of such a plan does not exist outside of professional military circles.

Specific examples can be provided at length, but I think the point is clear. In areas where they themselves cannot make reasoned judgments, what the public can and should expect is principled decision making by people of demonstrated character and expertise. If that isn't found at the top of a federal agency, then there is cause for concern.

Next, management in government is difficult because in most of the federal government and certainly at NASA, there is not enough money to do everything that is expected. When major priorities cannot be set and enforced over the long term, the result is that to at least some people, everything seems equally important. If you can't set priorities, then everything actually *is* equally important. But there is never enough money to do everything.

In a private company that's a much easier problem to solve. You have to manage to a black bottom line, or you won't be around long. But just as in government, there is always more that needs doing than you have the resources to do, so you have to manage in a responsible fashion, setting priorities and cutting work where necessary to fit the budget. As a leader, you are judged by how well you decide what really needs to be done, and what can be deferred, because there will always be work in each of those categories. In private industry, the boss' priorities are the company's priorities.

At NASA, but also broadly across the government, those of us who run federal agencies cannot function in that manner. Things are rarely so clear.

We receive authorization legislation in which the Congress tells us what to do, and we have presidential policy which also tells us what to do. It is nice when they agree, but that is not guaranteed. Administration policy is debated in Congress and either approved, disapproved, or modified. But either way, one emerges with authorization legislation specifying what the various federal agencies are to do.

Separately, money is appropriated to execute those activities – or maybe not. The activities that Congress desires that we perform don't necessarily fit within the amount of money appropriated to do them. It is nice when the authorizers and appropriators agree, but again it is not required. The pancakes and the syrup don't necessarily come out even.

When they don't come out even, the rational management approach is to eliminate those priorities which rank at the bottom of the totem pole. In government, that's not allowed.

What we end up doing is called “salami slicing” or “peanut butter spreading”. These are denigrating terms, and with good reason, because what one does is to cut all programs in some more or less equitable fashion, with equity depending on how key Congressional stakeholders view it. One person's equity is another person's unfair cut.

But by whatever means, we spread the money around so that everything keeps going, albeit at a lower level of efficiency than that to which the taxpayers really should be entitled.

I think all of us here know that real-world programs have a natural life cycle that should be followed, depending on the nature and the complexity of the work. In government, we rarely can

execute any given program on the natural life cycle that ought to be followed. That's just a fact of life.

This is, of course, compounded by the allocation of funding on an annual, rather than a mission basis. In industry, a wise board of directors will not approve a new project until the funding plan is in place, or at least established with high confidence. The program manager knows he has that allocation to draw upon. It's not that way in government. In any given year, money that was expected can simply fail to be appropriated, leaving program managers to cope with the damage by reducing functionality, stretching schedules, or both.

Another crucial factor affecting efficiency in government is that “geography” often matters more than “mission”. The importance of a given thing at NASA, and across government, is often dependent upon whether or not it resides wholly or in part in the district or state of a powerful member of Congress.

As taxpayers, I think we would say that whatever scheme might be devised to allocate priorities, allocating them according to ZIP code is probably not the filter we would like to use. And yet, that is a filter that plays a major role in deciding government priorities. It makes management very difficult.

Then, of course, there is all of the external “help” we receive. Especially at NASA, because we are so visible and so many people care about what we do, we are not lacking in help from those who think that all NASA really needs is people with better ideas. It is amazing to me how many people out there in the world, and especially in the blogosphere, turn out to be space architects with untapped expertise crying out to be utilized by the nation's policymakers. A good portion of any senior manager's time at NASA is spent explaining why a superficially bright idea being advocated to Congressional or Executive Branch staff, really isn't.

I mentioned earlier that the time constant of what we do in technical arenas, and certainly in aerospace development, is rarely compatible with electoral cycles. That's a fact, and it has specific implications.

The benefits of successful aerospace and defense programs, things that make us look good as a nation, are not enjoyed by those who invest the political capital to start them, unless they continue to get elected. But, when things go wrong, the losses accrue to those who are in place at the time, and who often aren't responsible for earlier poor decisions.

So, if it turns out that an Air Force tanker procurement of a certain type creates a great deal of dissension, or if it turns out that a large NASA mission slips its schedule, or fails entirely, that happens during the tenure of someone who really probably didn't have much to do with causing the problem. This weakens the link between accountability and responsibility for decision making that one would like to have in the system, and sometimes obviates it entirely.

I mentioned earlier that in a political system such as we have, the necessary constancy of purpose that is needed across electoral cycles is very hard to sustain, harder than one might imagine. For example, most people looking back on Apollo would say that it was one of humankind's greatest

accomplishments, and certainly a pinnacle of achievement by the United States. Apollo certainly represented a sustained commitment, right? Well, not really.

Not many people remember that the budget for Apollo began declining in 1966, because of pressures from the Vietnam War and the desire to have both "guns and butter", in Lyndon Johnson's words. It didn't work out well. I can't imagine that it would ever work out, and Apollo funding began declining only five years after President Kennedy asked for, and received, a major national commitment to do it.

Thus, the last three Apollo missions, for which the hardware had already been bought, were cancelled by President Nixon in the late '60s, largely for funding reasons. So, even during a period which we regard as a healthy time for the space program, in the middle of one of the nation's and the world's greatest efforts, even during that time, to sustain a fixed purpose for more than five years proved undoable.

As a consequence, 80% of the money that was spent on Apollo was used to develop a capability that the world had never seen before. Only 20% of the money was spent using that new capability, after which it was thrown away, dismantled and discarded. I can't think of another major development for which such a thing was true, or another major enterprise that we have treated like we have treated our nation's space enterprise.

To put the Apollo decision in perspective, let's look to another arena for comparison. This nation has spent uncounted billions developing aircraft carrier technology to the point where something that looks damned near impossible when you watch it, is almost routine. But we didn't develop aircraft carriers and then throw them away after we figured out how to do it.

We are even having difficulty maintaining our sense of purpose in the years immediately following the loss of Space Shuttle *Columbia* in 2003.

The Executive Branch and Congress, upon receiving Admiral Gehman's report on the loss of *Columbia*, accepted the need to retire the space shuttle and made the commitment to build a new system. But if you read yesterday's *Wall Street Journal*, you will note that today, not six years later, people are questioning whether NASA is building the "right" new system, and even whether we should do it at all. Those questions were supposedly settled several years ago. But it often seems as if there's no such thing as a settled question in government.

Efficient management requires discretionary authority on the part of the manager, no matter whether the enterprise being managed is private or public. Such authority is not usually granted to government managers. Now, there are exceptions, and they stand out in our history. They are the things that people make movies and write books about. The Manhattan Project, under the direction of General Leslie Groves and Dr. Robert Oppenheimer. The ICBM program, under General Bernard Schriever, whom I am fortunate to claim as a mentor. The nuclear submarine, directed by Adm. Hyman Rickover, and the ballistic missile carrying submarine, under Admiral Red Raborn. I've already mentioned Apollo, carried out under leaders like Jim Webb, Bob Gilruth, Wernher von Braun, and George Mueller. As another example, this nation took the F-117 stealth fighter program from a sketch on a piece of paper to delivery of an operational wing

in six years, an extraordinarily impressive accomplishment, one that President Carter unveiled in a State of the Union address.

When we really care enough to lift the constraints on discretionary authority accorded to government managers, government can be every bit as efficient as private industry. But as a nation and as a culture, we usually do not feel threatened enough to provide such discretion to those whom we believe can solve the problem. Usually, we do not provide commanding generals with succinct, unambiguous direction like the actual orders provided to Dwight Eisenhower for the Normandy invasion: “cross the Channel, enter the heartland of Germany, and free the continent of Europe”. We don't do it that way often enough. Absent a crisis, “business as usual” prevails, with the churn that we are accustomed to seeing in government processes – exactly the topic that this seminar series is devoted to discussing!

Another major impediment to efficient management in government is personnel management. In government, we can hire the best people in the world, because they are driven by a sense of mission. We have a Nobel Prize winner working at NASA for a civil service salary. President-elect Obama just announced another Nobel Prize winner as his nominee for Secretary of Energy. What a great choice. In government, for the right missions, we can get the best in the world. But we can't fire even the very worst. And yes, that's a bit of an exaggeration. If I spend two years on it and work hard, I can fire the very worst. But even then, it often it generates a lawsuit.

In addition, we have the problems that accrue with a volunteer labor force. Anyone you would want to have at NASA, or in any other federal agency, can make more money doing a similar job almost anywhere else. Just by working there, almost everyone at NASA is contributing money to the government, and to that extent, they are volunteering at least part of their time.

In any volunteer organization, people are there to do what they want to do. They're not there because it's the only job they can get. They're there because they have a sense of mission, their mission. It's not necessarily quite the same as someone else's mission. Under such circumstances, it can be very difficult to get everybody pulling on the oar in the same direction. Most people are capable of setting aside minor differences and working toward the common good, but there are always a few who will pursue a private agenda.

Even very low-level folks in the hierarchy of a government organization may have close, direct access to local Congressional or Senatorial delegations. They may be personal friends. After all, even politicians have friends... So, people anywhere in the organizational hierarchy may be free to promote a private agenda directly to Legislative or Executive Branch officials that is in conflict not only with agency policy, but quite possibly with legislative direction for the agency at large. If a given person has the right access, established policies can be undermined or even reversed without substantive public debate.

Sometimes, in the larger scheme of things, that turns out to be good.

I happen to believe that it was a good thing for the nation when, at the behest of the astrophysics community, Senator Mikulski authored the legislation that directed NASA to do yet another Hubble repair mission, if technically possible. But, in fact, her efforts ran against Administration

policy at that time. Privileged access to key lawmakers by independent parties is not necessarily a bad thing. It can be good selectively, but it certainly makes management difficult.

Let's now talk about procurement in the federal government. I often find it necessary to remind people that the federal procurement system is designed to be fair, it is designed to be open, it is designed to be impartial. I believe that it largely achieves these goals. There are exceptions, but they *are* exceptions.

However, the federal procurement system is *not* designed to provide the best value for the taxpayer. In fact, it is explicitly designed to block the knowledge and discretion of senior managers in selecting sources, rather than to take advantage of such knowledge and discretion.

This is completely opposite to the situation in private industry. "Fairness" is not a concept in business. Procurements are conducted so as to provide maximum benefit to the company's bottom line. If, for example, one is conducting a competition for a new chip design and elects to restrict the competition to, say, Motorola and Intel, there is no concern about whether one is being "fair" to other potential competitors. The project manager must justify his procurement decision to his CEO, or possibly his Board of Directors, but not to a local Congressman.

That is not the case in government, unless again we are operating in a crisis mode.

Finally, in government we must conduct our affairs within a framework of extensive external review, much of which in my opinion is focused on inappropriate topics. Let me name just a few of the entities which can claim a right of review over NASA's decisions, and can make it stick. These would include the GAO, the Inspector General, the National Research Council, the National Academies of Science and Engineering and Medicine, Capitol Hill, the Office of Management and Budget, the Office of Science and Technology Policy, and many more. None of those organizations necessarily have the same goals in mind. Consensus is just not possible. There are too many voices, too many agendas.

Now, what I teach, and what I try to practice, is that management at any level consists of specifying to those below you *what* it is that you want done, and reviewing how well it has been done. You should not tell those whom you manage *how* to do something. If you have to tell them "how", you need different people.

In government, "what to do" is policy, formulated by presidents and cabinet officers and other advisors, and finally decided by the legislature. That's how our democracy works. "How to do it" is the province of a vast network of federal agencies.

So, when a review of the activities of an agency is conducted, it ought logically to concentrate on *how well* we're implementing *what* we were told to implement. But in reality, most of the people in the various groups I have mentioned above do not do that, do not care to do it, and are in fact not appropriately qualified to do it. Assessing how well we're doing isn't their intention. What they actually want is a role in determining what it is that is to be done. They want a role in setting policy. Their desire is to set, create, or alter policy from the position that they hold. This

may be as a member of the Congressional staff, Executive Branch staff, or in some other entity like the Government Accounting Office or the OMB.

There are hundreds of positions throughout the federal government, in Washington alone, that allow this sort of continual influence by unelected and usually non-appointed staff, concerning what is to be done with federal tax dollars. An agency head or other senior official cannot fight every battle. There are too many of them and not enough of you, and again, few of these external reviewers have a common goal. To meet the desires of one group would be to thwart those of another. Thus, NASA and other federal agencies are often in the middle between Executive Branch staff, Congressional staff, the National Academy, and innumerable other entities.

Even presidents and senators and congressmen who know and agree on what they want done cannot control all of the actions taken by their staff in their name. It was Eisenhower who famously noted that when he was in the army and gave an order, action was taken, whereas in the White House, he would give an order and nothing would happen. He was not the first president to discover that and will not be the last.

But as an agency head, that fact certainly makes life difficult.

I'd like to conclude by noting a special concern that we at NASA have today. We lost the Space Shuttle *Columbia* in 2003, a loss representing billions of dollars in both direct and consequential damages, and of seven brave people in the most highly public way possible. Since then, and directly attributable to that fact, one can see throughout the media today that NASA simply is not yet fully trusted to make the kinds of decisions that agencies need to make to carry out their business.

We are at present subject to more than the normal amount of review of the type I have mentioned above. I am not saying that I don't understand it. I do understand it. But it makes life at NASA much more difficult than previously, yet without yielding any compensating benefit. As a practical matter, the technical choices of NASA or of any federal agency can't effectively be subjected to continual public referenda, vetting by industrial contractors having their own self-interest, or approval by the various non-accountable staff that I've mentioned.

In practice, one simply cannot run anything this way. Progress grinds to a halt. So, on behalf of our agency – and I would submit for any agency when it gets in trouble – I would offer that from time to time we need to remind ourselves that a federal agency has to enjoy the confidence of the president and the Congress and the public at large if it is to do its job. Today this issue is applicable to NASA, but how many jokes have you seen about FEMA after Hurricane Katrina? FEMA is not the incompetent entity that the media would have you believe, but there will be FEMA jokes for a long time.

We can't guarantee success, but we can find ways to guarantee failure, and one of them is to operate in a way that subjects the agency's decisions to continual churn, until everyone agrees that the right things are being done. Everyone will not agree. And in general, the qualifying expertise to hold a valid opinion doesn't exist among those who are causing the churn.

So, that's a problem for NASA today. It occurred after the Apollo fire in 1967, again after the loss of *Challenger* in 1986, and we are still in the middle of it in 2008 after the loss of *Columbia*. We'll work our way out of it.

These are some of the problems that I see in running a federal agency in an efficient manner. I hope I've been able to give you some food for thought.

Thank you.