

**Competing Technologies, National(ist) Narratives, and Universal Claims:
Revisiting the Space Race**

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David Nye has succinctly noted that “the meaning of a tool is inseparable from the stories that surround it.”¹ What is the meaning of space technology, particularly for the Cold War “space race”? How do these meanings differ in different national contexts? Is it possible to conceive of a universal narrative of the era of space exploration? The fiftieth anniversary of the Society for the History of Technology—and the almost simultaneous fiftieth anniversary of *Sputnik*—provides an obvious occasion to revisit these questions.

In the fifty years since the launch of *Sputnik* on October 4, 1957, more than six thousand functioning satellites have been launched into orbit and beyond—some to the farthest reaches of our solar system. By its physical nature, space exploration has a resonance beyond national borders—at a fundamental level, it is a project that transcends national claims, and appeals to the global, perhaps even the universal. Yet, our understanding of the half-a-century of space travel is still firmly rooted in the framework of the national imagination. Until now, only nation-states have been able to mobilize the resources necessary for regular access to space. National identity casts a long shadow also over our received knowledge about space travel: for most laypeople, the perceived apotheosis of space exploration remains the heady competitive days after *Sputnik*, when the “space race” and the “space age” meant much the same thing. The Cold War space race retains its mystique, either as a benchmark which subsequent accomplishments could never equal, or as an anomaly whose particular conditions could never be repeated.

My goal in this paper is to offer some thoughts on the way in which this relationship between national identity and space exploration has affected our discipline’s approach to the history of spaceflight—in fact, has been fundamental to it. This discussion is intended to be a starting point to revisit both the history and the historiography of space exploration and suggest some new avenues of investigation. I will begin by illuminating the ways in which multiple and contradictory narratives of space history—engendered by national claims—have been a staple of space history in both the United States and Russia, the two foremost spacefaring nations. The citizens of both nations remember space exploration quite differently yet appeal to same kind of universal import. In addition, the maturation of other national space programs—those of China, Japan, and India, for example—will require us to approach space history with new lenses as more and more “new” narratives join the old Cold War-centered approach to space history. Second, by using the particular case of the burgeoning Indian space program and its postcolonial context, I will draw attention to avenues opened up by de-privileging borders in the history of space exploration, i.e., clearing the path to a potentially *global* history of space exploration. This

1. David E. Nye, *Technology Matters: Questions to Live With* (Cambridge, MA: The MIT Press, 2006), p. 3.

line of thinking may open raise a set of provocative questions concerning the motivations which lead nations to explore space, and why, in doing so, they take certain pathways that are not explicable by resorting to deterministic explanations.

National Narratives

Ask historians of technology from the United States to name the most important and influential event in the history of space exploration, and they will cite the Apollo Moon landing in 1969. Pose the same question to their Russian counterparts and they will recall the flight of Yuri Gagarin in 1961. American historians of spaceflight (or, indeed technology) would be surprised to learn that few beyond the United States remember or care about Apollo while Russians find it shocking that few Americans have even heard of Gagarin. Two nations that have engaged in essentially the same endeavor—to take leave of this planet—have fundamentally dissimilar perspectives on the same set of events. That history is told differently in different places by different people is hardly surprising. The same historical episode, seen from two different national cultures can engender entirely different national claims, which are contingent upon a complex matrix of deeply ingrained cultural assumptions. Yuri Gagarin has little resonance among Americans while Apollo is a minor footnote to Russians, yet both are important punctuations in the space race. What is unique about the history of spaceflight is that its claims—such as those for Gagarin or Apollo—have been imputed with a certain universal, even anthropological significance. In each nation’s canon of space history, Gagarin’s flight and Armstrong’s first step have been compared with the evolutionary movement of life from water to land. This simultaneous invocation of national aspirations and universal significance is what distinguishes the conflicting national narratives of space history from other more common Rashomon-like views of history.

Essential to this tension between the more specific narrative and the universal claim in the case of the space program is the perceived importance of technological prowess in the construction of a national identity. While the notion that *scientific* prowess is a constitutive element of national identity goes back to at least the 17th century, the Enlightenment strongly reinforced this relationship. By the late 19th century, with the fruits of the Industrial Revolution evident and the appearance of a distinct category of technology, many of the rationales used in favor of science were even more persistently applied to technology and its essential role in the enterprise of nation-building. And, as the European colonial project reached its peak, the discussion on modern technology became inseparable from empire-building; technology, in effect, became a dominant metric of modernity—Michael Adas’ “measure of man.”² By the turn of the century, and especially in the light of experiences during the Great War, technology assumed a fundamental role in the projection of national prowess, a role that was now further complicated by the specter of international competition for global dominance—through science, technology, culture, war, and imperial holdings. In his study of the role of technology in the creation of modernity in early twentieth century Britain and Germany, Bernhard Rieger notes that:

2. The most obvious touchstones on the technologies of empire are Daniel Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (Oxford, UK: Oxford University Press, 1981) and Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989). For a useful survey of the field, see David Arnold, “Europe, Technology, and Colonialism in the 20th Century,” *History and Technology* 21 no. 1 (2005): 85-106.

[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.³

The competition between Britain and Germany in *fin-de-siècle* Europe suggests some striking antecedents to the space race of the late 1950s and 1960s, particularly the collective national rumination in the U.S. following the shock of *Sputnik*. In the earlier case, the British were surprised and then alarmed by the rise of German technological innovation. Rieger notes that “[a]fter decades of unchallenged economic leadership, competition from [Germany] came as a shock to the world’s foremost imperial power and immediately conjured up the specter of ‘decline’.”⁴ World War I fighter pilots (much like later astronauts) assumed a key role in Germany’s projection of technological acumen, augmenting the value of technological artifacts as formidable national symbols: both pilots and artifacts were physical expressions of the notion that technology was indispensable to “national self-assertion in competitive environments,” created in this case by the British-German rivalry.⁵

The launch of *Sputnik* starkly accentuated the relationship between national identity and technology. Both Soviet and American commentators actively encouraged this link, using many of the same rationales advanced previously for technological prowess, albeit in entirely different conditions. *Sputnik*, launched on the same night that *Leave it to Beaver* premiered, awoke a nation, now seen as far too complacent. Walter McDougall noted that “[n]o [single] event since Pearl Harbor set off such repercussions in public life.”⁶ A crisis of confidence washed over most of American society, an anxiety that depended on the assumption of an intrinsic equation between modern America and science and technology. The political response unfolded with the legislation to create several new agencies focused on science, technology, and innovation, including the National Aeronautics and Space Administration (NASA). Believing that better education in Soviet Russia contributed to *Sputnik*, federal money poured into the American higher education system, making it a key component in the battles of the Cold War. These policies—the creation of new government agencies, further increases in state-sponsored R&D, and expansion and restructuring of higher education—had enormous influence on America’s political, social, and cultural trajectory in the Cold War.⁷

3. Bernhard Rieger, *Technology and the Culture of Modernity in Britain and Germany, 1890-1945* (Cambridge, UK: Cambridge University Press, 2005), p. 224. In a similar vein, see Guillaume de Syon, *Zeppelin!: Germany and the Airship, 1900-1939* (Baltimore: 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).

4. Rieger, *Technology and the Culture of Modernity in Britain and Germany*, p. 227.

5. *Ibid.*

6. Walter McDougall, *...the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985).

7. For only a small sampling of the literature on the domestic political repercussions of *Sputnik*, see McDougall, *Heavens and the Earth*; Roger D. Launius, John M. Logsdon, and Robert W. Smith, eds., *Reconsidering Sputnik: Forty Years Since the Soviet Satellite* (Amsterdam: Harwood Academic Publishers, 2000); Paul Dickson, *Sputnik: Shock of the Century* (New York: Walker & Co., 2001); Robert A. Divine, *The Sputnik Challenge: Eisenhower's Response to the Soviet Satellite* (New York: Oxford University Press, 1993); Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993); Rip Bulkeley, *The Sputniks Crisis and Early United States Policy: A Critique of the Historiography of Space* (Bloomington: Indiana University Press, 1991).

In the years after *Sputnik*, space exploration assumed a critical role in the projection of American identity both at home and abroad. More than anything, human spaceflight, in the form of the Mercury, Gemini, and Apollo programs, solidified this link. The rhetoric of politicians, media commentators, and NASA spokespersons helped to mobilize support for one of the most expensive civilian endeavors in the history of the nation, the Apollo Moon landing. Rieger's comment about Britain and Germany in the early 20th century, that "playing up technology's national significance . . . engendered understandings that overcame public resistance to new artifacts and instead highlighted their promise and led . . . laypersons to embrace advances" mirrors the strategies engendering Apollo.⁸ Mark E. Byrnes, in his *Politics and Space: Image Making by NASA* (1994), has traced the effects of NASA's image-building policy on popular perceptions of the organization as well as broader support for the cause of space travel.⁹ He argues that NASA primarily used three images—nationalism, romanticism, and pragmatism—to create and consolidate political support across the nation for its major endeavors in space. During the early years of NASA, no one infused these arguments with more passion than then-Vice-President Lyndon B. Johnson who characteristically noted that "Failure to master space means being second best in every aspect, in the crucial area of our Cold War world. In the eyes of the world, first in space means first, period; second in space is second in everything."¹⁰ In a very popular 2002 book on Apollo, David West Reynolds distills his belief in the connection between national identity and Apollo succinctly and emotionally:

[The Moon Race] was a Cold war battle to demonstrate the superior ability of the superior system, capitalism versus communism. . . . And the battle did prove out the more capable system. . . . The reasons are many, but among them the power of free enterprise ranks high. . . . 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.¹¹

For the Soviet Union, the flight of Yuri Gagarin only reaffirmed what was a given: that the Soviet state's existence and future explicitly depended on the development and use of modern science and technology. The early architects of the Bolshevik state were explicit on this point, their stance fortified by the reality (and perception) of Russian "backwardness" in comparison to its Western neighbors. Lenin's fascination with the rapid electrification of Russia, industrial Taylorism, and the construction of modernized railroads in Russia were certainly all practical, but they also carried with them an underlying idea that technology itself was a national panacea.¹² Beyond Lenin's oft-quoted phrase "communism equals Soviet power plus the

8. Rieger, *Technology and the Culture of Modernity in Britain and Germany*, p. 224.

9. Mark E. Byrnes, *Politics and Space: Image-making by NASA* (Westport: Praeger, 1994). See also James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963* (Tuscaloosa: University of Alabama Press, 1994).

10. Lyndon B. Johnson, quoted in Walter A. McDougall, "Technocracy and Statecraft in the Space Age: Toward the History of a Saltation," *American Historical Review* 87 (October 1982): 1010–1040.

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

12. Jonathan Coopersmith, *The Electrification of Russia, 1880-1926* (Ithaca: Cornell University Press, 1992); Anthony Heywood, *Modernising Lenin's Russia: Economic Reconstruction, Foreign Trade and the Railway*

electrification of the entire country,” he had an almost evangelical view of the role of electricity, and technology in general, as if it had the power to transform nation and culture. Aviation—and eventually space exploration—represented a powerful marker of modernity that proved irresistible to the Communist Party. In the aftermath of Gagarin and at the height of the Space Race in the 1960s, the discourse of cosmic flight was ubiquitous in Soviet popular culture and polity—cosmonauts became heroes of the Space Age, their iconic status infused with a heady mixture of nationalism and worship of technology. The Soviet space program was a potent projection of Soviet national aspirations—which is probably why when it failed to keep up with American advances in the late 1960s, the damage done to public perceptions of Soviet technological prowess was doubly damaging.

Universal Claims

Space exploration’s link with national identity partly overlapped with its claims to a larger idea, that appealed to global, even universal vision of humanity. Counter-intuitively, these ideas emerged from ideas deeply embedded in national contexts. Historian Roger Launius has noted that nations have historically justified space exploration by appealing to one (or a combination) of five different rationales: human destiny, geopolitics, national security, economic competitiveness, and scientific discovery.¹³ The latter four clearly stem from national and nationalist requirements; the first, human destiny, appeals to the idea of survival of the species. In the American context, this universal rationale of human destiny combines older traditions of technological utopianism and an updated version of “manifest destiny.” Technological utopianism, i.e., a notion that conflates “progress” (qualified technologically) with “progress” (unqualified) has been an essential part of popular discourse since the late nineteenth century, and if the crisis of modernity and the Great War made Western Europeans less enamored of the panacea promised by technology, Americans continued to embrace more fully the idea of technological utopianism than few other societies.¹⁴ As Launius has shown, influential space activists of the past fifty years have deployed rhetoric and rationale to support space exploration that simultaneously invoke romanticized notions of the American frontier—Frederick Jackson Turner’s “frontier thesis” is ubiquitous—with emphatic language that underscores that what is at stake with space exploration is not about Americans but the entire human race. Commentators as varied as Wernher von Braun, Gerard K. O’Neill, and Robert Zubrin all have couched their arguments with a distinctly American spin—ingenuity, frontier, freedom—in their search to create the opportunity for global survival in the form of human colonization of the cosmos.¹⁵ Here, the American becomes the normative for space travel for the species.

The situation was and is eerily similar in the Russian (and former Soviet) case. As in the case of the United States, there is a deep strand of technological utopianism in Russian society, a cultural trait that was undeniably heightened by the Bolshevik Revolution. What was once a

(Cambridge, UK: Cambridge University Press, 1999); Kendall E. Bailes, “Alexei Gastev and the Soviet Controversy over Taylorism, 1918-24,” *Soviet Studies* 29, no. 3 (1977): 373-94.

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

14. Howard P. Segal, *Technological Utopianism in American Culture* (Chicago: University of Chicago Press, 1983).

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

vision of the future for Russian intelligentsia at the turn of the century took on millenarian overtones after 1917.

Beginning in the 1920s, space exploration became a powerful avatar of utopian dreaming in post-Revolution Russia. The most powerful symbol of this appeal was the patriarch of Soviet cosmonautics Konstantin Tsiolkovskii, the half-deaf village school teacher who before any other in the world, articulated the practical possibility of space travel in an obscure journal article in 1903. Tsiolkovskii was driven not only by a fervent belief in the power of science and technology to save the world but also by ideas deeply rooted in Russian culture, particularly the philosophy of Cosmism. Cosmism's intellectual foundations comprised 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.¹⁶ The cause of Cosmism was "liberation from death," a goal that would be achieved by human migration into space which 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: "[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 co-existence of all the resurrected generations. . . ."¹⁷ 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.¹⁸

For those Russians not partial to occult ramblings about reanimation of the dead, the launch of *Sputnik* and the astonishing series of successes in its aftermath—the first dog in space (1957), the first lunar impact (1959), the first pictures of the farside of the Moon (1959), the first human in space (1961), the first woman in space (1963), the first "walk" in space (1965), the first lunar soft-landing (1966), and many others, seem to only confirm that the Soviet Union's natural destiny was as the leading spacefaring nation. The successes that the Soviets accumulated under the legendary "Chief Designer" Sergei Korolev in the late 1950s and 1960s were never matched after his death in 1966; as such they remain markers of the golden era of Soviet space travel. Like Apollo in the United States, that period, with its cosmonauts, spaceships, and memorabilia, has remained the archetype of the Russian space program in the public eye. Cosmonauts and commentators flooded the official Soviet media with ruminations emphasizing the link between nation and space exploration not only for the Soviet case but also for the American one. Thus, highlighting Soviet successes and American failures in space were implicit critiques of national

16. 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.

17. N. F. Fedorov, "Iz I toma 'filosofii obshchego dela'," in A. V. Gulyi, ed., *Nikolai Fedorovich Fedorov: sochineniia*, ed. A. V. Gulyi (Moscow: Mysl', 1982). For detailed expositions on the role of Cosmism in Soviet space exploration, see Asif A. Siddiqi, *The Red Rockets' Glare: Soviet Imaginations and the Birth of Sputnik* (Cambridge, UK: Cambridge University Press, forthcoming).

18. 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).

worth of the United States. Additionally, as in the U.S., there was a vibrant public culture of space enthusiasm in the Soviet Union that was rooted back in the pre-*Sputnik* years of the 1950s. This discourse helped to reinforce the notion that the Soviet way to space was the universal, the only way to space. To give one example, in a recent article, a prominent Russian philosopher argued that Konstantin Tsiolkovskii's ideas on space travel provide the foundation for a "Russian 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, was in space, a place that transcends borders and nations.¹⁹

Both the United States and the Soviet Union, the two earliest space-faring nations, then, produced narratives on space exploration that were deeply grounded in domestic cultural discourses that simultaneously couched their achievements as if they had universal import. These dichotomy runs through most of the historiography on both the Soviet and American space programs. The grand narratives of each nation—frequently utopian in nature—rely on the assumption that each is the normative history of space exploration. This is not a trivial issue, since how we remember and write history bequeaths to future generations how *they* will remember and memorialize human efforts to explore space. But who will write a history that reflects a global consensus? Is it even possible to propose such a thing? In a recent book, *Cosmodolphins: Feminist Cultural Studies of Technology, Animals and the Sacred* (2000), authors Mette Bryld and Nina Lykke argue that:

The early space race was, amongst other things, a discursive battle over entitlement to represent Universal Man in the biggest story told in modern times. Who was going to be the script writer and the protagonist of the master narrative of mankind's cosmic exodus? This was and is a question that matters a great deal when the official story of spaceflight is retold.²⁰

Who writes the history of space exploration and how do you account for multiple and contradictory national narratives? In their recent book, *Hubris and Hybrids*, Mikael Hård and Andrew Jamison describe the process of "cultural appropriation" of science and technology as "the discursive, institutional, and daily practices through which technology and science are given human meaning."²¹ How do you account for cultural appropriations of the same technological events—say, Cold War space history—that are wildly different? And finally, how do these particular cultural appropriations which are essentially nation-specific narratives make claims as global narratives, or the "global normative"?

From the Postcolonial to the Global

These questions are relevant and perhaps even urgent, not only for those of us who cross the divide between Russian and American space history and the communities they involve, but also in light of the "newer" space powers such as China, Japan, and India, who are now defining and writing their own narratives about their role in the project of space exploration. Like their

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

20. Mette Marle Bryld and Nina Lykke, *Cosmodolphins: Feminist Cultural Studies of Technology, Animals and the Sacred* (London: Zed Books, 2000).

21. Mikael Hård and Andrew Jamison, *Hubris and Hybrids: A Cultural History of Technology and Science* (New York: Routledge, 2005), p. xiv.

Western predecessors, Indians and Chinese commentators, for example, locate their own narratives about space travel to indigenous scientific and technological achievements that have both national and global import. Some Chinese writers are eager to emphasize the importance of China as the birthplace of rocketry in the pre-modern era, while Indian writers similarly stress the importance of heliocentric ideas to Vedic Sanskrit texts that long predate Copernicus.²² In their narratives, *Sputnik*, Gagarin, Apollo—these are all peripheral.

The case of the Indian space program specifically—but postcolonial studies in general—points to fruitful avenue of research for historians of technology grappling with the conundrums posted by multiple and conflicting narratives that make claims for the universal. A growing body of scholarship on the history, sociology, and anthropology of postcolonial science has rendered problematic such essentialist identifiers as “Western” and “colonial” when describing the development of science and technology outside of Europe and the United States. This body of postcolonial theory questions the authority of Western knowledge systems as being objective and universally valid. Warwick Anderson recently underscored that “postcolonial studies have enabled [a] sort of ‘decentered, diasporic, or ‘global’ rewriting of earlier nation-centered imperial grand narratives.” In other words, the field has re-phrased “[m]odernity within the framework of ‘globalisation’.”²³ As such, postcolonial theory prompts us to reconsider received wisdom about existing power relations and to avoid distinct markers as “colonial” and “indigenous” and instead focus on cultural and historical spaces where various types of interaction and exchange can occur. One way to begin such a project would be—in the words of postcolonial theorist Dipesh Chakrabarty—to “provincialize” Europe, i.e., to question the received structures that make it impossible for us to conceive of modernity (and by extension, one might argue, modernization) without reference to Europe. Chakrabarty argued that there is an “asymmetric ignorance” whereby historians within postcolonial locales must inevitably refer to Europe as a point of orientation without any expectation of the reverse.²⁴

Postcolonial thought makes possible a provocative rethinking of both the Indian space program and the history of space exploration in general. Western evaluations of the Indian space program have reflexively been grounded in assumptions about the marriage of poverty and high technology, i.e., a rhetorical question mark about why a nation so poor should have a space program at all. Because the project of space exploration has been a normatively Western idea, non-Western space programs such as the Indian space program are understood in relation to aspirations for a Western modernity. But the Indian space program, as manifested in its technology, its goals, and its architects, is a new kind of postcolonial modernity that is neither completely Western nor fully postcolonial—it is a vision of modernity that is decentered, constantly mutating, often contradictory, and globalized.²⁵ We see these processes in India in the 1960s as an influential domestic constituency “sold” their goals of self-reliance and social

22. See the Chinese references, see Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight* (Berlin: Springer, 2004). See also A. P. J. Abdul Kalam, *Wings of Fire: An Autobiography* (Hyderabad: Univ. Press, 1999); Gopal Raj, *Reach for the Stars: The Evolution of India's Rocket Programme* (New Delhi: Viking, 2000).

23. Warwick Anderson, “Introduction: Postcolonial Technoscience,” *Soc. Studies of Sci.* 32 nos. 5/6 (2002): 643-658.

24. Dipesh Chakrabarty, *Provincializing Europe: Postcolonial Thought and Historical Difference* (Princeton, NJ: Princeton Univ. Press, 2000).

25. For more on postcolonial modernities, see Arjun Appadurai, *Modernity at Large: Cultural Dimensions of Globalization* (Minneapolis: University of Minnesota Press, 1996). For the Indian context, see Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton: Princeton University Press, 1999).

benefit to consecutive governments. This was not easy given the significant amounts of international collaboration as well as domestic opposition from local advocacy groups who argued that India had more pressing concerns. By rhetorically linking the “modern” space program with poverty alleviation, the architects of the space program not only overcame local opposition but created a new vision of space exploration that could exist in the postcolonial context. If previously the question had been “*why should India have a space program when it is so poor?*” the answer was now “*India should have a space program precisely because it is poor.*”

Here, on the one hand, the space program with its advanced technologies allows India to be modern, a Western metric of modernity that harks back to the European “machines as the measure of men.” On the other hand, the Indian space program fundamentally depends on the existence of those markers that Vikram Sarabhai, the founder of the effort, identified as *less than modern*—poverty, illiteracy, and economic underdevelopment. This built-in tension is complicated by other factors, including migration (both of people and knowledge), evolving aspirations and metrics of “how to be modern,” and military and strategic questions. In a sense, what is modern about the Indian space program betrays complexities, contradictions, and considerations that are not easily parsed into conventional Western ideals of modernity.

The new postcolonial vision of space exploration is as much part of the fabric of space history as the more well-known American and Soviet models of technological hypermodernity.²⁶ These multiple perspectives on space travel suggests that our view of the long history of spaceflight may benefit from a standpoint that no longer privileges borders—demarkations that create rigid categories such as ownership and proliferation. The Indian space program was at the intersection of multiple flows of knowledge from a variety of sources including, of course, local expertise. Likewise, the history of spaceflight has been one of a consistent flow of knowledge and technology across (geographical) space and time—among Germans, Soviets, Americans, British, French, Chinese, Japanese, Indians, Israelis, Brazilians, etc. By rethinking the relationship between modernity and the postcolonial state, postcolonial thought challenges us to rethink the connection between modernity and spaceflight, and ultimately, to replace the “national” with the “global” when thinking of space exploration, an exercise that has become doubly important as dozens of developing countries in Asia, Africa, and the Middle East are now spending money on space exploration.

Writing on the history of nuclear power, Itty Abraham has noted that “practically no state travelled alone.”²⁷ 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 . . .²⁸

26. For a recent perspective on the intersection between European conceptions of space exploration and the colonial context, see Peter Redfield, *Space in the Tropics: From Convicts to Rockets in French Guiana* (Berkeley: Univ. of California Press, 2000).

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

28. Itty Abraham, “The Ambivalence of Nuclear Histories,” *Osiris* 21 (2006): 49-65. See also his “Notes Toward a Global Nuclear History,” *Economic and Political Weekly* 39 nos. 46-7 (November 20, 2004): 4,997-5,005.

Abraham's argument in favor of moving towards a global history of nuclear energy has much to offer to the case of rocketry and space exploration. The available evidence points strongly to similar processes of knowledge flows in the evolution of ballistic missiles and space technology.²⁹ 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.³⁰ 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, of course, 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.

I am not suggesting that we should ignore nations, national identity, or vital indigenous innovation. But I believe that nation-centered approaches, useful and instructive as they were, occlude from view important phenomena in the history of space exploration (and the history of technology, in general). My hope is that by de-emphasizing ownership and national borders, the invisible connections and transitions of technology transfer and knowledge production will become clear in an abundantly new way. Such an approach would inform a project encompassing the entire history of modern rocketry and space exploration, from the early twentieth century to the present focusing on Europe, America, Russia, and Asia. Most important, a global history of rocketry and space exploration would avoid the pitfalls of the “discursive battles” between nation-centered histories and open up the possibility to revisit older debates in the historiography of space exploration in entirely new ways.

Taking a global history approach—or for shorthand, a perspective that favors “flows over borders”—would allow historians to redirect their attentions in three ways: we can shift our gaze from nations to *communities*, from “identification” to *identities*, and from moments to *processes*. These three strategies, in one way or another, are inspired by the problems posed by historicizing the ambitions and achievements of emerging space powers, which operate in a postcolonial context where categories such as indigenous and modern are problematic.

In the space imagination, nations typically represent airtight constituencies despite evidence to the contrary that *communities* cutting across borders and cultures—national, institutional, and disciplinary—represent important actors and actions. The most obvious example here is, of course, the German engineers who formed the core of the Army Ballistic Missile Agency (ABMA) in the U.S. in the 1950s and who later went to direct the development of the Saturn V rocket that put Americans on the surface of the Moon. Wernher von Braun's

29. 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.

30. Siddiqi, *Red Rockets' Glare*.

team represented a unique mix of Germans and Americans who worked together with several different communities, from Boeing, North American Aviation (including its separate Space and Rocketdyne Divisions), Douglas Aircraft Company, and International Business Machines. These communities represented scientists and engineers, the government and private industry, and customers and contractors. In the rush to draw up airtight national narratives, we inevitably tend to gloss over the ambiguities and flows among each of these communities.

By highlighting communities, we can also avoid the reductive problems of essentialization (another way of talking about “national styles” of science and technology) that aspire to explain everything but fail to elucidate much.³¹ Instead, one might think in terms of fluid *identities* of scientists and engineers engaged in particular projects, identities which are not only tied to national identification but also regional, professional, cultural, religious, and educational markers, to name only a few categories. Using the perspective of mutable identity—different in different circumstances—we might be able to understand more clearly the ways in which space exploration has not only been a project of national consideration but also the result of communities (or individuals) who identify with a whole host of other markers that are not connected to national claims. In other words, it is a way to problematize the notion that space exploration represents national aspirations.

Finally, space historians have tended to focus on moments in history that define the story. For example, we use the notion of “achieving a capability” (the space equivalent of “going nuclear”) as shorthand for an encompassing a variety of complex *processes*. Whether it be the first indigenous launch of a satellite or the first test of a liquid hydrogen rocket engine, these moments become historical sign posts, turning points, bereft of the messiness inherent in the process of innovation. As a result, space history slips into the comfort mode of “what and when” instead of the more illuminating path of “how and why.” The focus on process would highlight the ambiguities instead of the binary poles (success, failure) inherent in isolated moments, thus encompassing both the material event and how the event becomes constructed as a historical moment.

Whither Determinism?

I will end this discussion by revisiting the period of space exploration that most resonates with both our community of historians and laypeople in general, the era commonly known as “the space race” spanning from the late 1950s to the late 1960s. My hope is to extend some thoughts on how an approach that favors flows over borders might open up new ways of thinking about the early history of space exploration. The actions of the two superpowers during the space race, and the way in which historians and laypeople have accessed that memory has cast a long shadow over humanity’s attempts to explore space *after* the era was over. In other words, Soviet and American achievements in space over a period of roughly a decade, spanning *Sputnik*, Gagarin, and the Apollo lunar missions, have assumed a kind of normative historical function in the broader fifty year history of space exploration. Our methodological tools, analytical tropes, and even future aspirations for everything that came after are usually measured against the tools, tropes, and aspirations related to what went before. Historians have long argued that the space race was an anomaly—with a set of peculiar and given conditions which have never been

31. For “national styles,” see Jonathan Harwood, *Styles of Scientific Thought: The German Genetics Community 1900-1933* (Chicago: University of Chicago Press, 1993).

repeated, but we have been less eager to interrogate the legacy of this anomaly for our scholarship on spaceflight in general.³²

No interpretive strategy is more ubiquitous and dominant in the narrative of space history than technological determinism. Although it has lost much if not all its resonance in most other subfields of the history of technology, it still retains a strong appeal as a powerful and plausible explanatory model for the space race.³³ Determinism has played out in two ways in the literature: first, as a tool to explain the unique trajectory of the space programs of the Soviet Union and the United States, particularly, their reactive relationship to each other, and second, as a framework to suggest that space achievements, such as *Sputnik* and Apollo, profoundly “affected” society in a unidirectional manner. For space historians, “the dilemma of technological determinism,” to quote Merritt Roe Smith and Leo Marx, has not been about its explanatory power but rather about the degree to which some events were more deterministic than others. Newly available evidence in the post-Cold War era from opened archives on both sides would seem to reinforce older claims about a “race” that depended on an appreciation of parallel actions by each side—which were often erroneous in nature—a kind of “determinism of perception.” There are any number of examples on both sides of the equation, especially the events from 1957 to 1969, that suggest at least a weak form of this connection between the two space programs. One side developed a certain capability in spaceflight, often in reaction to the other which had developed a similar ability—a dynamic that was especially true for military and human spaceflight, the two most dominating directions of activity of that period.³⁴

The notion that external events affected decisions of Soviet and American policy-makers and led them to adopt specific decisions explains actions at a very broad level but fails as a tool to fully understand the process of innovation at mid levels, such as, for example, why space program managers adopted particular technologies and why scientists and engineers focused on particular paths of development. Indeed, few phenomena on both sides follow parallel and proportional paths of development, as one would expect if the space race were truly deterministic. For example, neither the Soviet decision to adopt liquid hydrogen as propellant nor their selection of the lunar orbit rendezvous option for a Moon landing follow the expected pattern of response to American imperatives (or even perceptions of American imperatives). These paths were taken because of a mix of factors: local industrial capacity, competition among designers, and perceived tradeoffs between payload weight and mission requirements. Here, American efforts to develop a liquid hydrogen engine (in the form of the Centaur upper stage) becomes one of many forces which affected Soviet decision-making.³⁵ Strictly deterministic

32. For comprehensive and recent surveys of space historiography, see Roger D. Launius, “The Historical Dimension of Space Exploration: Reflections and Possibilities,” *Space Policy* 16 (2000): 23–38; Asif A. Siddiqi, “American Space History: Legacies, Questions, and Opportunities for Future Research” in *Critical Issues in the History of Spaceflight*, eds. Steven J. Dick and Roger D. Launius (Washington, DC: NASA, 2006), pp. 433–480.

33. For the obvious and standard arguments against technological determinism, see Wiebe J. Bijker et al., eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT Press, 1987); Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

34. See for example, William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998); T. A. Heppenheimer, *Countdown: A History of Space Flight* (New York: John Wiley & Sons, 1997); Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945-1974* (Washington, DC: NASA, 2000).

35. Asif A. Siddiqi, “The Other Side of the Space Race: Perception and Decision-Making in the Soviet Space Program,” paper presented at the annual meeting of the Organization of American Historians (OAH), March 30–April 2, 2000, St. Louis, Missouri.

approaches also fail to explain events in the later era of the space age, for example, the development of a vibrant Indian space program and the lack of one in Pakistan. Both nations had substantive intellectual and industrial foundations to embark on space research in the 1960s but only India opted to develop a domestic launch capability. Pakistan never responded to the Indian challenge.

This approach, where the relationship between space and broader society is couched in terms that are unidirectional or deterministic has endured for two principal reasons: the heightened importance of nationalist narratives in the history of space exploration, and space historians' general reluctance to see space technologies as part of broader social and cultural concerns. As such, an interpretive approach that favors flows over borders, a kind of global history of spaceflight, would allow historians to avoid both these pitfalls. For example, the Soviet decision to develop liquid hydrogen can be explained more fully by integrating a number of different approaches: Cold War action-reaction determinisms, the social and cultural construction of technologies, and flows of knowledge across borders and time. The latter can be traced through genealogies of knowledge going back decades, discerned in Soviet scientists' perception of Western media accounts of NASA's liquid hydrogen development, and seen in exchanges between indigenous but different Soviet communities that had a vested interest in this new technology. A problem, previously seen as a relatively simple action-reaction dynamic is now seen as a much more complex and contested process. In other words, interpretive approaches derived from the idea of a global history of spaceflight may have much utility even for that era which we tend to assume has no global(ized) component, the era of the Cold War space race.

Conclusions

My goal in this paper has been to explore the relationship between nationalism and spaceflight, problematize it, and, using insights from that process, suggest some possible new avenues in the practice of space history. Although nationalist narratives (and nationalism) have been essential to space exploration and the retelling of space exploration, the connection has been all but ignored by space historians. Deconstructing this relationship has become more urgent as a flotilla of non-Western nations are becoming more visible in the endeavor of space exploration, rendering the old Cold War dynamic—both in reality and in memorialization—less powerful in its efficacy. Deterministic explanations from the Cold War, which often rely on simplistic binary and oppositional divisions, although useful to some degree, display their limitations as ways to fully explain the complexities of space exploration both during and after the Cold War. Without disposing of technological determinism, I would urge historians to incorporate a broader matrix of approaches, including particularly the highlighting of global flows of actors and knowledge across borders and identities. Ultimately, this approach might lend itself to constructing for the first time a global and transnational history of rocketry and space travel. Since a global history would theoretically be decentered and a nation's space program rendered as a more nebulous transnational process, one might expect a multitude of smaller (and ambiguous) processes and meanings to become visible. With a new approach grounded in a global history of spaceflight, we might learn much more about how individuals, communities, nations perceive space travel, i.e., how they imbue space exploration with meaning, and especially how those meanings are contested over and repeatedly reinvented as more and more nations articulate the urge to explore space.