Space Policy 30 (2014) 5–12

Contents lists available at ScienceDirect

Space Policy

journal homepage: www.elsevier.com/locate/spacepol

Transforming solar system exploration: The origins of the Discovery Program, 1989–1993

Michael J. Neufeld

National Air and Space Museum, Smithsonian Institution, United States

ARTICLE INFO

Article history:
Received 18 October 2013
Accepted 18 October 2013
Available online 19 April 2014

Keywords:
Space history
NASA
Space programme organization

ABSTRACT

The Discovery Program is a rarity in the history of NASA solar system exploration: a reform program that has survived and continued to be influential. This article examines its emergence between 1989 and 1993, largely as the result of the intervention of two people: Stamatios "Tom" Krimigis of the Johns Hopkins University Applied Physics Laboratory (APL), and Wesley Huntress of NASA, who was Division Director of Solar System Exploration 1990–92 and the Associate Administrator for Space Science 1992–98. Krimigis drew on his leadership experience in the space physics community and his knowledge of its Explorer program to propose that it was possible to create new missions to the inner solar system for a fraction of the existing costs. He continued to push that idea for the next two years, but it took the influence of Huntress at NASA Headquarters to push it on to the agenda. Huntress explicitly decided to use APL to force change on the Jet Propulsion Laboratory and the planetary science community. He succeeded in moving the JPL Mars Pathfinder and APL Near Earth Asteroid Rendezvous (NEAR) mission proposals forward as the opening missions for Discovery. But it took Krimigis's political skill and access to Sen. Barbara Mikulski in 1993 to get the NEAR into the NASA budget, thereby likely ensuring that Discovery would not become another one-mission program.

As space policy analyst Stephanie Roy noted in 1998, the Discovery Program, which features relatively small, cost-constrained spacecraft, is a rarity in the history of NASA solar system exploration. Similar reform programs proposed in the 1970s and 1980s failed to cut ballooning spacecraft sizes and budgets. Subsequent attempts at transformative programs like New Millennium, one might add, have also come and gone. But a crisis in NASA's program in the early 1990s forced a transformation in how the agency did business, at least in part and at least in this area of space science. While proclamations that big, expensive "flagship" missions are dead have proven premature, the Discovery Program has continued to fund innovative small spacecraft that have allowed much more frequent access, particularly to the smaller bodies of the inner solar system. Moreover, its success has encouraged the extension of its Principal-Investigator-centered, cost-contained model to other programs, including New Frontiers, which funds medium-sized missions to the outer solar system. Even the Explorer program for Earth-orbiting science spacecraft, the original model for Discovery, has been modified to make it more like the Discovery competition process.[1]

This article examines how the Discovery Program emerged between 1989 and 1993, largely as the result of the intervention of two people: Stamatios M. "Tom" Krimigis of the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, who was Chief Scientist before 1991 and Head of the Space Department afterward, and Wesley T. "Wes" Huntress, who became Division Director of Solar System Exploration in 1990 and the Associate Administrator for Space Science in 1992. Krimigis drew on his leadership experience in

E-mail address: neufeldm@si.edu.

[1] Stephanie A. Roy, "The origin of the smaller, faster, cheaper approach in NASA's solar system exploration program," *Space Policy* 14 (1998), 153–71. For the context of the creation of the Discovery Program see John E. Naugle and John M. Logsdon, "Space Science: Origins, Evolution, and Organization," in *Exploring the Unknown: Volume V: Exploring the Cosmos*, edited by John M. Logsdon (Washington, DC: NASA, 2001), 1–15, esp. 14–15; Howard E. McCurdy, *Faster, Better, Cheaper: Low-Cost Innovation in the U.S. Space Program* (Baltimore: Johns Hopkins University Press, 2001), esp. 55–57; and Amy Page Kaminski, "Faster, Better, Cheaper: A Socio-technical Perspective on Programmatic Choice, Success, and Failure in NASA's Solar System Exploration Program," in *Exploring the Solar System: The History and Science of Planetary Exploration*, edited by Roger D. Launius (New York: Palgrave Macmillan, 2013), 77–101. It is noteworthy that none of the above discusses the origins of Discovery more than in passing. The accounts that do exist are primarily focused on the role of the Johns Hopkins Applied Physics Laboratory (APL): Howard E. McCurdy, *Low-Cost Innovation in Spaceflight: The Near Earth Asteroid Rendezvous (NEAR) Shoemaker Mission*, NASA Monographs in Aerospace History, no. 36 (NASA SP-2005-4536) (Washington, DC: NASA, 2005), 7–15, which is based on the accounts of participants, notably Stamatios M. Krimigis and Joseph Veverka, "Foreword: Genesis of Discovery," *Journal of the Astronautical Sciences* 43 (Oct.–Dec. 1995), 345–47, and Robert W. Farquhar, who subsequently published his memoir: *Fifty Years on the Space Frontier: Halo Orbits, Comets, Asteroids and More* (Denver: Outskirts Press, 2010), see esp. 137–42. The Jet Propulsion Laboratory's side of the Discovery origins story is briefly covered in Peter J. Westwick, *Into the Black: JPL and the American Space Program, 1976–2004* (New Haven: Yale University Press, 2007), 210–18.

0265-9646/$ – see front matter
http://dx.doi.org/10.1016/j.spacepol.2013.10.002

the space physics community and his knowledge of its Explorer program to propose in mid-1989 that it was possible to create new missions to the inner solar system for a fraction of the existing costs. He continued to push that idea for the next two years, but it took the influence of Huntress at NASA Headquarters to put it on to the agenda. Huntress explicitly decided to use APL to force change on the Jet Propulsion Laboratory (JPL) and the planetary science community. He succeeded in moving the JPL Mars Pathfinder and APL Near Earth Asteroid Rendezvous (NEAR) mission proposals forward as the opening missions for Discovery. But it took Krimigis's political skill and access to Sen. Barbara Mikulski in 1993 to get the NEAR into the NASA budget, thereby forestalling the possibility that Discovery would become another one-mission program.

1. Origins of Discovery

At the end of the 1980s, there was a widespread perception in the planetary science community that NASA's solar system exploration program was in trouble. Because the disruptive effects of the space shuttle overruns and delays of the late 1970s and early 1980s, and then of the *Challenger* accident of January 1986, no planetary spacecraft were launched between 1978 and 1989. The spectacular, if short-lived, Voyager 1 and 2 encounters with the outer planets provided almost the only new data in the 1980s. The Mars Observer program, started in the mid-1980s as the first in a line of what was to be lower-cost Observer missions based on an Earth-orbiting spacecraft bus, was running considerably over original projections. The underestimation of the technical difficulty of adapting an Earth-orbit satellite bus, plus instrumentation that proved more challenging than anticipated, broke the original budget estimates. The overrun was exacerbated considerably by NASA Headquarters' decision to postpone the mission from the 1990 to 1992 launch opportunities and change the booster from the shuttle to a Titan III, both as a result of the *Challenger* disaster. The prospect of future Observer missions slowly evaporated. A widespread perception in the planetary science community and JPL was that low-cost planetary missions were a chimera.[2]

In contrast to this rather gloomy picture, the then-Associate Administrator for Space Science and Applications (OSSA), Lennard Fisk, remembers the late eighties as a buoyant period of expansion. Thanks to a 1984 promise of Administrator James Beggs to the Space Science Board that science would get twenty percent of the NASA budget, and the expansions of the agency's appropriation thanks to the pro-space attitudes of Presidents Ronald Reagan and George H. W. Bush, including a two-billion dollar supplemental for a replacement shuttle orbiter, Fisk's budget was doing very well, doubling to $3 billion by 1991. He instituted a strategic planning process, which he claims was a first at NASA, to choose the missions and long-term objectives for the Office of Space Science and Applications (OSSA). The much-delayed launches of the Magellan Venus radar mapper, Ulysses International Solar/Polar mission, Galileo Jupiter orbiter/probe, and Hubble Space Telescope in 1989/90, plus several flagship missions on the horizon, promised a new golden age for space science, in Fisk's view.[3]

All of that was to change after mid-1990, when a combination of the Hubble mirror embarrassment, the political fiasco of Bush's Space Exploration Initiative (SEI) for new human Moon–Mars exploration, a U.S. economy going into recession, the savings-and-loan scandal, the Gulf War and the sudden end of the Cold War, resulted in a rapid transition from rising to flat NASA budgets. But that was in the future when Discovery began in 1989/90, so it seems reasonable to speculate that the expansive prospects encouraged the idea of adding small missions to the agenda, but the lack of urgency from the top had something to do with why it took two years for a low-cost program to gather momentum.

The first signs of a new initiative come from spring 1989. On 8 May, Kerry Nock of JPL sent out forty-eight letters to university presidents at the behest of Geoffrey Briggs, head of OSSA's Solar System Exploration Division (SSED), "to assess the capability and interest with the community of universities of a concept he [Briggs] is thinking about for small, university-managed, planetary spacecraft projects." The targets could include the Moon, near-Earth asteroids, "and possibly Mars[,]" and the costs should be in the neighborhood of 100–150 million dollars.[4]

All the elements of the later Discovery Program were there, but the idea ran into a wave of opposition at Nock's institution. It appears likely that the JPL Director, Lew Allen, and his staff had not been properly briefed. Notes taken by Tom Krimigis during a 2 June phone conversation, presumably with someone at NASA Headquarters, mention "a lot of finger-pointing at JPL on who was responsible." His informant told him that a "cease and desist" message would go out soon—i.e., that the invitation to universities would be withdrawn.[5] Wes Huntress, who came from Pasadena in 1988 to be deputy director of the Earth Sciences division, assesses the behavior of his old center as firmly defending its turf and its way of doing business. "[T]hey saw this [small missions initiative] as a threat…. They liked the idea of one big mission at a time… and had no concept of how to break them [the JPL organization] up and work them on smaller missions. It was just a threat."[6]

Briggs' initiative seems likely to have begun immediately before the Nock letter.[7] Krimigis believes that it may reflect lobbying he had already made with Briggs, who thinks that is certainly possible. Cornell planetary astronomer Joseph Veverka also asserts that there was lobbying by some scientists for a small spacecraft program. However much that is true, evidence is currently lacking, but the initiative's immediate origins in Fisk's strategic planning process seems fairly apparent. The second strategic planning workshop for the SSED was to be held eight weeks later at the University of New Hampshire, providing another opportunity to present the idea and gather scientific support for inserting it into the plan. One of the presentations at

[2] Ibid., 154–57; Erik M. Conway, "Planetary Observers, Mars Observer," draft chapter 1 of Mars program history, JPL, 2010.

[3] James Beggs/NASA to Thomas Donahue/SSB, 9 May 1984, electronic copy supplied by Lennard A. Fisk, University of Michigan; Fisk oral history interviews (hereinafter OHI) by Rebecca Wright, 8–9 Sept. 2010, http://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Administrators/FiskLA/fiskla.htm, accessed 28 Sept. 2012; Fisk phone interview by Michael J. Neufeld (hereinafter MJN), 16 July 2012; William J. Broad, "NASA Moves to End Longtime Reliance on Big Spacecraft, *New York Times*, 16 Sep. 1991, p. A1.

[4] Nock to Stephen Muller (President, Johns Hopkins), 8 May, copy stamped received by Stamatios M. Krimigis (hereinafter SMK), 23 May, Krimigis Papers, Johns Hopkins University Applied Physics Laboratory (hereinafter SMKP/APL), box Krimigis Committees (SSES-SSAAC), file Solar System Exploration Subcommittee.

[5] SMK note 2 June, on message form from SMK to Dudley McConnell/NASA, 25 May 1989, SMKP/APL, box Krimigis Committees (SSES-SSAAC), file Solar System Exploration Subcommittee.

[6] Wesley T. Huntress (hereinafter WTH) OHI by Rebecca T. Wright, 9 Jan. 2003, p. 7, copy in NASA History Division (hereinafter NASA HD), HRC 18948.

[7] Unfortunately, the records from NASA Headquarters are almost entirely missing. I surveyed what NASA had transferred to the Suitland Federal Records Center as of summer 2012 and found almost nothing from Science Mission Directorate (SMD) and its predecessors after 1990. The records management function at SMD appears to have collapsed, a problem exacerbated by the switch to electronic records. Inquiries at SMD Planetary Science Division have turned up only some files from Carl Pilcher that Michael New, Discovery Program Lead Scientist, had saved. I had them transferred to the History Division, where they have been cataloged as files HRC 20237 to 20242. But it appears that almost everything from the Briggs era has been lost for the period in question, and the same may be true for Huntress, other than some electronic documents he was able to find in his computer that he provided to me, and some late 1990s presentations preserved in paper form in his files at the Carnegie Institution of Washington. Briggs told me in a. phone interview, 10 July 2012, that he had a large pile of documents on his windowsill that one day just disappeared. He does not know if it was discarded or saved. The former is looking increasingly likely.