Memo #3: Managing Large-Scale Presidential Science and Technology Initiatives (Harry Lambright)

Abstract: *Presidents periodically commit the nation to large-scale science and technology projects that may take years to complete. To survive different political administrations, successful "Big Science" projects have to be organized and managed differently than other large-scale Presidential initiatives. They require long-term consensus by key stakeholders, stable funding, and a strong leadership cadre within an agency setting. We recommend that the President heed these and other critical factors when launching a Big Science initiative.*

If the next President decides to take a major policy initiative in science and technology, he will be in good company. Since World War II, most Presidents have used science and technology ("Big Science") programs to achieve major purposes. They establish large-scale ventures—national projects—often costing billions. Most projects take longer to go from concept to conclusion than the tenure of the Presidents who started them. Indeed, there are projects that last so long that succeeding Presidents can put their stamp on an activity a predecessor began.

Consider what various Presidents have done since World War II. President Roosevelt authorized the Manhattan Project; President Truman, the H-Bomb; President Eisenhower, long-range missile development; President Kennedy, Apollo; President Nixon, energy independence; President Carter, energy independence; President Reagan, "Star Wars" (the space based missile defense project); President Reagan, the Space Station; President George H.W. Bush, back to the Moon and on to Mars; President Clinton, the International Space Station; President George W. Bush, Moon-Mars (called "Constellation") and President Obama, space commercialization. Most national projects start off as agency proposals and are subsequently elevated to Presidential status, the most notable example being the Genome Project, which Clinton made his own.

Why do Presidents adopt Big Science initiatives? Why do some projects succeed, while others fail? What lessons does history have for a possible future venture by the man sworn into office in January, 2013?

The answer to the first question is that Presidents use science and technology to solve or mitigate problems. The problems are typically war, cold war, energy security, health, or economic development. Moreover, they also find science and technology programs valuable in making a statement about national prestige. They see Big Science as engaging extremely talented people and the general public in great ventures that equate with "progress." They use science and technology to demonstrate leadership—for the nation and themselves.

Critical Success Factors to Consider

But, as the list above makes clear, not all initiatives succeed. What are critical factors in success and failure in Big Science? Following are factors that we recommend the President and his team seriously consider if he decides to commit his Administration to a "Big Science" initiative:

Realistic goals. The goals must be technically realistic. Reagan's call for an impenetrable defensive shield based in space was undoable. So was a now-forgotten initiative of Nixon to wage a "war on cancer." At the same time, goals should be bold—as Apollo and Genome Project were. That way they can capture the attention of the public and politicians and the funds to succeed. How the goals are framed is

important. They have to be a good match with the problem to be addressed. The Moon landing within the decade, (a deadline) converted the Cold War competition with the USSR into a race that the US had a chance to win. The goal was clear, and clarity is important in focusing the nation.

Strong agency capacity. Big goals require strong agencies to carry them out. NASA in 1961 could not implement Apollo, but NASA in 1969 did so. Early in the 1960s, NASA was remade into a powerful organization. Where Big Science ventures succeed, there is a strong government agency in charge. Agencies can be built up, created anew, or reorganized to enhance capacity. They need outstanding personnel with "the right stuff." The Genome Project required transfer from DOE to NIH leadership and NIH needed to create a new institute to manage this project.

President Nixon, in seeking energy independence, did not establish an organization capable of promoting it effectively. President Carter, in pursing the same goal, created the Department of Energy—but it proved inadequate for the task.

Effective organizational systems. Science and Technology initiatives may be led by individual government agencies, but the work is performed by industry, universities, and federal laboratories. Historically, these organizational systems have been dominated by domestic teams (e.g. Apollo had 400,000 people at its peak). But, increasingly, agencies in the US require international partners in addition to domestic contractors and grantees. The Genome Project could not have been carried out at the pace undertaken without the partnership of NIH with a counterpart in England. Similarly, the International Space Station is an international project involving many nations. The US (NASA) is the "managing partner," but is reliant on Russia for transportation to the facility. Without Russia, it is arguable whether the Space Station could have succeeded given US problems with the Shuttle (another Big Science project of note).

The US may not always be the dominant partner in a large-scale project. The Large Hadron Collider is a European project, with the US as a junior partner. Typically, Presidents do not want initiatives where the US is a minor player.

Another emerging model of an organizational system is seen under Obama and his commercial space effort. Here, the US (NASA) seeks to create a new industry to take the place of the retired shuttle (and Russia) in transporting cargo and humans to the space station. Doing this requires public money, but also private money, with the balance in payments shifting from public to private over time. The goal of commercializing space is to free NASA to concentrate on deep space projects, ultimately Mars. Obama has made Mars the long-term goal, as had the two Bushes,. The difference is that Obama has called for an asteroid in 2025 as a stepping stone rather than the Moon.

Bi-partisan political support. Large scale science and technology projects require political support over the long haul. It is not enough to have goals that are technically ripe. They must be politically ready also in terms of congressional, interest group, and public support. And that support must be maintained through implementation. They first Bush came out with a Moon-Mars initiative that never reverberated with the democratic-run Congress. The second Bush also had a Moon-Mars initiative and he failed to give it political support in regard to promised resources. It is not clear how committed Obama was to his asteroid-Mars goals. Without big money, Big Science does not get done.

The real test lies with political will over the years. Apollo succeeded because Kennedy was followed by Johnson. When Nixon became President in 1969, Apollo was at the point of the lunar mission, and he let

it happen. But he ended the Moon program in 1972. It would appear essential for these projects to get off to a fast start and show results within ten years or sooner, even if they last longer. Apollo built up to the Moon through interim steps—Mercury and Gemini. There were genetic maps of simpler organisms leading to the human genome. Success breeds political support. Failure is an excuse for cancellation.

Obviously, Nixon, Carter, and DOE could not produce enough success in energy independence for this initiative to survive. Whatever support DOE had under Carter for energy independence vanished under Reagan. Reagan's Star Wars project faced the same fate as he gave way to the first Bush. Missile defense continued, but not the grandiose project of Reagan.

Competition. Interestingly, competition helps in creating and maintaining political support, and generating a sense of urgency. This was true in the space race with Apollo, between the U.S. and the Soviet Union, and in the human genome race between the public and private projects. In seeking to commercialize space transportation to the International Space Station, NASA has used competition among firms. However, competition is not always necessary. There are Big Science projects that have succeeded where competition was replaced with cooperation. For example, Clinton helped keep the Space Station going by adapting the goal from competition with the Soviet Union (Reagan's rationale) to cooperation with Russia after the Cold War ended. It became a symbol of post-Cold War cooperation (and a covert way to aide the new and shaky Russian regime).

Experienced Executive Leadership. Absent James Webb, it is unlikely NASA could have gotten to the Moon in 1969. The ideal executive for a large-scale science and technology project is one is both an astute manager (inside role) and a savvy politician (outside role). Lacking such qualities, a project usually has troubles. The leader has to be an institutional builder—and usually a change agent on a large scale. And he/she has to think increasingly across agency lines to organizational systems. The leader must be an able advocate for the project. Sometimes the qualities it takes to start a project are different from those to maintain it. That was surely true of the Genome Project. The charismatic James Watson got it underway; the steady and managerially competent Francis Collins implemented it. At the same time, stability in executive leadership may be essential for projects that last over different Presidential terms. Dan Goldin of NASA set a record for longevity, serving under Bush, Clinton, and Bush 2. That longevity helped him get the International Space Station up and occupied.