REMEMBERING the SPACE AGE

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Chapter 2

Spaceflight in the National Imagination

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Introduction

Few would recount the history of spaceflight without alluding to national aspirations. This connection between space exploration and the nation has endured both in reality and in perception. With few exceptions, only nations (or groups of nations) have had the resources to develop reliable and effective space transportation systems; nations, not individuals, corporations, or international agencies, were the first actors to lay claim to the cosmos. The historical record, in turn, feeds and reinforces a broader public (and academic) consensus that privileges the nation as a heuristic unit for discussions about space exploration. Historians, for example, organize and set the parameters of their investigations along national contours—the American space program, the Russian space program, the Chinese space program, and so on. We evaluate space activities through the fundamental markers of national identity—governments, borders, populations, and cultures.

As we pass an important milestone, moving from the first 50 years of spaceflight to the second, nations—and governments—retain a very strong position as the primary enablers of spaceflight. And, in spite of increased international cooperation, as well as the flutter of ambition involving private spaceflight, there is a formidable, and I would argue rising, chorus of voices that privilege the primacy of national and *nationalistic* space exploration. The American and Russian space programs remain, both in rhetoric and practice, highly nationalist projects that reinforce the notion that space exploration is a powerful vehicle for expressing a nation's broader aspirations. Similarly, second tier space powers such as China, Japan, and India, which have long been spacefaring nations, have more recently strengthened the link between nationalism and competence in space activities. The evidence from the past 50 years of spaceflight convincingly counters utopian notions—expressed in television, film, fiction, and journalism—that as spaceflight becomes mature, national space programs will disappear, and all spacefaring countries will come together to work towards a shared set of objectives that have global resonance.

Despite the fundamental and enduring nature of the relationship between space exploration and the nation, we know very little about the manner in which

nations articulate their engagement in space activities. My goal in this essay is to offer some preliminary thoughts on the broad patterns that characterize the public rhetoric surrounding national space programs, patterns that are common across different national contexts. Here, I define "public rhetoric" to include the discourse generated by governmental agencies, journalists, historians, and public commentators, i.e., those that elucidate and establish the contours of public debate over space exploration in particular national contexts. I do not claim that this discourse reflects or approximates the "real" relationship of spaceflight to national aspirations, i.e., that space exploration can only be understood in terms of the nation. On the contrary, I strongly believe that the immutable association in the public eye of spaceflight with the nation has helped to *obscure* important non-state processes, an understanding of which might offer valuable insights in analyzing the history of space exploration.[1] I do, however, believe that the language describing space exploration has certain semiotic characteristics that communicate persistent ideas about the history of spaceflight that repeat across entirely different cultures and contexts. These ideas are important to discern since they serve as a filter for the public understanding of spaceflight and consequently contribute to the public enthusiasm (or lack of) for space exploration in general.

The evidence suggests that through the first 50 years of the Space Age, all spacefaring nations have used four different tropes—linguistic constructs dependent on symbols—to articulate their space programs to the broader public. These four tropes, which take the form of particular rhetorical strategies, continue to be fundamental to the way that the project of space exploration has been articulated in both official and unofficial discourses; governmental agencies, journalists, historians, public commentators and the lay public in spacefaring nations have consistently invoked these archetypes to construct a master narrative of the history of space exploration. They are: the myth of the founding father, the claim of indigenous creation, the connection between spaceflight and national identify, and the essential need to justify space activities. In elaborating these tropes, I use as examples the five nations which have achieved the domestic capability to launch objects into Earth orbit and still retain that capability—the Soviet Union (achieved orbit in 1957), the United States (1958), Japan (1970), China (1970), India (1980), and Israel (1988). Two European nations which once had that capability—France (1965) and Great Britain (1971)—have relinquished it. The former folded their efforts into the European Space Agency (ESA) while the latter saw no value in having such a

1. I make this point in my "Competing Technologies, National(ist) Narratives, and Universal Claims: Revisiting the Space Race," paper presented at the NSF-sponsored workshop of the Society for the History of Technology, October 18, 2007, Washington, DC. The paper can be accessed at *http://fiftieth.shotnews.net/?page_id=23*. (accessed February 29, 2008).

capability. ESA still remains the only multinational organization to develop its own satellite launch capability, having achieved that ability in 1979.[2]

Founding Fathers

The first trope of a national space history is that of the "founding father."[3] Each space program arrives in the historical record with a singular figure whose determinations mirror and telescope the spacefaring ambitions of the nation in question. For the Soviet Union, there was Sergei Korolev (1906-1966), for the United States, Wernher von Braun (1911-1977), for Japan, Hideo Itokawa (1912-1999), for China, Qian Xuesen (1911-), for India, Vikram Sarabhai (1919-1971), and for Israel, Yuval Ne'eman (1925-2006).[4] In some cases, their claims as founding fathers are contested—especially in the case of von Braun—but the commonalities between them are striking. Each of these individuals embodies a unique combination of dualities: they are always both capable and visionary, brilliant engineers and unequalled managers, and comfortable with the topmost levels of power and yet accessible to the rank-and-file technician. There are early traumas typically associated with each, ordeals that were physical, moral, or professional. For example, Korolev served a sentence in the Gulag, von Braun never fully escaped the moral quandaries of being associated with the Dora labor camp in Nazi Germany, and Qian's life and career were disrupted by the Red Scare in the 1950s when he was deported to China on charges of being a communist sympathizer. In all cases, these men were seen as overcoming these adversities to achieve prominence later in their lives. For those reconstructing narratives of national space programs, these traumas become metaphors for the uphill battles faced by the space programs themselves.

2. Although I do not focus on them, the same patterns also apply to those countries that are close to achieving a domestic capability to launch satellites into orbit but have not yet done so: Brazil, North Korea, Iran, and South Korea. In addition, I do not explore the strategies of those dozens of nations that have developed or purchased satellites but lack the expertise or resources to launch them themselves and, therefore, pay other nations or agencies to do so.

3. It goes without saying that there were no women founders of space programs; the history of space exploration has been dominated by men in all nations, partly because of the substantive obstacles faced by women in pursuing higher education in the applied sciences or engineering. On the other hand, women in large numbers did contribute to space programs globally at mid- and lower-levels of management (e.g., as computer operators, medical personnel, draftspersons, administrative staff, custodial laborers, and daycare workers). Because social history has not been a concern for space historians, these women and their contributions remain largely invisible in most space history narratives.

4. For useful biographies of some of these individuals, see Iaroslav Golovanov, *Korolev: fakty i mify* (Moscow: Nauka, 1994); Michael J. Neufeld, *Von Braun: Dreamer of Space, Engineer of War* (New York: Alfred A. Knopf, 2007); Iris Chang, *The Thread of the Silkworm* (New York: Basic Books, 1995); Amrita Shah, *Vikram Sarabhai: A Life* (New Delhi: Penguin Viking, 2007).

What purpose does the founding father trope serve? There is hardly a historian who would agree that Korolev single-handedly founded the Soviet space program, yet his epic biography completely overshadows the mention of many other individuals who made critical contributions to the emergence of the Soviet space program. Here it is important to distinguish between formal academic history and the popular notion of history that becomes part of the collective memory of a nation. With the former, historians are drawn to complexities and the messiness of yesterday; with the latter, our predilection is to distill complexities down to broad themes, personalities, and events that are often deterministic and teleological in nature. Thus, one purpose of the founding father archetype is to reinforce deterministic explanations for space history (e.g., "Korolev did X, therefore the Russian space program is like Y").

The founding father archetypes did not arrive out of a vacuum but rather drew upon a longer tradition of similar archetypes. Most European nations, for example, reinforce narratives that they have founding fathers for particular scientific and applied scientific fields such as physics, chemistry, biology, mathematics, computer science, etc. These narratives center around an individual who is not only a deep thinker but also a builder of institutions, as well as an individual who bequeathed a substantial system (of research, education, etc.) for the good of the nation. In that sense, the founding father narratives of space exploration also parallel and mirror narratives about the founding of the nation itself, which are often tied to singular individuals who embodied some of the same kinds of qualities. Thus, these founding fathers represent not only the space program but also become key figures in nation building. By association, our conceptions of the founding father archetypes attach national space programs to imperatives, challenges, and triumphs associated with the founding of the nation. As a result, to many, the space program acquires a level of gravitas typically associated with concerns about the future of the nation.

INDIGENITY

All national space program narratives depend on the claim that its achievements were native in origin. In other words, the space history of each country assumes that nations are airtight constructs where immutable borders overshadow transnational flows and fixed delineations trump the fluid nature of both identities and knowledge. There are obvious reasons why the appeal of a particular space program depends on the notion of home-grown expertise: such accounts bolster national claims of competence, both to domestic and international audiences. Indigenous technologies—or at least those that are represented as indigenous—serve as surrogates for the projection of national prowess, a phenomenon that dates back at least to the late 19th century when

both Great Britain and Germany began to assert their standing on a global stage through accomplishments in science and technology.[5]

In the case of the space powers, each of their achievements served to place them on a global stage. Much like the acquisition of nuclear capability—more prosaically termed "going nuclear"—the domestic capability to deliver objects into Earth orbit secures a powerful and symbolic status that is also discrete since it divides "before" and "after" as being completely different. The symbolic power of such moments derives from the way a single launch can represent a convergence of many national aspirations—pride in history, a consensus that the present is a moment to be celebrated, and a confidence in a bright tomorrow. In 1980, when India launched its first satellite into orbit, Prime Minister Indira Ghandhi noted in a speech to the Indian parliament that "This is a great day for India and for Indian science." Mass media response in the West was predictably reductive but couched the event as a landmark: the *Washington Post* reported, for example, that it was "a remarkable achievement for a country that still uses bullock carts as a prime mode of transportation."[6]

From the Indian perspective, it was important to emphatically underscore the value of indigenity and the issue of ownership: the Indian space program was, above all else, Indian. Participants of the Indian space program continue to emphasize this aspect of the development of their first satellite launch vehicle, the SLV-3, attributing the mastery of this capability both to the high level of existing Indian expertise and the circumstances generated by draconian technology proliferation controls which forced Indian engineers to "go it alone."[7] Even though the development of the SLV-3 actually predated the enforcement of the Missile Technology Control Regime (MTCR) that limited international flows of "sensitive" missile technology to selected countries, the current existence of such controls serves to embolden ahistorical and disingenuous lines of argument and, in fact, obscures the significant international collaboration that led to the SLV-3 rocket.[8]

Claims of indigenity are not monolithic across nations. In the more mature space powers, the tone of these assertions communicate unquestioned celebrations of national character, while in the "newer" space powers, they come across as preemptive responses to accusations of clandestine (or otherwise) appropriation

5. Bernhard Rieger, *Technology and the Culture of Modernity in Britain and Germany, 1890–1945* (Cambridge, UK: Cambridge University Press, 2005).

6. "India Becomes 6th [*sic*] Country to Put Satellite into Orbit," *Washington Post*, July 19, 1980. India was actually the seventh nation to put a satellite into orbit using its own rocket, and the eighth if one includes the European Space Agency.

7. See for example, B. N. Suresh, "History of Indian Launchers," IAC-07-D2.2.01, paper presented at the 58th International Astronautical Congress, Hyderabad, India, September 24-28, 2007.

8. The history of international contribution to the SLV-3 has been all but forgotten from the "official" record of its development. For a still-valuable historical work that explores the development of Indian launch vehicles, see Gopal Raj, *Reach for the Stars: The Evolution of India's Rocket Programme* (New Delhi: Viking, 2000).

of technology from other nations. An example of the former is the United States, where the achievements of the American space program—particularly the Apollo lunar landings—represent the achievements of Americans, and not, for example, Germans or Canadians.[9] As the author of a very popular book on Apollo recently noted:

> Free competition motivated American workers whose livelihoods were related to the quality and brilliance of their work, and we saw extraordinary, impossible things accomplished by ordinary Americans. The American flag on the Moon is such a powerful symbol because it is not a vain one. America, like no other nation, *was* capable of the Moon.[10]

Soviet and Russian commentators, including veterans, have long made similar pronouncements in relation to the achievements of Sputnik and Gagarin, albeit, in the backdrop of latent suspicions (especially in Europe and the United States) that the help of German engineers kidnapped after World War II was critical to the spectacular early successes of the Soviet space program.[11]

Claims of fully indigenous space technology are often motivated by accusations from abroad that this technology was "borrowed"; such allegations themselves focus mostly on non-Western nations. In other words, while the mature Western programs are largely insulated from charges of benefiting from foreign technological expertise, both new and mature non-Western programs are continually dogged by such accusations—usually emanating from the West—prompting a generally defensive posture that requires repeated assertions about domestic expertise. Through the entire period of the Cold War, for example, Soviet space achievements were continually marred by Western claims that the Soviets benefited from the "other Germans" or that they used

9. Both Germans and Canadians, naturalized as U.S. citizens by the early 1960s, made significant contributions to the Apollo program. For the Canadian contribution, see Chris Gainor, *Arrows to the Moon: Avro's Engineers and the Space Race* (Burlington, Ontario: Apogee Books, 2001). There are a vast number of books on the German contribution. For a representative example, see Frederick I. Ordway, III and Mitchell R. Sharpe, *The Rocket Team* (New York, NY: Cromwell, 1979).

10. David West Reynolds, *Apollo: The Epic Journey to the Moon* (New York, NY: Tehabi, 2002), p. 257.

11. Soviet rocketry veteran Boris Chertok, who represents a "mainstream" voice within the Soviet space history community, concedes that German help was important in the immediate postwar years but dismisses any notion that this help was essential to the early successes of the Soviet space program. See Boris Chertok, *Rockets and People*, ed. Asif A. Siddiqi (Washington, DC: NASA, 2004). On the other hand, a number of German writers, without much convincing evidence, have recently attributed most of the early Soviet successes in rocket design to Germans. See for example, the three-part article by Olaf Przybilski, "Die Deutschen und die Raketentriebwerksentwicklung in der UdSSSR," *Luft- und Raumfahrt* no. 2 (1999): 30-33; no. 3 (1999): 28-33; and no. 4 (1999): 33-40.

technology stolen from the U.S. space program through skillful spying.[12] Similarly, Western commentators, both official and independent, continue to express concern about possible Chinese use of sensitive American technology for use in the development of their ballistic missiles and launch vehicles.[13] While such expressions are linked to concerns about the global proliferation of potentially harmful technology, they also communicate an implicit message about the inability of certain nations to innovate without outside help. Not surprisingly, such a stance tends to embolden and fortify the opinions of the scientific elite in non-Western nations who reject the notion that they are not capable enough to master the technology of space exploration. Affirmations of domestic competence emanating from Chinese or Indian scientists and engineers challenge the unquestioned assumption that there is an arbitrary line in history that divides those who are innovators (i.e., Western nations) and those who are proliferators (i.e., non-Western nations).[14] As such, in the non-Western world, claims of indigenity serve not only to boost national pride but are also vehicles for affirming a kind of revisionist and non-Orientalist historical thinking that decenters and deprivileges the West as the de facto basis for all discussions of spaceflight.

Space as an Expression of National Identity

Each national space program is also articulated both in contemporaneous times and in retrospect as an expression of a nation's identity. In other words, discussions about space exploration across extremely different national

12. The most famous example of Soviet "copying" was the case of the Buran space shuttle. See John Noble Wilford, "Soviet Design Appears in Debt to U.S. Shuttle," *New York Times*, November 16, 1988. For a careful and recent analysis of the possibility of Soviet appropriation of U.S. technology in relation to the Buran, see Bart Hendrickx and Bert Vis, *Energiya-Buran: The Soviet Space Shuttle* (Springer: Chichester, UK, 2007), pp. 82-85.

13. For the controversial and error-ridden report issued by the U.S. House of Representatives on China's alleged efforts to obtain technological information covertly from the United States (including those related to space technology), see the *Report of the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China* (more commonly known as the "Cox Report") at *http://www.house.gov/coxreport/* (accessed February 29, 2008).

14. Itty Abraham makes this argument about the arbitrary nature of the definition of nuclear proliferation in "The Ambivalence of Nuclear Histories," *Osiris* 21 (2006): 49-65. Hugh Gusterson similarly describes a moral distinction made by Westerners in terms of the acquisition of nuclear weapons. He writes: "There has long been a widespread perception among U.S. defense intellectuals, politicians, and pundits—leaders of opinion on nuclear weapons—that, while we can live with nuclear weapons of the five official nuclear nations for the indefinite future, the proliferation of nuclear weapons to nuclear-threshold states in the Third World, especially the Islamic world, would be enormously dangerous. This orthodoxy is so much a part of our collective common sense that, like all common sense, it can be usually stated as simple fact without fear of contradiction." See Hugh Gusterson, "Nuclear Weapons and the Other in the Western Imagination," *Cultural Anthropology* 14 (1999): 111-143.

contexts almost always include the notion, implicitly or explicitly, that there is something fundamental in the national character that gives force to the urge to explore space. Such expressions use three different rhetorical strategies that are not necessarily mutually exclusive: first, they involve a suggestion that space exploration represents a logical and further expression of deep-rooted cultural traits; second, they underscore national space achievements as a natural outcome of historical events; and third, they couch the space program as a vehicle for communicating a nation's prowess in science and technology.

Both the United States and the Soviet Union had deep-rooted traditions that suggest antecedents for their respective 20th century space programs. In the former case, there are any number of archetypes that justify and underlie the spacefaring activities of the United States. These are dominated by the notion of exploring the Western frontier and its attendant links to the idea of freedom: the freedom to explore, the freedom to settle, and the freedom to move again into the unknown. The "frontier thesis," as first cogently articulated by historian Frederick Jackson Turner in the late 19th century was a powerful statement of American exceptionalism, and as an analogy, it has proved remarkably resilient for many different American endeavors, including, of course, the space program.[15] In American space exploration, many commentators saw not only how engagement with the frontier shaped American society and culture but also how American society and culture shaped the frontier itself. American exploration—from Lewis and Clark to the Apollo program—was acting both on a generic human impulse to seek knowledge and a deep-rooted American urge for inquiry, exploration, and the freedom of wide open spaces.[16] Commentators as varied as rocket engineer Wernher von Braun, space visionary Gerard K. O'Neill, and space advocate Robert Zubrin all have couched their arguments with a distinctly American spin—ingenuity, frontier, freedom—in their search to advance the cause of human survival in the form of human colonization of the cosmos.[17]

As with Americans, many Russians also argue for deep-seated autochthonous urges for space exploration. In a recent article, a prominent Russian philosopher argued that the ideas of Konstantin Tsiolkovskii—the founding theorist of Soviet space exploration—provides the basis for a "Russian

15. For Turner's original works, see John Mack Faragher, ed., *Rereading Frederick Jackson Turner: The Significance of the Frontier in American History and Other Essays* (New Haven, CT: Yale University Press, 1994); George Rogers Taylor, *The Turner Thesis: Concerning the Role of the Frontier in American History*, 3rd ed. (Lexington, MA: Heath, 1972). For a more contemporary critique, see Richard Slotkin, *Gunfighter Nation: The Myth of the Frontier in Twentieth Century America* (New York, NY: Atheneum, 1992).

16. For an excellent summary of these themes as they relate to American space exploration, see Roger D. Launius, "Perfect Worlds, Perfect Societies: The Persistent Goal of Utopia in Human Spaceflight," *Journal of the British Interplanetary Society* 56 (2003): 338-349.

17. Howard E. McCurdy, *Space and the American Imagination* (Washington, DC: Smithsonian Institution Press, 1997).

national idea," an alternative to a "Europeanized" Russia that is part of the global system of capitalism and dependency. Tsiolkovskii, the author argued, had shown that the true destiny of Russians, like no other nationals on this Earth, resided in space, a place that transcends borders and nations.[18] While some would argue that this line of thinking is rooted in the Marxist-Leninist utopian thinking unleashed by the Russian Revolution of 1917, such ideas of technological utopianism can actually be traced further back to the mystical and occult pre-Revolutionary philosophy known as Cosmism, a tradition that was made up of a hodgepodge of Eastern and Western philosophical traditions, theosophy, panslavism, and Russian Orthodox thinking. The outcome was a nationalist and often reactionary philosophy that, in spite of its reactionary tenets (or perhaps because of it), continues to attract the attention of many Russian nationalist intellectuals in the post-Communist era.[19] The cause of Cosmism was "liberation from death," a goal that would be achieved by human migration into space that would allow humans to reanimate the atom-like particles of all those who had already "died" in the previous hundreds of thousands of years. The eccentric late 19th century Russian philosopher Nikolai Fedorov, who articulated much of this philosophy before anyone, wrote in 1905 that "[the] conquest of the Path to Space is an absolute imperative, imposed on us as a duty in preparation for the Resurrection. We must take possession of new regions of Space because there is not enough space on Earth to allow the coexistence of all the resurrected generations. . . ."[20] In present-day Russia, the philosophy of Cosmism holds a deep sway among many commentators, especially those who meditate on the meaning of Russian space exploration.[21]

Spaceflight is also linked to national identity through history. Most spacefaring countries, for example, claim pre-modern historical events as part of their narrative of space exploration. Such arguments rooted in history lay claim to the idea that the nation's path to space was preordained and inevitable, and that the modern space program is but a continuation of activities stretching

18. L.V. Leskov, "K. E. Tsiolkovskii i rossiiskaia natsional'naia ideia," *Zemlia i vselennaia* no. 4 (1998).

19. For links between modern Russian Cosmism and post-Soviet Russian nationalism, see James P. Scanlan, ed., *Russian Thought After Communism: The Recovery of A Philosophical Heritage* (Armonk, NY: M. E. Sharpe, 1994), pp. 26-28. See also Michael Hagemeister, "Russian Cosmism in the 1920s and Today" *The Occult in Russian and Soviet Culture*, ed. Bernice Rosenthal (Ithaca, NY: Cornell University Press, 1997), pp. 185-202.

20. S. G. Semenova and A. G. Gacheva, eds., *N. F. Fedorov: Sobranie sochinenii v chetyrekh tomakh*, 4 vols. (Moscow: Progress, 1995-2000). For a detailed exposition on the role of Cosmism in the origins of Soviet space exploration, see Asif A. Siddiqi, *The Red Rockets' Glare: Soviet Imaginations and the Birth of Sputnik* (Cambridge, UK: Cambridge University Press, forthcoming).

21. For a small sampling of works on Russian Cosmism since the early 1990s, see L.V. Fesenkova, ed., *Russkii kosmizm i sovremennost'* (Moscow: IFAN, 1990); S. G. Semenova and A. G. Gacheva, eds., *Russkii kosmizm: antologiia filosofskoi mysli* (Moscow: Pedagogika-Press, 1993); O. D. Kurakina, *Russkii kosmizm kak sotsiokul'turnyi fenomenon* (Moscow: MFTI, 1993); O. Ia. Gelikh, ed., *Kosmizm i novoe myshlenie na Zapade i Vostoke* (St. Petersburg: Nestor, 1999).

back centuries that embody similar sensibilities. In non-Western nations, there is also a specific pattern of linking contemporary space programs with events that predate Western modernity. Chinese writers, for example, are eager to emphasize the importance of China as the birthplace of rocketry in the 13th century, while Indian writers similarly stress the importance of Tippu Sultan's rockets from the late 18th century as a harbinger of the future.[22] In these narratives, Tsiolkovskii, Goddard, and Oberth are all peripheral.

Finally, national identity is linked to spaceflight as an expression of national technological competence. Since the very first satellites, space exploration has served as a reminder to both domestic and international audiences of a nation's mastery of science and technology, not too dissimilar from other technological metrics of late 20th century modernity such as nuclear power, computing, and biotechnology. Already by the late 19th century, and especially in the light of experiences during the Great War, technology had assumed a fundamental role in the projection of national prowess, contributing to and joining the other measures of global dominance such as imperial adventurism, military assets, and industrial growth. In his study of the role of technology in the creation of modernity in early 20th century Britain and Germany, Bernhard Rieger notes that:

> [t]echnological innovations not only underpinned the competitiveness of national economies as well as both countries military might; a large range of artifacts also became national symbols and prestige objects that signaled international leadership in a variety of engineering disciplines.[23]

A half a century later, especially after the launch of Sputnik in 1957, the connections between technology and national prowess became fully established. And just as Sputnik marked a particular historical moment that attached the notion of technological competence to the Soviet Union, Apollo did the same for the United States. I would argue that the most enduring aspect of the iconography of Apollo has been to set a benchmark for technological competence in American

22. For the Chinese references, see Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight* (Berlin: Springer, 2004). For India, see A. P. J. Abdul Kalam, *Wings of Fire: An Autobiography* (Hyderabad: Univ. Press, 1999); S. Krishnamurthy and B. R. Guruprasad, "On the Nature and Significance of Tipu Sultan's Rockets from a Historical Perspective," IAC-07-E4.4, paper presented at the 58th International Astronautical Congress, Hyderabad, India, September 24-28, 2007.

23. Rieger, *Technology and the Culture of Modernity in Britain and Germany, 1890–1945*, p. 224. In a similar vein, see Guillaume de Syon, *Zeppelin!: Germany and the Airship, 1900–1939* (Baltimore, MD: Johns Hopkins University Press, 2002); Peter Fritzsche, *A Nation of Fliers: German Aviation and the Popular Imagination* (Cambridge, MA: Harvard University Press, 1994); Gabrielle Hecht, *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, MA: MIT Press, 1998).

culture, as underscored in the oft-repeated lament that begins, "If we could send a man to the Moon, there's no reason we can't. . . ." The later second-tier space powers have deployed this fundamental link between national prowess and space technology in similar ways. For emerging global players such as China and India, space exploration represents one of a constellation of important ways with which to announce their "arrival" as global powers: upon the launch of their first lunar probe, for example, Chinese space scientist Ouyang Ziyang noted that, "[a]s lunar exploration embodies our overall national strength, it is very significant for raising our international prestige and our national unity."[24] The media hype over a possible Asian space race among China, Japan, and India in recent times is one symptom of this belief in "raising" prestige on a global level; the overtly nationalist rhetoric about the meaning of space exploration for the youth of the nation—as was seen with the domestic coverage of cosmonaut missions from Malaysia and South Korea—was another.[25]

Justifications

The fourth dimension of the public articulation of national space programs are best described as justifications. Space exploration—especially the kind that involves developing a domestic space transportation system—requires enormous investments in resources. As such, articulation of any particular space event, whether in real time or in retrospect, demands a variety of rationalizations not only to justify but also to explain the event. Historically, most other major and mature technological systems of the 19th and 20th centuries, especially ones that have developed over a period of a half a century (such as urban electrical systems, air travel, high speed rail, telephone networks, and television systems) have not required the kind of concomitant justifications that are *de rigueur* in discussions about space travel. While the benefits of these other systems—in the form of social welfare or profit or both—have been seen self-evident, in the case of space travel, social benefits and material gain continue to be issues of debate

24. Jim Yardley, "China Sends Its First Probe for the Moon Into Space," *New York Times*, October 25, 2007.

25. Both Malaysia and South Korea paid the Russian Space Agency to launch individuals from their respective nations into orbit on board a Soyuz spacecraft for short visits to the International Space Station. See Azura Abas and Nisha Sabanayagam, "First Malaysian in Space: Angkasawan to Inspire Schoolkids," *New Straits Times Online*, October 11, 2007, *http://www.nst.com.my/Current_News/NST/Thursday/Frontpage/2057731/Article/index_html* (accessed February 29, 2008); "Malaysians over the Moon as Their Astronaut Blasts into Space," *Space Travel: Exploration and Tourism*, October 10, 2007, *http://www.space-travel.com/reports/Malaysians_over_the_moon_as_their_astronaut_blasts_into_space_999.html* (accessed February 29, 2008); Cho Jin-Seo, "Sputnik and Arirang: 50 Years of Space Exploration and Korea," *Korea Times*, October 8, 2007, *http://www.koreatimes.co.kr/www/news/tech/2007/10/129_11545.html* (accessed February 29, 2008).

rather than unquestioned axioms. As a result, discussions surrounding national space programs have remained inseparable from invocations of justifications.

Historian Roger Launius has described the various rationales put forth justifying the cause of space exploration: survival of the species, national pride, national security, economic competitiveness, and scientific discovery.[26] To these five, I would add "benefits to the populace" as a sixth set of justifications. These justifications are central to space narratives because they preemptively try to insulate discussions about space travel from critiques both internal (i.e., domestic and institutional) and external (i.e., international and public). Without dispensing judgment on the validity of these justifications, it is clear that they play a critical role in the discourse about space exploration, one that is so deeply ingrained that we hardly even think it odd that there should be any suggestion that we not have to justify spaceflight.

Justifications for spaceflight have been historically contingent; different historical periods required different justifications to be accentuated. Moments of perceived crisis, for example tend to privilege some justifications over others. In the initial collective national anxiety following Sputnik, the *raison d'être* of the American space program was framed in discourses of national pride and national security. These justifications were particularly effective in the 1960s, the former for Apollo and the latter for various military and intelligence space projects. The other three justifications—economic competitiveness, survival of the species, and scientific discovery—were at the forefront in the post-Apollo years when the American space program was more mature but also more directionless in the inevitable letdown after the Moon landings.

The crisis of the post-Apollo years—in the aftermath of a costly foreign war, an energy crisis, and a space program without a vision matching Apollo—generated enormous discussion about the practical costs and benefits of the space program.[27] As indifference to the space program mounted in the 1970s, NASA sought to attract positive attention to its cause by emphasizing the rewards of space exploration, benefits beyond the clichés of Tang, Teflon, and Velcro—none of which were developed by NASA but which had become comedic counterpoints to the perceived majesty of Apollo. The Agency also devoted significant resources to advertising its efforts to transfer the benefits of space travel to taxpayers; in 1962, it created the Technology Utilization Program, and, since 1976, it has published the annual *Spinoff* volume. What is the purpose of preparing this publication? According to NASA:

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26. Roger D. Launius, "Compelling Rationales for Spaceflight: History and the Search for Relevance" in *Critical Issues in the History of Spaceflight*, eds., Steven J. Dick and Roger D. Launius (Washington, DC: NASA, 2006), pp. 37-70.

27. For a lengthy discussion of how the writing of American space history was also affected by the rise and fall of Apollo, see Siddiqi, "American Space History: Legacies, Questions, and Opportunities for Further Research" in *Critical Issues in Space History*, pp. 433-480.

> it is a convincing justification for the continued expenditure of NASA funds. It serves as a tool to educate the media and the general public by informing them about the benefits and dispelling the myth of wasted taxpayer dollars. It reinforces interest in space exploration. It demonstrates the possibility to apply aerospace technology in different environments. It highlights the ingenuity of American inventors, entrepreneurs, and application engineers, and the willingness of a government agency to assist them. And finally, it continues to ensure global competitiveness and technological leadership by the United States.[28]

One striking aspect of these justification narratives is that they have been deployed in support of space programs regardless of the nature of the political system in question: nations that are vibrant democracies use the same kind of justifications as those nations where large portions of the popular are politically disenfranchised. For example, while the Chinese space program has no immediate counterpart to NASA's Commercial Technology Program, it does frequently articulate very similar justifications about its own growing space program. In a white paper on the Chinese space program prepared in 2000, the foremost rationale of the Chinese space program was laid out as such:

> The Chinese government attaches great importance to the significant role of space activities in implementing the strategy of revitalizing the country with science and education and that of sustainable development, as well as in economic construction, national security, science and technology development and social progress. The development of space activities is encouraged and supported by the government as an integral part of the state's comprehensive development strategy.[29]

China's democratic neighbor, Japan, has communicated similar rationales, albeit ones that have changed over the decades with the evolution of the Japanese economy and industry. If in the 1970s and 1980s the space program was rationalized by the need to keep the Japanese economy competitive and its industry robust, by the early 2000s the justifications for space exploration incorporated a new motive: the security of the Japanese people from natural disasters and global environmental degradations. Perhaps responding to the perception that the Japanese public "is becoming increasingly skeptical of

28. *"History of Spinoff,"* *http://www.sti.nasa.gov/tto/spinhist.html* (accessed February 29, 2008).

29. Information Office of the State Council, "White Paper on China's Space Activities," *http://english.peopledaily.com.cn/features/spacepaper/spacepaper5.html* (accessed February 29, 2008).

claims that the space program will produce major economic benefits," the Japan Aerospace Exploration Agency (JAXA) issued a 20-year vision statement in 2005.[30] In it, the Agency emphasized goals that were reiterated by JAXA President Keiji Tachikawa in an annual message:

> I feel that Japan's space program can contribute more to the safety and security of the Japanese people. I hope that JAXA will actively bear responsibility to follow this lofty goal and space development leads to greater safety and security for all mankind, from our daily lives to emergency situations.[31]

Tachikawa's message is emblematic of a general shift in justifications characteristic of all the major global space programs, one that equates a concern for the welfare of the environment with important social benefits. All national space programs—both major and minor—now pay lip service to critical environmental issues such as global warming, deforestation, land erosion, earthquake prediction, and disaster warning. Such rationales have begun to augment and replace Cold War-centered justifications that centered largely around prestige and national security.

The justification tropes, then—whether arguing for survival of the species, national pride, national security, economic competitiveness, scientific discovery, or benefits to the populace—serve to provide a foundation for which to discuss the very possibility of space exploration. Because of its extremely high costs and attendant high risks, nations have had to frequently and insistently justify the existence of space programs; thus, justifications are not simply extraneous rhetoric but have become intrinsic to our future visions of space exploration.

CONTESTED VISIONS

Each of these four elements that form the core of space exploration narratives—the founding fathers, the notion of indigenity, connecting spaceflight with national identity, and the need for justifications—are contested and mutable. In each case, there are actors who seek to displace or destabilize the master narratives.

Perhaps the most rancorous disagreements have been over the founding father archetypes and the claims of indigenity. In the former case, the U.S. space program is somewhat of an anomaly. A plausible candidate for a founding father is the rocketry pioneer Robert Goddard who designed, built, and

30. The quote is from Steven Berner, *Japan's Space Program: A Fork in the Road?* (Santa Monica, CA: RAND Technical Report TR-184, 2005), p. 30.

31. "Message from President of JAXA," *http://www.jaxa.jp/about/president/index_e.html* (accessed February 29, 2008).

launched America's first liquid propellant rocket in 1926.[32] Despite Goddard's quite significant technical achievements in rocket development in the interwar years, however, he had little or no influence on the birth of the American space program, having passed away in 1945. And although his place in the pantheon of original space visionaries is secure, his contributions to spaceflight in the American context have been overshadowed by those of Wernher von Braun.

For many reasons, von Braun does not fit the typical mold of the founding father: he was originally German, he did not "found" the American space program, and he had little or no influence on the development of U.S. spacecraft. Yet he and his biographers, based upon his undeniably significant achievements, have positioned him—some would say very successfully—as one of the most iconic, if not *the* most iconic non-astronaut figure in the history of the American space program.[33] The fact that rockets designed under von Braun's direction launched the *first* U.S. satellite, the *first* American into space, and the *first* American to the Moon are important touchstones in his legacy; arguably, all of these achievements are overshadowed by von Braun's charisma and larger-than-life charms as a public figure in the 1950s and 1960s. Besides the astronauts, no individual in the public eye during that time personified the ingenuity, daring, and resourcefulness required to send humans to the Moon than Wernher von Braun.

Von Braun's legacy has been a contested one. Within the historical community, disagreements have raged over his alleged complicity with the forced labor at Dora during World War II.[34] Another debate has centered on his proper place in the history of the U.S. space program: for many years, von Braun's "rocket team" was square and center in the American space narrative that began with the capture of V-2 rockets at the end of World War II and ended with Apollo 11. A group of influential historians invested in maintaining von Braun's legacy have ensured the continuing prominence of this narrative (often called the "Huntsville School" of historiography), one that traces the roots of the American space program, particularly the Apollo project, to the V-2 rocket and its brilliant designers in Germany during the interwar years. In this narrative, which has had a near-impervious hold on the public perception of the American space program, the so-called German rocket team who were

32. David A. Clary, *Rocket Man: Robert H. Goddard and the Birth of the Space Age* (New York, NY: Hyperion, 2003).

33. For the many sympathetic and often hagiographic biographies of von Braun, see Erik Bergaust, *Wernher von Braun: The Authoritative and Definitive Biographical Profile of the Father of the Modern Space Age* (Washington, DC: National Space Institute, 1976); Ernst Stuhlinger and Frederick I. Ordway, III, *Wernher von Braun, Crusader for Space* (Malabar, FL: Krieger, 1994); Bob Ward, *Dr. Space: The Life of Wernher von Braun* (Annapolis, MD: Naval Institute Press, 2005).

34. Michael J. Neufeld, "Wernher von Braun, the SS and Concentration Camp Labor: Questions of Moral, Political, and Criminal Responsibility," *German Studies Review* 25, no. 1 (February 2002): 57-78.

brought to the United States in the aftermath of World War II played a singular and critical role in taking America to space and eventually to the Moon.[35] Although there has been a stream of recent scholarship highlighting more indigenous sources of innovation in the American context—such as the Jet Propulsion Laboratory and Reaction Motors—there continues to be a large divide between historians' understanding of the role of von Braun in the early U.S. space program and laypeople's perception of the same topic.[36]

Perhaps the most contested aspect of national space history narratives is the issue of indigenity. Every single space power has made a claim for indigenous origins of expertise, technology, and competence, and for every one of these claims, there exist counter-claims. In the American case, there are competing schools centered on German and more homegrown contributions. Similar arguments over German help have raged over the birth of the Soviet space program. The "second-rank" space powers all have comparable disputes over their stories of origin. We find obvious parallels in claims made for the development of atomic energy by various nations. At least one recent scholar of the history of atomic energy has begun to question the hermetically sealed nature of these nation-centered narratives. Writing on the history of nuclear power, historian Itty Abraham has noted that "practically no state travelled alone."[37] He adds:

> One of the most enduring tropes of nuclear histories is the idea that atomic energy programs are always national programs. The close relation between nuclear power and national power has led to the assumption that, for reasons of security especially, nuclear programs must be uniquely identified with particular countries. Official histories and scientists encourage this belief, for obvious parochial reasons, but it is rarely true. No atomic program anywhere in the world has ever been purely indigenous . . .[38]

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35. For an erudite analysis of the Huntsville School, see Roger D. Launius, "The historical dimension of space exploration: reflections and possibilities," *Space Policy* 16 (2000): 23-38.

36. For von Braun-centered works embodying the Huntsville School, see, for example, Willy Ley, *Rockets, Missiles, and Men in Space* (New York: Viking Press, 1968); Ordway, III and Sharpe, *The Rocket Team*; Wernher von Braun, Frederick I. Ordway, III, and Dave Dooling, *History of Rocketry and Space Travel* (New York: Thomas Y. Cromwell, 1986); Ernst Stuhlinger, Frederick I. Ordway, III, and Wernher von Braun, *Crusader for Space*, 2 vols. (Malabar, FL: Robert E. Krieger, 1994). For syntheses that take a more balanced approach to U.S. space history, see T. A. Heppenheimer, *Countdown: A History of Space Flight* (New York: John Wiley & Sons, 1997); William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998).

37. Itty Abraham, *Making of the Indian Atomic Bomb: Science, Secrecy, and the Postcolonial State* (London: Zed Books, 1998), p. 9.

38. Abraham, "The Ambivalence of Nuclear Histories." See also his "Notes Toward a Global Nuclear History," *Economic and Political Weekly* 39 nos. 46-7 (November 20, 2004): 4,997-5,005.

The available evidence points strongly to similar processes of knowledge flows in the evolution of ballistic missiles and space technology.[39] Every nation engaged in this technology has been a proliferator and has benefited from proliferation; this process of proliferation already began in the 1920s when an informal and international network of spaceflight enthusiasts in Europe—particularly in Germany, Austria, France, Poland, Great Britain, and the Soviet Union—and the United States, generated the first substantive exchange on topics related to rocketry and space exploration.[40] The development of sophisticated German ballistic missiles in the 1930s benefited from this discourse as did parallel but less ambitious Soviet efforts to build rockets. In the aftermath of World War II, the remainder of the German missile program, the most developed effort at that point, then fed into several different postwar missile programs, including those of the United States, the Soviet Union, France, and Great Britain. The Soviet Union in turn passed both German and "indigenous" technology to the Chinese while the Americans did the same to the Japanese. By the mid-1970s, the "space club" included all of the countries, joined in the 1980s by India and Israel who depended on flows from the United States and France respectively. Europe itself—in the form of international agreements—had many cooperative efforts that blurred distinctions of ownership, even as it gained the "indigenous" capacity for space activity in 1979.

Conclusions

The public awareness of spaceflight as an endeavor fundamentally associated with nations will remain unchanged for the foreseeable future. This relationship depends on a number of factors that are unlikely to alter soon; these include the perception of a powerful relationship between science and technology and nationalism; and an understanding of the high costs of space exploration that have impeded non-state actors in investing in such activities. In the latter case, the promise of private spaceflight remains only a promise; even if the sector develops into a vibrant industry in the next decade or so, private spaceflight will represent a very small portion of the overall space projects of any given nation. In perception at least, the major space projects such as human spaceflight and deep space exploration—executed by federal agencies such as NASA—will dominate. And while the creation, maintenance, and expansion of the ISS represents a striking case of international cooperation on a global scale, it is too early to say whether the ISS will serve as a harbinger of future international cooperation; it might well be remembered as a historical anomaly

39. For an ahistorical but useful and recent take on space technology transfers, see Mike H. Ryan, "The Role of National Culture in the Space-Based Technology Transfer Process," *Comparative Technology Transfer* 2 no. 1 (2003): 31-66.

40. Siddiqi, *Red Rockets' Glare*.

rather than as a precedent for future international cooperation. President George W. Bush's announcement of a new Vision for Space Exploration (VSE) that mandates a termination of American activities involving the ISS sometime around 2016 suggests that, on a tangible level, the most powerful and capable spacefaring nation on the globe is rejecting a global cooperative vision of human spaceflight in favor of a unitary national imperative.[41] There are many complex geopolitical, technological, and cultural reasons for taking this path, but from the perspective of public rhetoric and public understanding of the future of spaceflight, the VSE has unambiguously reinforced the link between the nation and spaceflight.

I have argued that there are four elements ubiquitous in the public conception of any national space program: the iconography of a founding father, the claim of indigenity, the link with national identity, and the necessity of justifications. It is doubtful that any of these four rhetorical archetypes will recede in importance in the near future. Barring a fundamental change in the link between the projection of national prowess and science and technology, there is little chance that we will see the founding father trope disappear or claims of indigenity recede. And unless space exploration becomes cheap or immensely profitable—a distant possibility—we may not soon see any need to reduce or eliminate the need for justifications in considering the topic of national space travel. On the other hand, there is a probability that public discussions about national space programs will accrue other characteristics, including, paradoxically, an appeal to a global imagination. There are already a few singular achievements in the history of spaceflight that could be described in terms of universal import, i.e., achievements of a national space program that have relevance to the people of the Earth itself. These undertakings would include the launch of Sputnik (the first human-made object in orbit), the mission of Yuri Gagarin (the first human in space), and the landing of men on the Moon (the first humans on another planetary body). One might also include the flotilla of robotic spacecraft sent out to deep space, to the inner and outer planets, and ultimately out of the solar system. On some level, these spacecraft represent artifacts that transcend national ownership.

I believe that significant global firsts and the capability to exit near-Earth space can be construed as benchmarks for a national space program to rise to a new level and claim global significance. Until now, only two nations have achieved that capacity: the former Soviet Union and the United States. The

41. "President Bush Announces New Vision for Space Exploration Program," *http://www.whitehouse.gov/news/releases/2004/01/20040114-3.html* (accessed February 29, 2008); Marcia S. Smith, *Space Exploration: Issues Concerning the "Vision for Space Exploration,"* CRS Report for Congress RS 21720, revised June 9, 2005, *http://opencrs.com/getfile.php?rid=51025* (accessed February 29, 2008); Carl E. Behrens, *The International Space Station and the Space Shuttle*, CRS Report for Congress RL33568, revised November 9, 2007, *http://opencrs.com/getfile.php?rid=59204*.

language of global significance has been deployed frequently by commentators to characterize a few singular achievements—Sputnik, Gagarin, and Apollo being the most obvious ones—since the beginning of the space era in 1957. Arguably, some other nations or international agencies, including the European Space Agency (ESA) and Japan, can make a claim to have performed acts with comparable significance, particularly in the area of planetary exploration.[42] And although China has a vibrant and diversified space program, until now it has only repeated actions done by others. But as more nations begin to become vibrant space powers capable of achieving critical "firsts" in the history of space exploration and equally capable of sending their handiwork out into deep space, we will probably see a rise in the kind of rhetoric we saw during the times of Apollo. In that sense, we may be soon witness to an interesting rhetorical clash between the national and the global—and at this point, it remains to be seen how that tension will play out.

42. ESA has directed and participated in a number of ambitious and path-breaking deep space exploration projects, including missions to Halley's Comet (Giotto, launched in 1985), Mars (Mars Express, 2003), the Moon (SMART 1, 2003), minor planets (Rosetta, 2004) and to Saturn's moon Titan (Huygens, 1997). Similarly, Japan has implemented a modest series of deep space missions since the 1980s including missions to Halley's Comet (Sakigake and Suisei, both 1985), the Moon (Hiten in 1990, Kaguya in 2007), the minor planets (Hayabusa, 2003), and Mars (Nozomi, 1998). See Asif A. Siddiqi, *Deep Space Chronicle: A Chronology of Deep Space and Planetary Probes, 1958-2000* (Washington, DC: NASA, 2002).