SECTION VII

POSTSCRIPT

AFTERWORD: COMMUNITY AND EXPLANATION IN SPACE HISTORY (?)

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> *The deep significance of certain problems for the advance of mathematical science in general and the important role which they play in the work of the individual investigator are not to be denied. As long as a branch of science offers an abundance of problems, so long is it alive; a lack of problems foreshadows extinction or the cessation of independent development. Just as every human undertaking pursues certain objects, so also mathematical research requires its problems. It is by the solution of problems that the investigator tests the temper of his steel; he finds new methods and new outlooks, and gains a wider and freer horizon.*
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> —David Hilbert, "Mathematical Problems," 1900

Hilbert, a pivotal figure in mathematics in the late 19th and early 20th centuries, addressed these thoughts in 1900 to the International Congress of Mathematicians in Paris—a quadrennial, premier gathering of practitioners.[1] In this year, poised at the crossing between centuries, Hilbert and his colleagues self-consciously took stock as to professional ethos, standards, and research. Holding center stage, Hilbert presented (in what was recognized then and since as) one of the most significant templates for research in mathematics, providing a conceptual outlook for his discipline and a list of 23 outstanding problems that engaged, in different ways, the foundations of the field. These problems, for Hilbert, served as vital links among practice, theory, and tacit notions of professional community—and, more broadly, connected all of these to European culture.

Hilbert's moment, of course, is not ours. The early modernist temperament, confidently ascendant, shines through—the application of reason seems to confront few limits. Too, the "profession" as social and intellectual instrument

1. David Hilbert, "Mathematical Problems: Lecture Delivered before the International Congress of Mathematicians at Paris in 1900" (trans. by Dr. Maby Winton Newson), *Bulletin of the American Mathematical Society* 8 (1902): 437–479.

(with scientific disciplines as model) seems to promise a progressive, well-oiled engine to extend and secure reason's reach—indefinitely. Hilbert's moment reminds us of the arc (choose your geometric tracing) from then to now and of the undermining of that world's foundational assumptions. Late modern and postmodern perspectives have made problematic the relationship among researcher, subject, and knowledge claims—the ontology and epistemology of the "true" and the "objective"—as well as the idea of the profession as self-contained and self-regulated in its pursuits.

Hilbert's thoughts and their context provide one of many possible points of departure for reflecting on notions of discipline and profession in space history. The aim here is not an extended comparison with that earlier example, but a simple reminder of the history of these inventions and the complex of issues embedded within them. Nor is this afterword a critique of the seminar's papers, separately or collectively, nor is it a meta-literature review. Rather, it is an attempt to foreground assumptions that lingered backstage in many of the papers, assumptions that speak to our sense of what space history is and does. The "(?)" in the title above signals one part of this examination: How and why we self-identify as "space history" rather than as space "something else"—and what such a choice implies.

All of these bits of critique, of course, are right out of the big playbook of analytic moves—a (pseudo-)knowing voice taking us from background to foreground, dark to light, fuzzy to sharp—yet necessary and useful as part of thinking about "critical issues." Reviews of this type are the rare occasions when "we" and "I"—as much as our subject matter—are preeminently our concern.

This discussion will touch on two intertwined themes central to notions of discipline and profession (hereafter, for concision, I will use "discipline" to speak for both), yet largely submerged in this "Critical Issues" conference: community and explanation (our equivalent of Hilbert's problems). The former, with a nod to Robert Merton, refers to norms and shared practices, and the latter to how we conceptually establish ourselves in relation to history and related disciplines and how we frame the aims of inquiry. In outline, these themes almost are banally familiar; in application to space history, they may illuminate "we" choices that should be explicit rather than implicit.

COMMUNITY

Is there something missing in our sense of community, in the way we approach our research domain?

Such a question may seem off. The very fact of this seminar, of a thoughtful focus on critical issues, signaled health and intellectual robustness. It reflected a shared interest (at least to the level of subject matter) among scholars from a range of disciplines. In narrative and argument, the individual papers were

"right on," embodying a knowledgeable engagement with the best methodological practice. And as a topical map of the field, the seminar provided a thorough survey.

Yet there were two prominent lacunae: a *collective* self-awareness and openness on the importance of methodology—of presenting, testing, and critiquing the conceptual tools that define a field as a domain of inquiry—*and* of the core aims of research. In short, the seminar shied away from "discipline"—of explicit correlation between methods and aims, a communal orientation and set of commitments that distinguish a discipline from a subject area. Open, systematic exchange, rumination, and struggle on points of method and explanatory focus (and attaching value to such) are integral to community practice within a discipline. To suggest the relative absence of such a mindset at the seminar is not to cast aspersion, but to bring to the fore an important choice: discipline (or more accurately, subdiscipline) or subject specialty? This choice was a largely unspoken tension within the seminar: we assumed discipline but performed as subject specialty.

Does this distinction or choice matter? Space history as subject specialty can be commodious, welcoming a range of scholarship under a big tent—the seminar was a showcase. Under this mode of practice, we can learn from each other, then head back to our respective subfields—a kind of intellectual tourist model of research. And that may be enough. Space history best may be pursued as loose confederation sans discipline. But does the notion of discipline offer us opportunities worth considering? I'll highlight a few issues associated with method first, and then with aims and explanation.

Method, of course, is not an end in itself. In recent years, its reputation has edged, on occasion, into a preoccupation with dreary, constant self-reference and culture-war comedy (recall Alan Sokal's parody of postmodernism and deconstructionism in *Social Text*, a journal edited by the noted Stanley Fish).[2] And, of course, to refer to method abstractly, without accounting for the many variants that have effloresced since the early 1960s, is to risk reduction and simplicity (Margaret Weitekamp's essay, nonsimplistically, gives one overview of this landscape). But the point for us is primarily attitudinal—to note that a primary motivation for the boon in critique was a fundamental (and from a disciplinary perspective, necessary) question: How do we know and justify what we know (about the world)?[3] Taking that question seriously is not to turn historians (or other disciplines represented at the seminar) into phi-

2. Alan Sokal, "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity," *Social Text* 46/47 (1996): 217–252.

3. For one recent overview of the centrality of epistemology and of the genealogy of critique in relation to the modern and postmodern, see Bruno Latour, "Has Critique Run Out of Steam: From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225–248.

losophers, but to foreground the importance of method in any discipline's practice—in establishing the constructs and categories through which we do research. Such a concern, for example, was at the heart of the formation of science and technology studies. There, method served two functions: to elevate epistemological issues as just noted and, equally important, as a focus for creating a sense of community among a congeries of disciplines. Method and explicit talk about method provided a means for drawing disciplines together and connecting and building on each community's research perspectives. This orientation and the norm which is its corollary led to the designation of "studies" to characterize this research enterprise.

With this "Critical Issues" seminar, space history, I think, faces, à la Yogi Berra, the simple recognition that there is indeed a fork in the road.[4] The seminar was notable in that this norm regarding methodology (making how we do research as much a part of the discussion as the subject of research) was largely absent. How, for example, do we fruitfully interconnect history, political science, sociology, and policy studies (the four major disciplines represented at the seminar)? What are the issues arising from—the goals for—such interconnection? Are we after merely some vague expansion of "context"? Or can explanatory aims be integrated? Are there research projects that emerge from such interconnection that confront basic issues of historical change and explanation? To entertain these (or similar) questions is to probe the possibilities of discipline and space history as multidisciplinary crossroad.

The supercilious "(?)" I keep pinning on the rump of space history is a suggestion that self-description matters—as it did with science and technology studies, women's studies, and other domains of research—that it is a marker of our notion of community (subject specialty or [sub]discipline); goals; and organized, professional self-reflection. If we wish to emulate these examples, then we might rethink how we designate what we do—to self-identify in a way that embraces a range of disciplines in a common enterprise. Space history, hereafter in this essay, will stand, awkwardly, for history as well as a constellation of other disciplines interested in the cultural meaning and manifestations of space activity.

Discipline is more than branding—as with that bygone image of the teacher rapping knuckles with a ruler, it imposes restraints, or, at the very least, "stop and think" road markers. One of those is a commitment to clarity in what methodological tools are in play and how they interrelate. In the seminar, this issue most often came to the fore in the several papers that sought to join a policy voice (concerned with the prescriptive and/or normative) and either a historical, political science, or sociological voice (concerned, primarily, with description and explanation). These two voices involve a different use of time and

4. For those unfamiliar with Yogi Berra wisdom, the aphorism is: "If you come to a fork in the road, take it."

tense, approach to conditionals and normative claims, and modes of argument. They have, succinctly, different narrative standards. To shift casually between these narrative strategies is to muddy what is at stake analytically in space history as subject matter—and to blur the distinction between the methods and aims of explanation and the elucidation of options in service of policy.

These concerns raise a deeper consideration regarding notions of discipline and space history: the stance of practitioners to subject matter and, especially, to participants in that subject matter. As noted by Roger Launius, many writers on space history conflate their research with a "fer it or agin it" normative stance on space exploration's social or political value.[5] The prevalence of this stance, of the conflation of the normative (which presumes at least a partial overlap between analytic practitioners and participants) with narrative explanation, is profoundly antidisciplinary—that is, undermines discipline's formative characteristic: independence in intellectual standards.[6] In an important but not often cited essay, "Independence, not Transcendence, for the Historian of Science," Paul Forman addressed a closely similar set of relations in history of science.[7] His argument was that for history of science to be *history* of science it had to frame questions, methods, and aims distinct from those of science. History of science, if it was to be a profession (sporting more than the social trappings of self-regulation), had to separate itself from providing social and intellectual justification for (or dismantling of) science and scientists' self-image. It had to be thoroughly, completely historical. The thick veins of a similar predicament run through space history. If space history leans toward discipline rather than subject specialty, then issues of practice and boundary setting will need to come to the fore.

EXPLANATION

Let's take as given that understanding and explaining change—socially, culturally, historically—is a fundamental task of our effort, that description *and* causality loom large. To think in terms of discipline, then, is to ask in what ways space history might define its research domain and to focus an

5. Roger D. Launius, "The Historical Dimension of Space Exploration: Reflections and Possibilities," *Space Policy* 16 (2000): 23–38.

6. This point is not to say that history cannot be "useful" or be applied to a wide range of cultural concerns. The notion of utility, too, has been a central methodological issue for sociology and political science since their formation as disciplines in the 19th century. The issue is whether "usefulness" provides the right intellectual basis for a discipline that aims toward explanation. For one of the most prominent statements on history and its application, see Richard Neustadt and Ernest May, *Thinking in Time: The Uses of History for Decision-Makers* (New York: Free Press; London: Collier Macmillan, 1986). Importantly, for Neustadt, "usefulness" is a byproduct of disciplinarity, not an aim.

7. Paul Forman, "Independence, not Transcendence, for the Historian of Science," *Isis* 82 (1991): 71–86.

explanatory enterprise.[8] In contrast to space history as subject specialty, this slight shift of the kaleidoscope has ramifications.

Consider Walter McDougall's seminal . . . *The Heavens and the Earth.*[9] This work, I think, is most often viewed as an exemplar of contextualization, of rescuing space history from the modalities of program and institutional history and binding the subject to the perspectives of diplomatic history and political science. For McDougall, the emergence of spaceflight was not a subplot, but a major narrative thread of the all-encompassing drama of the Cold War. Less noted, but more germane here, is that McDougall's work was not merely context-expanding and thesis-driven, but broadly explanatory—an identifiable set of causes (preeminently ideology, new social/technical tools associated with systems thinking, and an uptick in the concentration of power in the federal government and willingness to apply it—in combination, technocracy) structured historical description and shaped historical change on a broad cultural scale. It was an explanatory framework that, with national variations, provided a common way of seeing events in the U.S., USSR, and Europe and that yielded good, scholarly fruit: a coherent (albeit contestable) notion of period.[10]

It is a revealing feature of space history scholarship that this call to explanation generated little to no resonance in the community.[11] The work was absorbed into mantras for "context" (an improvement over "internalism," but still a half-rigorous notion for a research program) and into quasi-policy research agendas (Why did spaceflight diminish in the U.S.'s political agenda?). Vestigial trails of this absorption were evident throughout the seminar. Embedded in this stance is a stultifying (and unexamined) research proposition: that with the undoing of the 1960s framework for spaceflight, space history itself has no deep relation to explanatory accounts of change in the world after 1970 and, thus, provides no distinctive vantage onto recent history. Or, stated somewhat differently, the field has no overarching explanatory outlook.

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8. For adherents to history-as-special-kind-of-narrative, explanation as an aim of inquiry is not a given. The description versus explanation stands in history have, well, a tangled history. The best account, seen through the lens of the "objective," is Peter Novick, *That Noble Dream: The "Objectivity Question" and the American Historical Profession* (Cambridge: Cambridge University Press, 1988). For an enlightening but philosophically muddled defense of description and its relation to explanation, see Allan Megill, "Recounting the Past: 'Description,' Explanation and Narrative in Historiography," *American Historical Review* 94 (1989): 627–653.

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

10. These views were more succinctly argued in an earlier essay: Walter McDougall, "'Technocracy and Statecraft in the Space Age: Toward the History of a Saltation," *American Historical Review* 87 (1982): 1010–1040.

11. To be clear: My claim is that the space history literature seems to have had little interest in the explanatory element of McDougall's work. Science and technology studies, Cold War studies, and diplomatic history did engage and integrate the issues of explanation posed by McDougall into the problematics of their respective fields.

If this is true, then space history is history at the margins—or, more generously, serves as a source of case studies for other disciplinary projects (for example, for sociology in understanding organizations that manage risk or pursue complex problems, or for political science in unpacking decision-making in technology-infused modern polities) or as a site for exploring important but largely disaggregated themes: exploration, innovation, and so on. This may be the proper research stance—but it should be arrived at through open examination, not happenstance. If space history is to have a self-identity, to be discipline-oriented, then a concern with explanation, with the relation of space history to macrostructures of change, seems a crucial starting point. This is not to say that the only "good" history is grandly explanatory, that theory reigns over the hard work of research—but rather that models of explanation, and debate about them, are central to discipline.[12]

Perhaps, historiographically, the Cold War lulled us into anticipating an explanatory framework (in that case, the centrality of state action joined to an overweening interest in science and technology) that was conceptually straightforward, yet capable of informing and being informed by a variety of "local" histories. Is there an explanatory framework, post–*Heavens and the Earth*, which offers us the start of a (contingent) synthetic view of space history and currents of change in recent decades? Significantly, McDougall hinted at the necessity of new interpretive frames nearly contemporaneously with publication of *Heavens and the Earth* in his article "Space-Age Europe: Gaullism, Euro-Gaullism, and the American Dilemma."[13] Here he argued that to comprehend the European approach to space, the market as well as the state needed to be incorporated into post-Apollo and broadly geopolitical analyses.

But a deeper, sustained response to the problem of post–World War II periodization arose in other scholarly quarters—in sociology, literary criticism, and philosophy—as part of the tangled reflections on demarcating the modern from the postmodern. For discussion and to retain a focus on explanation in space history, I will pull only a few threads from this skein. Postmodernism (by no means monolithic) is best known for its epistemological and ontological claims, particularly Francois Lyotard's dictum that grand narratives (transcendent certainties about human nature, culture, knowledge

12. Exemplars of such history abound in which explanation, problems, research, cases, and debate create a disciplinary ecology. A beautiful recent snapshot of such scholarship is captured in Leonard Rosenband's retrospective on David Landes's seminal *The Unbound Prometheus*: Leonard Rosenband, "Never Just Business: David Landes, *The Unbound Prometheus*," *Technology and Culture* 46 (2005): 168–176. Seminar contributor Phil Scranton has been at the center of a related research ecology for most of his career through his scholarship on innovation, business, and U.S. industrialization.

13. Walter A. McDougall, "Space-Age Europe: Gaullism, Euro-Gaullism, and the American Dilemma," *Technology and Culture* 26 (1985): 179–203.

of the "real") no longer could withstand scrutiny.[14] But, more important for our purpose here, it advances a set of causes that provide tentative reference points for description and explanation of contemporary culture (generally, and not coincidentally for space history, taking the 1970s as watershed). And these causes that shape the postmodern condition ring familiar: that, relatively, economic and political power have shifted from states to markets; that communications technologies and systems (and that large-scale technological systems of many types) have been integral to this shift; and that, in combination, these factors have remapped processes of cultural production, changing the ways in which states, corporations, communities, ethnic groups, and individuals exercise power and create identities. The acceleration of actions and reactions across national borders, of the collapse of geographic distance, of the sense that everyone and every place potentially seem proximate become, in this frame, distinctive features of a global cultural landscape. This new condition mirrors, with steroids injected, McLuhan's infamous "global village," a notion partially rooted in the beginnings of the Space Age. That postmodernism has attempted to specify a template of material causes for such phenomena is not too surprising. The leading exponents draw heavily on the Marxist intellectual tradition that links base to superstructure, economics to culture.[15] Too, in considering causes and explanation, postmodernism must be seen in conjunction with its close cousin, globalism. The two roughly map onto each other—but with one important difference in emphasis: globalism addresses more directly the functioning of political and economic power on the transnational stage, particularly as regards the U.S. dominant position in the aftermath of the Cold War.

Should these turns of thinking be of interest to space history? Readers already will have their pointy objects handy to prick the above notions of any seeming juice;—at minimum, we might skeptically ask if such causal assertions have empirical weight. But as a set of ideas, as a heuristic, I think this framework is provocative for space history, suggesting ways to explore notions of causation and change that (re)integrate the field into broader structures of meaning and reconceptualize our sense of the problem map of the field.[16]

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14. See Jean-Francois Lyotard, *The Postmodern Condition: A Report on Knowledge* (Minneapolis: University of Minnesota, 1984 [originally published in 1979]), and Frederic Jameson, *Postmodernism, or, The Cultural Logic of Late Capitalism* (Durham: Duke University Press, 1991).

15. The most lucid and extended account of the interconnections among epistemology, causes, and cultural effects in the postmodern is David Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change* (Oxford, England: Basil Blackwell, 1989).

16. One case study that attempts to connect space history with the interpretive frames of postmodernism and globalism is Peter Redfield, "The Half-Life of Empire in Outer-Space," *Social Studies of Science* 32 (2002): 791–825. See also Martin Collins, "One World . . . One Telephone: Iridium, One Look at the Making of a Global Age," *History and Technology* 21 (2005): 301–324.

At a simple level of correspondence, elements of space activity seem central to postmodern/global analysis: a variety of space-based transnational technical systems—communications, navigation, and surveillance and monitoring—are implicated in their material and causal account of the how and why of recent cultural change. Notably, these applied space systems—with origins in markets, civilian government, and military and intelligence agencies—have not been, relatively, the center of policy debate (at least in the U.S.), nor the perceived strategic focus of scholarship. Through the lens of postmodernism/globalism, though, one is inclined to start from the proposition that these undertakings, individually and collectively, are crucial sites for research, for understanding the very composition of a post-1960s world order. This emphasis on the applied, on systems of culture and technology that intersect with the global "everyday" (including constructions of power and identity), if taken seriously, de-centers NASA and human space exploration as the signature markers of geopolitics—an orientation that aligns with the halting course of decisions and funding in post-Moon-landing space history—yet provides a rich, alternative framework for making the "international" a central area of investigation.

Conceptually, postmodernism and globalism, too, reemphasize, in comparison to the focus on state-centered accounts in Cold War space history, the centrality of markets and culture (in particular, their distinctive interrelation in the postmodern) as loci of change. To say this is almost to be "history 101" obvious. But the persistent legacy of Cold War literature seems to have pushed the obvious to the margins. Regarding markets, postmodernism/globalism highlights the issue of developing better accounts of state-market configurations in the post-Moon-landing years as a means to situate all space activities, including human space exploration. Thus considered, NASA's travails in the 1970s and after might be examined as part of a broader framework of change, rather than as (often, normatively, bemoaned) exemplars of half-measure policy-making and institutional diminishment. This, I think, put somewhat differently, is Asif Siddiqi's point on the "problem" of Apollo in space history scholarship.

Regarding culture, postmodernism points us to a fundamental (and not yet fully articulated) question in the field: How do we analytically frame the interconnections between space activity and culture? Is this primarily a dynamic in which cultural tropes broadly circulate to be plucked, adopted, and made instrumental by a range of groups (individuals, civil associations, markets, government)? Is such a process marked by a mutual perfusion of the real and fictional—with broad consequences for creators and consumers of space-related cultural productions? Or, more narrowly, is space culture merely an overlay, a gloss, a distraction from the meaty acts of political and business decision-making? In considering such questions, postmodernism advances an important claim: that culture, especially in the post–World War II years,

serves not primarily as a set of restraints but becomes an active instrument, a resource to be deployed by the powerful and, in the information age, by the less powerful. Culture, thus, is not only precepts, assumptions, ways of doing, but is as protean and purpose-driven as capital—and is as central to macrostructures of change.[17] Seen from this angle, culture is not a side motif in space history, but a central explanatory problem.

These reflections are not meant to suggest that we swallow the bait and barb of postmodernism and globalism claims without care. Rather it is, first and foremost, to point to the value of generating our own conscientious engagement with scholarly discussions of historical change—with a suggestion that postmodernism and globalism make provocative foils. Second, it is to acknowledge the special place of historical (and other) research in situating and grounding explanatory claims in the empirical. This latter task is not insignificant. In the case of postmodernism/globalism, an outlook primarily developed by disciplines other than history, it theorizes about but often fails to engage the tough actualities of how technology, markets, states, and cultures

17. A little more needs to be said here. Consider two prominent definitions of culture.

First, Clifford Geertz: "The concept of culture I espouse . . . is essentially a semiotic one. Believing, with Max Weber, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretative one in search of meaning. It is explication I am after . . ." (Clifford Geertz, *The Interpretation of Cultures: Selected Essays* [New York: Basic Books, 1973], pp. 4–5).

Second, Raymond Williams: "Culture is ordinary: that is the first fact. Every human society has its own shape, its own purposes, its own meanings. Every human society expresses these, in institutions, and in arts and learning. The making of a society is the finding of common meanings and directions, and its growth is an active debate and amendment under the pressures of experience, contact, and discovery, writing themselves into the land. The growing society is there, yet it is also made and remade in every individual mind. The making of a mind is, first, the slow learning of shapes, purposes, and meanings, so that work, observation and communication are possible. Then, second, but equal in importance, is the testing of these in experience, the making of new observations, comparisons, and meanings. A culture has two aspects: the known meanings and directions, which its members are trained to; the new observations and meanings, which are offered and tested. These are the ordinary processes of human societies and human minds, and we see through them the nature of a culture: that it is always both traditional and creative; that it is both the most ordinary common meanings and the finest individual meanings" (Raymond Williams, *Culture and Society* [New York: Columbia University Press, 1958]).

These notions of culture were used implicitly and effectively in a number of the essays, especially in those that focused on institutions and communities (including those by Diane Vaughan, Todd La Porte, Phil Scranton, and Alexander Brown). Postmodernism/globalism does not upend these analytic frameworks but does claim that "capital" and new communications technologies (to be unwarrantedly deterministic) have assumed an enhanced role in lifting and disconnecting cultural products from their local settings, resulting in two strata of culture: that associated with capital and global information flows and that associated with the "traditional" and the local. This dynamic is the core idea in a range of global "clash" literature, including work by Samuel Huntington, Bernard Barber, and Thomas Friedman.

interrelate, of how technological innovation occurs and integrates with culture, and of how the local and global are variously co-related.

But those are tepid aspirations and disciplinary goals. More, I think, postmodernism and globalism highlight the ways in which space and associated undertakings are central to the modern condition, and provide crucial sites of research for an explanatory enterprise. Three longstanding, deep cultural-technical themes of space history—exploration, control, and systems—also are integral to unpacking and giving substance to postmodern and globalism accounts. Space history, too, raises issues that these literatures largely sidestep: for example (and crucially), analytic engagement with the meaning and import of military and intelligence space activities (especially in relation to the U.S.). The scale of these activities (in terms of funding, geospatial reach, and range of technologies) and, for a significant fraction, their relative invisibility behind barriers of security classification, pose important issues for models that seek to interconnect states, markets, and global technical systems. As Stephen Johnson's essay ably and starkly details, great chunks of military and intelligence space activity are shadowed. The emphasis in the postmodern has been on the *public* transnational modalities of interconnection. But what are we to make of the largely secret global systems of surveillance and control, of their interconnections with markets, of their integration into models of explanation and change? Given classification barriers, this now may be an unresearchable question, but as a discipline, it is of the first consequence to pose it.[18]

I have offered here at least two layers of idiosyncrasy: my own reading of the present state of the field and of possible responses and questions that ask us to consider the implications of subject specialty versus discipline. My goal here was not to make the case for a particular formulation of community, but to argue that we face a substantive choice—and that space history possesses the intellectual heft to make that choice important. We have come to a fork in the road. Take it.

18. An important reconnaissance of this problem in the Cold War and after (especially post-9/11) is Peter Galison, "Removing Knowledge," *Critical Inquiry* 31 (2004): 229–243. On the comparative scope of unclassified and classified information in the United States, the money quotation is: "In fact, the classified universe, as it is sometimes called, is certainly not smaller and very probably much larger than this unclassified one" (p. 229). The "unclassified one" that Galison uses as a point of reference is the total estimated page count of *all* material in the Library of Congress: 7.5 billion pages. The significance of classified activity in understanding the Cold War or "postmodern" eras is yet to be fully mapped.

About the Authors

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and chairman of the department (1984–86). Since 1985, he has held the concurrent position of chairman of the Advisory Committee to the Smithsonian Videohistory Program, and he spent the summer and fall of 1991 as a visiting member of the Institute for Advanced Study in Princeton. His major research interests are in the origins and development of modern astrophysics during the 20th century and the origins of the space sciences in the V-2 and early Aerobee eras through the International Geophysical Year (IGY). He specializes as well in the history of space astronomy and in the government patronage of science in the postwar era. He recently has published a major biography of the Princeton astronomer Henry Norris Russell, which has been critically acclaimed. DeVorkin has authored over 100 scholarly papers and has authored, edited, or compiled 9 monographs in the history of, and education in, astronomy and the space sciences. His works have appeared in the *Journal for the History of Astronomy, Sky & Telescope, Isis, Scientific American, Minerva, Science, Historical Studies in the Physical Sciences, Physics Today,* and elsewhere. He holds a Ph.D. in the history of science from the University of Leicester (1978), a master of philosophy in astronomy from Yale (1970), an M.S. in astronomy from San Diego State College (1968), and a B.S. in astronomy/physics from the University of California, Los Angeles (UCLA) (1966). His present external and research activities are supported by an ongoing National Science Foundation (NSF) grant and a newly approved scholar's grant from NSF (with Patrick McCray). An educational outreach grant from NASA is pending. His present major contract is with National Geographic for a book on the Hubble Space Telescope.

Steven J. Dick is the Chief Historian for NASA. He obtained his B.S. in astrophysics (1971) and his M.A. and Ph.D. (1977) in history and philosophy of science from Indiana University. He worked as an astronomer and historian of science at the U.S. Naval Observatory in Washington, DC, for 24 years before coming to NASA Headquarters in 2003. Among his books are *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (1982), *The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science* (1996), and *Life on Other Worlds* (1998). The last book has been translated into Chinese, Italian, Czech, and Polish. His most recent books are *The Living Universe: NASA and the Development of Astrobiology* (2004) and a comprehensive history of the U.S. Naval Observatory, *Sky and Ocean Joined: The U.S. Naval Observatory, 1830–2000* (2003). The latter received the Pendleton Prize of the Society for History in the Federal Government. He also is editor of *Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications* (2000) and (with Keith Cowing) of the proceedings of the NASA Administrator's symposium *Risk and Exploration: Earth, Sea and the Stars* (2005). He is the recipient of the Navy Meritorious

Civilian Service Medal. He received the NASA Group Achievement Award for his role in NASA's multidisciplinary program in astrobiology. He has served as chairman of the Historical Astronomy Division of the American Astronomical Society and as president of the History of Astronomy Commission of the International Astronomical Union, and he is the immediate past president of the Philosophical Society of Washington. He is also a member of the International Academy of Astronautics.

Slava Gerovitch received two doctorates in the history of science and technology from the Russian Academy of Sciences (1992) and from MIT (1999). His book *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (2002) received an honorable mention from the American Association for the Advancement of Slavic Studies for an outstanding monograph in Russian, Eurasian, or East European studies. He published articles on the history and historiography of Soviet science and technology in the journals *Technology and Culture*, *Social Studies of Science*, and the *Russian Review*, and in the collections *Science and Ideology*, *Cultures of Control*, and *Universities and Empire*. Currently, he is a research associate at the Dibner Institute for the History of Science and Technology at MIT, serving as the principal investigator on the NSF-funded project "Trusting the Machine: Onboard Computing, Automation, and Human Control in the Soviet Space Program."

Peter L. Hays is a policy analyst supporting the planning integration division of the National Security Space Office. A retired lieutenant colonel with 25 years of service in the U.S. Air Force (USAF), his previous positions include executive editor of *Joint Force Quarterly*, professor at the School of Advanced Airpower Studies (SAAS), associate professor of political science and division chief for the international relations and defense policy curriculum, and director of the USAF Institute for National Security Studies. He holds Ph.D. and M.A.L.D. degrees in international relations from the Fletcher School of Law and Diplomacy at Tufts University and an M.A. in defense and strategic studies from the University of Southern California. A 1979 honor graduate of the USAF Academy, Hays was a command pilot with over 3,200 hours of flying time, primarily in the C-141 Starlifter. He has focused his studies and research on U.S. national security space policy by developing space policy courses at the USAF Academy, SAAS, National Defense University, and George Washington University; serving as a research assistant at the White House Office of Science and Technology Policy and the National Space Council; and writing a dissertation on the U.S. military space doctrine. Hays is author of *United States Military Space* (2002) and is a coeditor of *Space Power for a New Millennium* (2000), *Countering the Proliferation and Use of Weapons of Mass Destruction* (1998), and the seventh edition of *American Defense Policy* (1997).

Stephen Johnson is an associate professor in the Space Studies Department of the University of North Dakota (UND) teaching military space, space history, and management and economics of space endeavors. He is the author of *The United States Air Force and the Culture of Innovation, 1945–1965* (2002) and *The Secret of Apollo: Systems Management in American and European Space Programs* (2002). He is also the editor of *Quest: The History of Spaceflight Quarterly.* His current research involves the development of cognitive psychology and artificial intelligence, space industry management and economics, dependable system design, and the history of space science and technology. Prior to coming to UND, he worked in the aerospace industry for 15 years, managing computer simulation laboratories, designing space probes, and developing engineering processes. He received his doctorate in 1997 in the history of science and technology from the University of Minnesota, where he was also the associate director of the Babbage Institute for the history of computing.

John Krige is the Kranzberg Professor in the School of History, Technology, and Society at the Georgia Institute of Technology, Atlanta, Georgia; for academic year 2004–05, he was the Charles A. Lindbergh Professor at the National Air and Space Museum in Washington, DC. His historical interest is in the relations between science, technology, and foreign policy in the first two decades of the Cold War. He has coauthored a three-volume history of CERN, the European Organization for Nuclear Research, and a two-volume history of ESA, the European Space Agency. Krige serves on the editorial board of several international journals and is the executive editor of *History and Technology*, published by Routledge. His most recent book, *American Hegemony and the Postwar Reconstruction of Science in Europe*, is scheduled for publication by MIT Press in 2006. He currently is working on U.S.-European relations in the field of rocketry.

Todd R. La Porte has been a professor of political science at the University of California, Berkeley, since 1965, where he was also associate director of the Institute of Governmental Studies (1973–88). He received his B.A. from the University of Dubuque (1953) and his M.A. and Ph.D. from Stanford University (1962). He also held faculty posts at the University of Southern California and Stanford University. He teaches and publishes in the areas of organization theory; technology and politics (and assessment); and the organizational and decision-making dynamics of large, complex, technologically intensive organizations, as well as public attitudes toward advanced technologies and the problems of governance in a technological society. He was a principal of the Berkeley High Reliability Organization Project, a multidisciplinary team that studied the organizational aspects of safety-critical systems such as nuclear power, air traffic control, and nuclear aircraft carriers. Currently, his research concerns the evolution of large-scale organizations

operating technologies demanding a very high level of reliable (nearly failure-free) performance and the relationship of large-scale technical systems to political legitimacy, especially in the nuclear domain. This took him to Los Alamos National Laboratory (1998–2003) to examine the institutional challenges of multigeneration nuclear missions. He was elected to the National Academy of Public Administration (1985) and was a Fellow at the Woodrow Wilson International Center for Scholars, Smithsonian Institution, and Research Fellow at the Wissenschaftszentrum (Sciences Center), Berlin, and the Max Planck Institute for Social Research, Cologne. He has been a member of the Board on Radioactive Waste Management and served on panels of the Committee on Human Factors and Transportation Research Board, National Academy of Sciences. He served on the Secretary of Energy Advisory Board, Department of Energy, and chaired its Task Force on Radioactive Waste Management, examining questions of institutional trustworthiness; he also was on the Technical Review Committee, Nuclear Materials Technology Division, Los Alamos National Laboratory. Additionally, he has served as a member of the Committee on Long-Term Institutional Management of Department of Energy (DOE) Legacy Waste Sites: Phase Two and the Committee on Principles and Operational Strategies for Staged Repository Systems, both of the Board on Radioactive Waste Management, National Academy of Sciences (2001–03). He is currently a faculty affiliate, Decision Science Division, Los Alamos National Laboratory.

Roger D. Launius is Chair of the Division of Space History at the Smithsonian Institution's National Air and Space Museum in Washington, DC. Between 1990 and 2002, he served as Chief Historian of NASA. A graduate of Graceland College in Lamoni, Iowa, he received his Ph.D. from Louisiana State University, Baton Rouge, in 1982. He has written or edited more than 20 books on aerospace history, including *Space: A Journey to Our Future* (2004); *Space Stations: Base Camps to the Stars* (2003), which received the American Institute of Aeronautics and Astronautics' (AIAA's) history manuscript prize; *Flight: A Celebration of 100 Years in Art and Literature* (2003); *Reconsidering a Century of Flight* (2003); *To Reach the High Frontier: A History of U.S. Launch Vehicles* (2002); *Imagining Space: Achievements, Possibilities, Projections, 1950–2050* (2001); *Reconsidering Sputnik: Forty Years Since the Soviet Satellite* (2000); *Innovation and the Development of Flight* (1999); *Frontiers of Space Exploration* (1998; rev. ed., 2004); *Spaceflight and the Myth of Presidential Leadership* (1997); and *NASA: A History of the U.S. Civil Space Program* (1994; rev. ed., 2001). He is frequently consulted by the electronic and print media for his views on space issues. His research interests encompass all areas of U.S. and space history and policy history, especially cultural aspects of the subject and the role of executive decision-makers and their efforts to define space exploration.

John M. Logsdon is the director of the Space Policy Institute at George Washington University's Elliott School of International Affairs, where he is also a professor of political science and international affairs. He holds a B.S. in physics from Xavier University (1960) and a Ph.D. in political science from New York University (1970). Dr. Logsdon's research interests focus on the policy and historical aspects of U.S. and international space activities. Dr. Logsdon is the author of *The Decision to Go to the Moon: Project Apollo and the National Interest* and is general editor of the eight-volume series *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program.* He has written numerous articles and reports on space policy and history. He is frequently consulted by the electronic and print media for his views on space issues. Dr. Logsdon recently served as a member of the Columbia Accident Investigation Board. He is a former member of the NASA Advisory Council and a current member of the Commercial Space Transportation Advisory Committee of the Department of Transportation. He is a recipient of the NASA Distinguished Public Service and Public Service Medals and a Fellow of the American Institute of Aeronautics and Astronautics and of the American Association for the Advancement of Science.

Howard McCurdy is a professor of public affairs and chair of the Public Administration Department at American University in Washington, DC. An expert on space policy, he recently authored *Faster, Better, Cheaper,* a critical analysis of cost-cutting initiatives in the U.S. space program. An earlier study of NASA's organizational culture, *Inside NASA,* won the 1994 Henry Adams prize for that year's best history on the federal government. He also has written *Space and the American Imagination* and coedited *Spaceflight and the Myth of Presidential Leadership.* His work appears in scholarly journals such as *Public Administration Review* and *Space Policy.* He is often consulted by the media on public policy issues and has appeared on national news outlets such as the *NewsHour with Jim Lehrer,* National Public Radio, and *NBC Nightly News.* Professor McCurdy received his bachelor's and master's degrees from the University of Washington and his doctorate from Cornell University.

David A. Mindell is Dibner Professor of the History of Engineering and Manufacturing and Professor of Engineering Systems at MIT. He is the founder and director of MIT's "DeepArch" research group in technology, archaeology, and the deep sea. His research interests include technology policy (historical and current), the history of automation in the military, the history of electronics and computing, new theories of engineering systems, deep-ocean robotic archaeology, and the history of space exploration. His book *War, Technology, and Experience aboard the USS Monitor* was published in April 2000 by Johns Hopkins University Press. His second book, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics,* was published in the spring of 2002.

Mindell is currently researching a book on the history of the Apollo Guidance Computer that guided the astronauts to the Moon. From 1992 to 1995, Mindell was a National Science Foundation Graduate Fellow, and from 1995 to 1996, he was a Fellow at the Dibner Institute for the History of Science and Technology at MIT. He is an adjunct researcher at the Institute for Exploration. Before coming to MIT, Mindell worked as a research engineer in the Deep Submergence Laboratory of the Woods Hole Oceanographic Institution, where he is currently a visiting investigator. Mindell has consulted on engineering and policy for a number of industrial and research organizations, including the National Academy of Sciences. He has degrees in literature and electrical engineering from Yale University and a doctorate in the history of technology from MIT.

Stephen Pyne is a professor with the human dimensions faculty in the School of Life Sciences at Arizona State University, where he teaches courses on environmental history; the history of exploration; and the history, ecology, and management of fire. He is the author of 16 books, which mostly concern the history of fire on Earth. Of the others, three develop themes in the history of science and exploration (*Grove Karl Gilbert, The Ice: A Journey to Antarctica,* and *How the Canyon Became Grand*), as have several essays on space exploration. He is currently writing a fire history of Canada.

Philip Scranton is Board of Governors Professor in history of industry and technology at Rutgers University and director of the Center for the History of Business, Technology, and Society at the Hagley Museum and Library. He edits a monograph series, *Studies in Industry and Society,* for the Johns Hopkins University Press and coedits a collected-essays series, *Hagley Perspectives in Business and Culture,* for the University of Pennsylvania Press. He is author, coauthor, or editor of nine books; serves as a consultant for historical museums and public programming; and, most recently, held the Charles Lindbergh Chair (2003–04) at the National Air and Space Museum. His current project focuses on Cold War innovation and specialty production, especially regarding jet propulsion, NASA space capsules, instrumentation, and the new materials "explosion" in and following the Second World War.

Asif Siddiqi received his Ph.D. in history from Carnegie Mellon University in 2004. He specializes in the history of science and technology with a focus on the history of astronautics. He is the author of *Challenge to Apollo: The Soviet Union and the Space Race, 1945–1974* (2000) and the series editor for *Rockets and People,* the four-volume memoirs of Russian space engineer Boris Chertok. He is currently a Visiting Fellow in the American Academy of Arts & Sciences in Cambridge, Massachusetts, and took up a position as assistant professor of history at Fordham University in New York in the fall of 2004.

Diane Vaughan received her Ph.D. in sociology from Ohio State University in 1979 and began teaching at Boston College in 1982, where she is now a professor of sociology. She has been awarded fellowships at Yale (1979–82), Centre for Socio-Legal Studies, Oxford (1986–87), the American Bar Foundation (1988–89), the Institute for Advanced Study, Princeton (1996–97), and the John Simon Guggenheim Memorial Foundation (2003–04). Her areas of specialization are the sociology of organizations; sociology of culture; deviance and social control; field methods; research design; and science, knowledge, and technology. Much of her research has examined the "dark side" of organizations: mistake, misconduct, and disaster. In 2003, she worked with the Columbia Accident Investigation Board on their analysis and report on the loss of the Space Shuttle *Columbia*. Her books include *Controlling Unlawful Organizational Behavior*, *Uncoupling*, and *The Challenger Launch Decision*, which was awarded the Rachel Carson Prize, the Robert K. Merton Award, and Honorable Mention for Distinguished Contribution to Scholarship of the American Sociological Association, and was nominated for the National Book Award and Pulitzer Prize. Her current projects are *Theorizing: Analogy, Cases, and Comparative Social Organization* and *Dead Reckoning: Air Traffic Control in the Early 21st Century.*

Margaret A. Weitekamp earned her B.A. summa cum laude from the University of Pittsburgh and her Ph.D. in history at Cornell University in May 2001. Currently, she is a curator in the Division of Space History at the National Air and Space Museum, Smithsonian Institution, in Washington, DC. There, she oversees the "Social and Cultural Dimensions of Spaceflight" collection, almost 3,500 individual pieces of space memorabilia and space science fiction objects. These social and cultural products of the Space Age—everything from toys and games to clothing and stamps, medals and awards, buttons and pins, and even comics and trading cards—complete the story about spaceflight told by the museum's collection of space technologies. Her first book, *Right Stuff, Wrong Sex: America's First Women in Space Program*, was published by the Johns Hopkins University Press as a part of the Gender Relations in the American Experience series in November 2004. The book investigates shifting ideas about gender in the early 1960s through the history of a privately funded project that tested women pilots for astronaut fitness at the beginning of the Space Age. In addition, Weitekamp also has contributed to an edited anthology entitled *Impossible to Hold: Women and Culture in the 1960s* (2005). She won the Smithsonian Institution's National Air and Space Museum Aviation/Space Writers Award in 2002. She spent academic year 1997–98 in residence at the NASA Headquarters History Office in Washington, DC, as the American Historical Association/NASA Aerospace History Fellow. She was a 1993 Mellon Fellow in the Humanities.

Acronyms and Abbreviations

AAAS	American Association for the Advancement of Science
AAS	American Astronautical Society
ABC	American Broadcasting Company
ABM	antiballistic missile
ABMA	Army Ballistic Missile Agency
ACES	Air Collection and Enrichment System
AFB	Air Force Base
AGARD	Advisory Group for Aerospace Research and Development
AHA	American Historical Association
AIAA	American Institute of Aeronautics and Astronautics
AmRoc	American Rocket Company
ARDC	Air Research and Development Command
ARPA	Advanced Research Projects Agency
ASA	American Studies Association
ASAT	antisatellite
ASEE	American Society for Electrical Engineering; American Society for Engineering Education
ASME	American Society of Mechanical Engineers
ASSET	Aerothermodynamic/elastic Structural Systems Environmental Tests
AT&T	American Telephone and Telegraph Company
ATV	Advanced Technology Vehicle
BAMBI	Ballistic Missile Boost Intercept
BMD	ballistic missile defense
BMDO	Ballistic Missile Defense Organization
BMEWS	Ballistic Missile Early Warning System
BOR	Unpiloted Orbital Rocketplane (in Russian)

C2	command and control
C^3I	command, control, communications, and intelligence
CAIB	Columbia Accident Investigation Board
Caltech	California Institute of Technology
CAPCOM	capsule communicator
CBI	Chicago Bridge and Iron
CCD	charge-coupled device
CCP	Contract Change Proposal
CDC	Centers for Disease Control
CELV	Complementary Expendable Launch Vehicle
CEO	chief executive officer
CERN	European Organization for Nuclear Research
CEV	Crew Exploration Vehicle
CIA	Central Intelligence Agency
CMLC	Civilian-Military Liaison Committee (of the House)
comsat	commercial satellite; communications satellite
COMSAT	Communications Satellite Corporation
COMSTAC	Commercial Space Transportation Advisory Committee
CRV	Crew Recovery Vehicle
C/SGT	Continental/SemiGlobal Transport
CSM	Command and Service Module (Apollo)
CSOC	Consolidated Space Operations Center
DARPA	Defense Advanced Research Projects Agency
DCAS	Defense Contract Administration Services
DC-X	Delta Clipper-Experimental
DC-XA	Delta Clipper-Experimental Advanced
DDR&E	Director of Defense Research and Engineering; Deputy Secretary of Defense for Research and Engineering; designing, developing, researching, and engineering
DEW	Distant Early Warning
DMSP	Defense Meteorological Satellite Program
DNA	deoxyribonucleic acid
DOD	Department of Defense

DOE	Department of Energy
DSCS II	Defense Satellite Communications System II
DSP	Defense Support Program
Dyna-Soar	Dynamic Soaring
ECR	Engineering Change Request
EEC	European Economic Community
EELV	Evolved Expendable Launch Vehicle
ELDO	European Launcher Development Organisation
ELINT	electronics intelligence
ELV	expendable launch vehicle
EOP	Executive Office of the President
EORSAT	Electronic Intelligence Ocean Reconnaissance Satellite
EOS	Earth Observing System
EPA	Environmental Protection Agency
ESA	European Space Agency
ESRO	European Space Research Organisation
EST	eastern standard time
ET	External Tank (of the Space Shuttle)
EVA	extravehicular activity
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FLATs	First Lady Astronaut Trainees
FLTSATCOM	Fleet Satellite Communications
FOBS	Fractional Orbiting Bombardment System
FOC	full operational capability
FOIA	Freedom of Information Act
FRC	Flight Research Center
FRR	Flight Readiness Review
FY	fiscal year
GALCIT	Guggenheim Aeronautical Laboratory at the California Institute of Technology
GAO	General Accounting Office
GE	General Electric

GEODSS	Ground-Based Electro-Optical Deep Space Surveillance
GIRD	Group for the Investigation of Reactive Engines and Reactive Flight
GLONASS	Global Navigation Satellite System
GOES	Geostationary Operational Environmental Satellite
GPO	Gemini Program Office; Government Printing Office
GPS	Global Positioning System
GRAB	Galactic Radiation and Background
GUKOS	Chief Directorate of the Space Systems (Soviet)
GURVO	Chief Directorate of Reactive Armaments (Soviet)
HAER	Historic American Engineering Record
HL	Horizontal Lander
HRO	high-reliability organization
HSS	History of Science Society
HST	Hubble Space Telescope
Hum Vee, Hummer	High Mobility Multipurpose Wheeled Vehicle
IAU	International Astronomical Union
ICBM	intercontinental ballistic missile
ICO	Intermediate Circular Orbit
ICOM	International Council of Museums
IDCSP	Initial Defense Communications Satellite Program
IEEE	Institute of Electrical and Electronics Engineers
IGY	International Geophysical Year
ILV	Industrial Launch Vehicle
IMINT	overhead photoreconnaissance
IMP	Imager for Mars Pathfinder
INPO	Institute for Nuclear Power Operators
INTELSAT	International Telecommunications Satellite Consortium
IRBM	intermediate-range ballistic missile
IS	Istrebitel Sputnikov
ISS	International Space Station
ISTS	International Symposium on Space Technology and Science

IUS	Inertial Upper Stage
JBIS	*Journal of the British Interplanetary Society*
JCS	Joint Chiefs of Staff
JDFN	Joint Defence Facility Nurrungar
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KGB	Soviet secret police organization
KSC	Kennedy Space Center
KVR	Space Forces (Soviet)
L-5	Lagrange Point 5
LACES	Liquid Air Collection Engine System
LANL	Los Alamos National Laboratory
LBJ	Lyndon Baines Johnson
LEM	Lunar Excursion Module
LLRV	Lunar Landing Research Vehicle
LLTV	Lunar Landing Training Vehicle
LM	Lunar Module (Apollo)
LOR	lunar orbit rendezvous
MASI	Ministry of Space Industry (Chinese)
MASINT	measurement and signature intelligence
MASTIF	Multiple Axis Space Test Inertia Facility
MCC	Mission Control Center
MDA	Missile Defense Agency
MIDAS	Missile Defense Alarm System
MISS	Manned Military Space System; Man-In-Space-Soonest
MIT	Massachusetts Institute of Technology
MMT	Mission Management Team
MODS	Military Orbital Development System
MOL	Manned Orbiting Laboratory
MOM	Ministry of Machine Building (Soviet)
MOU	Memorandum of Understanding
MSC	Manned Spacecraft Center (later renamed Johnson Space Center)

MSE	Manned Spaceflight Engineer
MV	Ministry of Armaments (Soviet)
NA	North American
NAA	North American Aviation
NAC	NASA Advisory Council
NACA	National Advisory Committee for Aeronautics
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NASC	National Aeronautics and Space Council
NASCAR	National Association for Stock Car Auto Racing
NASM	National Air and Space Museum
NASP	National Aero-Space Plane
NATO	North Atlantic Treaty Organization
NEO	Near-Earth Object
NESC	NASA Engineering and Safety Center
NLS	National Launch System
NM	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Air Defense Command
NOTS	Naval Ordnance Test Station
NOTSNIK	designation combining "Naval Ordnance Test Station" and "Sputnik"
NPO	Scientific-Production Association (Soviet)
NPOESS	National Polar-Orbiting Environmental Satellite System
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRL	Naval Research Laboratory
NRO	National Reconnaissance Office
NS	national security
NSAM	National Security Action Memorandum
NSC	National Security Council
NSD	National Security Directive
NSDD	National Security Decision Directive

NSF	National Science Foundation
NSI	*NASA and the Space Industry*
NSIAD	National Security and International Affairs Division (within GAO)
NSPD	National Space Policy Directive
NSSD	National Security Study Directive
NSTC	National Science and Technology Council
NTDS	Naval Tactical Data System
OAH	Organization of American Historians
OCST	Office of Commercial Space Transportation
OKB	designation for a Soviet design bureau (such as OKB-1 or OKB-52)
OMB	Office of Management and Budget
ONR	Office of Naval Research
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
OSP	Orbital Space Plane
OSTP	Office of Science and Technology Policy
PAGEOS	Passive Geodetic Earth Orbiting Satellite
PAWS	Phased Array Warning System
PD	Presidential Directive
PSAC	President's Science Advisory Committee
psi	pounds per square inch
PUC	Public Utility Commissions
QA	quality assurance
R&D	research and development
RAF	Royal Air Force (United Kingdom)
RASV	Reusable Aerodynamic Space Vehicle
RCA	Radio Corporation of America
RFP	Request for Proposals
RGAE	Russian State Archive of the Economy
RLV	reusable launch vehicle
ROLS	Recoverable Orbital Launch System

RORSAT	Radar Ocean Reconnaissance Satellite
R.U.R.	*Rossum's Universal Robots*
RVSN	Missile Forces of Strategic Designation (Soviet)
SAAS	School of Advanced Airpower Studies
SAB	Scientific Advisory Board (USAF)
SAC	Strategic Air Command
SAE	Society of Automotive Engineers
SAEF	Spacecraft Assembly and Encapsulation Facility
SAGE	Semi-Automatic Ground Environment
SAINT	Satellite Inspector for Space Defense
SALT	Strategic Arms Limitations Talks
SATCOM	RCA Americom Satellite "SATCOM" series
SBIRS	Space-Based Infrared System
SCORE	Signal Communication by Orbiting Relay Equipment
SCOT	social construction of technology
scramjet	supersonic combustion ramjet
SDC	System Development Corporation
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SDS	Satellite Data System
SEI	Space Exploration Initiative
SETI	Search for Extraterrestrial Intelligence
SETP	Society for Experimental Test Pilots
SHF	Super High Frequency
SHOT	Society for the History of Technology
SIG	Senior Interagency Group
SIGINT	signals intelligence
SIR	Shuttle Imaging Radar
SLC	space launch complex
SLV	Standardized Launch Vehicle
SMV	Space Maneuver Vehicle
SOPC	Shuttle Operations and Planning Complex

SR&QA	Office of Safety, Reliability and Quality Assurance (NASA)
SRB	Solid Rocket Booster
SRM	Solid Rocket Motor
SRTC	Solid Rocket Technical Committee
SSI	Space Services, Inc.
SSME	Space Shuttle Main Engine
SSTO	single stage to orbit
STAIF	Space Technology & Applications International Forum
START	Strategic Arms Reduction Treaties
STG	Space Task Group
STP	space test program
STS	Space Transportation System
TAOS	Thrust-Assisted Orbiter Shuttle
TAV	TransAtmospheric Vehicle
TCP	Technological Capabilities Panel
TDRSS	Tracking and Data Relay Satellite System
TIROS	Television and Infrared Observation System
TQ	transition quarter
TRW	Thompson Ramo Wooldridge Corporation
TsUKOS	Central Directorate of Space Systems (Soviet)
UCLA	University of California, Los Angeles
UHF	Ultra-High Frequencies
UND	University of North Dakota
UNKS	Directorate of the Space Systems Commander (Soviet)
unk-unks	unknown unknowns
U.S.	United States
US-A	active radar (Soviet)
USA	U.S. Army
USACERL	U.S. Army Construction Engineering Research Laboratories
USAF	U.S. Air Force
US-P	passive radar (Soviet)
USSR	Union of Soviet Socialist Republics

VKS	Military Space Forces (Soviet)
VNIIEM	All-Union Scientific Research Institute of Electromechanics (Soviet)
V-PRO	Forces of Anti-Missile Defense (Soviet)
WDD	Western Development Division (USAF)
WS	Weapons System (USAF)
WWMCCS	World-Wide Military Command and Control System

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The Galileo spacecraft and its Inertial Upper Stage booster rocket were deployed from the Space Shuttle *Atlantis* on 18 October 1989. Shortly thereafter, the booster rocket fired and separated, sending Galileo on its six-year journey to the planet Jupiter. Upon its arrival at Jupiter in December 1995, Galileo released a probe into the atmosphere so that scientists could survey the composition of the planet's clouds. The Orbiter has relayed probe information, surveyed its surroundings, and photographed Jupiter and some of its major satellites. *(NASA photo no. STS-34-71-000R)*

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