Launching commercial space: NASA, cargo, and policy innovation

W. Henry Lambright

The Maxwell School, Syracuse University, United States

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ABSTRACT

In 2013, NASA completed its Commercial Orbital Transportation Services (COTS) program. Initiated in 2005, COTS developed a privately operated cargo transport system for the International Space Station (ISS). In doing so, it met an urgent NASA need to replace a vital space shuttle function and heralded the prospect of crew transportation. It also fostered more competition in the aerospace industry aimed at lowering costs for space access. Finally, it gave hope that low-earth orbit might someday become more the preserve of the industrial sector, so that NASA could concentrate its constrained government resources on deep-space exploration.

This essay analyzes the case of COTS as a policy innovation — how it was born, led, and the forces that helped and hindered it during its eight-year journey from concept to closure. It indicates factors critical to its success.

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1. Introduction

When the space shuttle Columbia was destroyed in 2003, there was universal recognition that the shuttle's days were numbered. However, NASA had no viable successor to take its place. The Columbia Accident Investigation Board (CAIB) stated, "It is the view of the board that the previous attempts to develop a replacement vehicle for the aging shuttle represent a failure of national leadership."[1] Since then, "national leadership" has sought to fill the shuttle gap. It has relied on Russia for transporting astronauts to the International Space Station (ISS). It has meanwhile developed a U.S. capacity for cargo delivery, and is working on the more complex and controversial task of transporting crew. In both cases, NASA has sought a public–private partnership to accomplish the task. This paper analyzes this first step in shuttle replacement: developing a cargo delivery and return capability. This step has been completed.

NASA accomplished cargo delivery and return under the Commercial Orbital Transportation Services (COTS) program. Building on ideas germinated in earlier years, the program ran officially from 2005 to 2013. It was successful in achieving its goals, and those goals included industry-building as well as supply to ISS. Elon Musk has stated that his firm, Space Exploration Technologies Corporation or SpaceX, clearly a disruptive and an invigorating force in

aerospace, owed much of its start to COTS. Referring to COTS, he declared: "We would not be the company that we are today without the support of NASA."[2]

There has been much interest in public–private innovation of late, including articles dealing with the NASA-SpaceX agreement.[3] What this essay adds is analysis of how the COTS program came about and the strategies NASA leaders used in its development. It is a case study in policy innovation, public–private relationships, and entrepreneurial leadership.

Who did what to steer COTS along the way? What barriers were overcome? How? What lessons can be drawn relevant to other programs, including commercial crew, from the "COTS model?"

2. Approach

To answer these questions we use a policy-innovation process approach. Policy innovation for a government agency refers to the creation of a new mission or a significantly novel way of carrying

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[1] Columbia Accident Investigation Board (CAIB), Report, Vol. 1 (Washington D.C.: NASA and U.S. Government Printing Office, August 2003), 211.

[2] Rebecca Hackler, "COTS: A New Era in Spaceflight" (Houston, Texas: NASA Johnson Space Center, 2013), 1.

[3] Chad Anderson, "Rethinking Public–Private Space Travel," *Space Policy* (October 3, 2013), 266–271; Michael Bouchey and Jason Delborne, "Redefining Safety In Commercial Space: Understanding Debates Over the Safety of Private Human Spaceflight Initiatives In the United States," *Space Policy* (April 13, 2014), 53–61; Daniel Sperling, "Public–Private Technology R&D Partnerships: Lessons from U.S. Partnership for a New Generation of Vehicles," *Transport Policy*, (March 2001), 247–256.

out an existing mission. Policy innovation takes place over stages: 1) agenda setting, when a problem or opportunity emerges for governmental decision; 2) formulation, when a response to that problem or opportunity is forged that entails technological and/or institutional change; 3) adoption, when authoritative decision makers turn the potential response into formal policy; 4) early implementation, when carrying out the policy commences under a specific organizational structure; 5) evaluation/reorientation, when decision makers determine either to maintain or alter a program based on initial results; and 6) later implementation to closure, when the program to develop a new capability ends, and the innovation is incorporated into an agency's routines and perhaps those of society more generally. Obviously, this policy-innovation model is an abstraction. Reality is not linear, more complex, with termination always a possibility. However, it is helpful for guidance in tracking a long-term program.[4]

Policy entrepreneurs move this innovation process forward. Some push it from the development side; others pull it from the user perspective. Both kinds of force are needed over the long-haul of change. Who plays the entrepreneurial role can alter over time and by stage. What the entrepreneur does is build support for the change and counter opposition. Since most space policy innovations take place over several years, the policy entrepreneur's strategy may have to shift with political winds as well as the innovation's evolution. The key is to keep going toward a goal of incorporation.

3. Agenda setting under O'Keefe

NASA had been aware that the space shuttle needed to be replaced long before the Columbia accident of 2003. Entrepreneurs of the new could never overcome adherents of the old. The shuttle "worked," and had a large constituency of NASA centers and industrial contractors. NASA Administrator Sean O'Keefe in late 2002 planned to keep the shuttle operating until at least 2020.

Columbia triggered major change. President George W. Bush's 2004 "Vision for Space Exploration" (VSE) called for a new NASA mission – exploration of the Moon, Mars, and beyond. The shuttle would be retired upon completion of ISS. A new way to carry out the shuttle's mission of access to low Earth orbit (LEO) was therefore necessary. Bush appointed an independent advisory committee to review how to implement the VSE. This panel urged NASA to broaden the existing space industry and to rely more on commercial firms to fulfill shuttle functions. Many new, smaller companies had come into existence in recent years, and they lobbied for inclusion in the NASA-industry dealings.

O'Keefe created a new Exploration Systems Directorate to implement the Bush "Vision." He appointed Craig Steidle, formerly of the Defense Department, to head it. O'Keefe and Steidle wanted to put NASA resources behind the Exploration Mission, and let the private sector assume more "repetitive" efforts such as servicing the space station.[5] Steidle sought ideas about how better to enlist the commercial sector in shuttle replacement. NASA's Ames Research Center in California generated novel concepts about how public–private partnerships might work.[6] O'Keefe departed NASA for the presidency of Louisiana State University in early 2005, and Steidle left a few months afterward. However, they had put ideas

relevant to COTS firmly on NASA's agenda.

4. Griffin's formulation

In April, Michael Griffin took NASA's helm as Administrator. Griffin had served at NASA in the early 1990s and shared his predecessor's view of the need to refocus NASA on exploration. In addition, he had thought and written about commercial space prior to becoming administrator. NASA staff made him aware of ideas and activity the agency had underway. Also, various commercial space advocates from outside NASA pressed their claims on him. Griffin informed commercial space proponents they had a supporter in himself.[7]

In his first or second week on the job, he asked the agency's general counsel how he could use NASA's procurement authority to stimulate commercial development. He was told that the original Space Act of 1958 provided flexibility to perform transactions other than through traditional federal acquisition policy.[8] That policy, under the Federal Acquisition Regulation (FAR), was a voluminous set of detailed rules government and potential contractors had to follow in the technology acquisition process. Ostensibly to protect both parties against malfeasance and assure fairness, FAR was cumbersome and often restricted creativity in public–private dealings.[9] Government was a customer; industry, a supplier. Government specified requirements; industry was obligated to meet them. Government directed; industry followed.

Griffin wanted to link space acquisition with an industrial policy. The idea of stimulating industrial development, for NASA and also for the nation's benefit, was not new at NASA. What was new was the strong, personal priority the NASA Administrator gave it and his use of a particular mechanism (Space Act Agreement) to enable a "partnership" relationship between government and firms. What was also new in Griffin's mind was to use ISS as a stable market once it was finished. It would need steady supply of cargo.

Griffin's interest derived in part from his experience in the 1990s as head of In-Q-Tel, an organization established by the Central Intelligence Agency, to help it draw on new technology emerging from high tech firms in Silicon Valley and similar "hot spots" of innovation. At In-Q-Tel, Griffin had provided seed money to induce companies to invest their own funds in developing and adapting technology relevant to CIA and national security more generally. He saw the government money as incentive – most of the funds would have to be private.[10] In traditional Federal Acquisition Regulation (FAR)-based policy, government set requirements top down and firmly controlled the process of technology development: designs, deadlines, payments, etc. In this alternative model, using Space Act authority, the requirements would come bottom up.

Technical direction would largely rest with industry. Government would exercise modest oversight with staffs reduced accordingly. A company's selection would be based not only its technical proposal, but its business plan to raise private money and commercialize technology. If companies did not perform in accord with their Space Act Agreement, government could terminate an arrangement with a minimum of legal hassle. Government was thus a venture capitalist. Griffin had provided $50 million in seed money at In-Q-Tel. Developing a more diverse space industry would take more, he believed. Quite arbitrarily, he multiplied the $50 million by ten, and came up with a $500 million investment over a

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[4] There is much writing on the policy process. One of the most valuable books is that of John W. Kingdon, *Agendas, Alternatives, and Public Policies, 2nd Edition* (Boston: Little Brown, 1984). See also Paul A. Sabatier, *Theories of the Policy Process* (Boulder, Colorado, Westview, 1999).

[5] Comments to author by Sean O'Keefe, October 1, 2014.

[6] Dan Rasky, Comments and documents for author, June 3, 2014.

[7] Interview with Michael Griffin, November 7, 2013.

[8] Interview with Mike Wholley, NASA Chief Counsel, by Rebecca Hackler, March 19, 2013.

[9] James Q. Wilson, *Bureaucracy* (NY, Basic Books, 1989), 126–127.

[10] Interview with Michael Griffin.