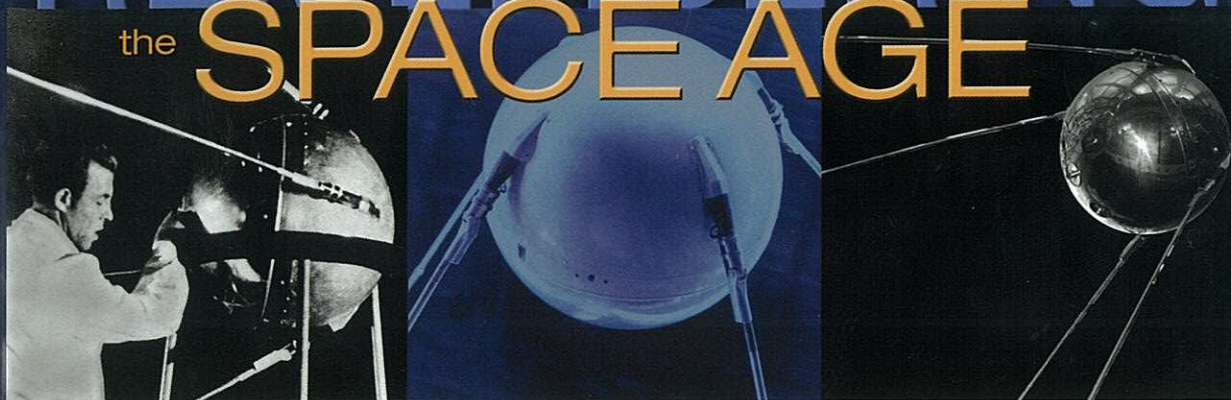
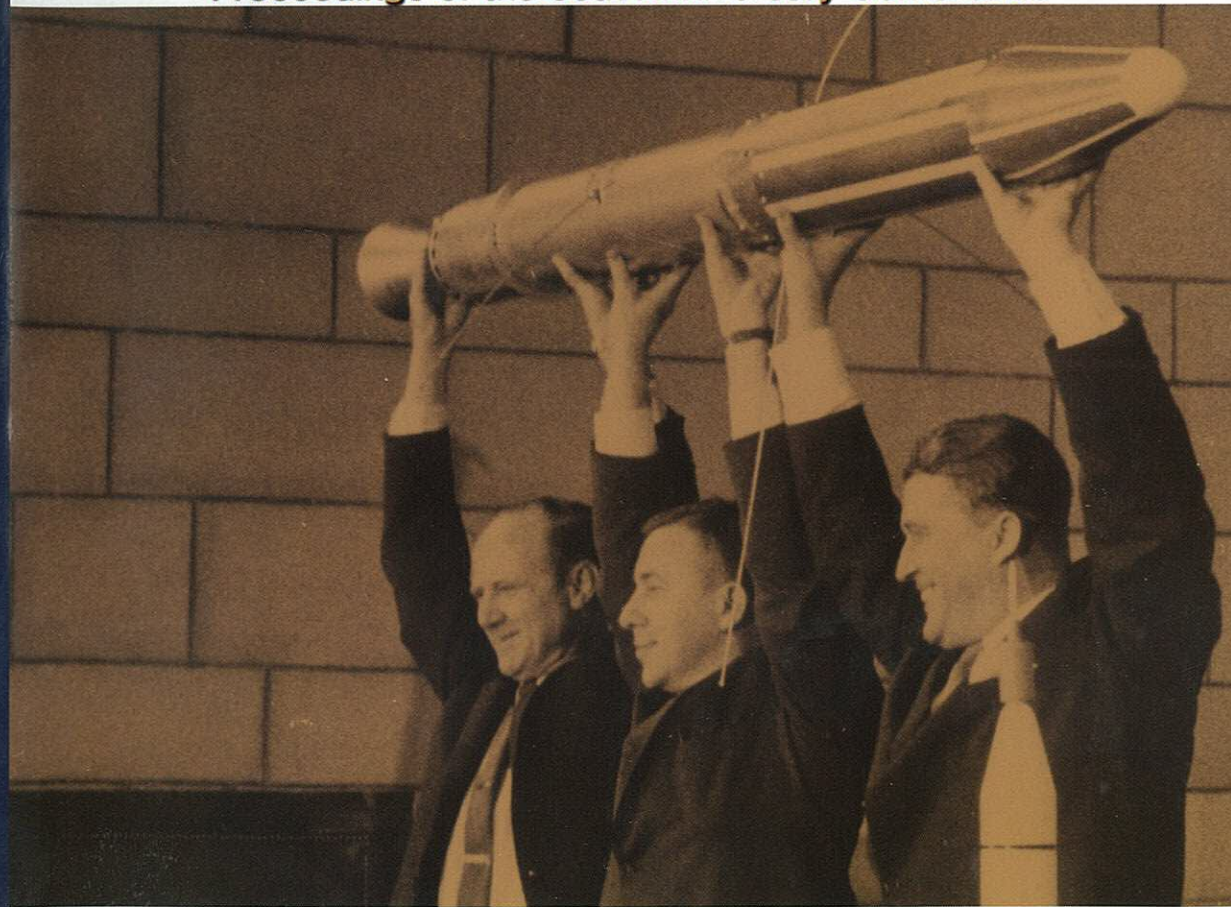


REMEMBERING the SPACE AGE



Proceedings of the 50th Anniversary Conference



Steven J. Dick

Editor

CHAPTER 16

ROBERT A. HEINLEIN'S INFLUENCE ON SPACEFLIGHT

Robert G. Kennedy, III

Robert Heinlein is one of the most influential science fiction authors of all time. His writings not only inspired numerous people to enter the sciences and engineering in general—and the field of spaceflight in particular—but also shaped the way that people thought about spaceflight. Thus, even though Sputnik was a strategic surprise for the United States, there were legions of young Americans predisposed to step up and get to work on the challenging task of winning the space race. Heinlein's influence can currently be seen in the activities of numerous private spaceflight entrepreneurs.

LOOKING BACKWARD

Science fiction has changed history. We know this happened at least once in a very direct and far-reaching way by the documented influence of the science fiction writer H. G. Wells upon the yet-to-be Manhattan Project physicist Leo Szilard—one of the seven so-called “Men from Mars,”¹—upon crossing a London street in 1933. As Richard Rhodes relates this story in his Pulitzer Prize-winning *The Making of the Atomic Bomb*:

On February 27, 1932 . . . physicist James Chadwick of the Cavendish Laboratory at Cambridge University . . . announced the possible existence of a neutron . . . The neutron . . . had no electric charge, which meant it could pass through the surrounding electrical barrier and enter into the nucleus. The neutron would open the atomic nucleus

1. The seven famous Hungarian Jewish physicists who emigrated to America before World War II were all products of the famous Minta Gimnasium in Budapest. Two of them would go on to win Nobel Prizes. They were in birth order: Theodor von Karman, George de Hevesy, Michael Polanyi, Leo Szilard, Eugene Wigner, John von Neumann, and Edward Teller. The joke among their American colleagues was that they were actually from Mars and not Hungary as they claimed because they possessed unearthly brilliance, spoke English with an impenetrable Central European accent, and nobody knew what a Hungarian accent really sounded like anyway.

to examination. It might even be a way to force the nucleus to give up some of its enormous energy. Just then, in 1932, Szilard found or took up for the first time that appealing orphan among H. G. Wells's books that he had failed to discover before: *The World Set Free*. . . . It was a prophetic novel, published in 1914, before the beginning of the Great War [World War I]. As Szilard recalled, Wells described

The liberation of atomic energy on a large scale for industrial purposes, the development of atomic bombs, and a world war which was apparently fought by an alliance of England, France, and perhaps including America, against Germany and Austria, the powers located in the central part of Europe. He places this war in the year 1956, and in this war the major cities of the world are all destroyed by atomic bombs.²

It is difficult to read this story, even at nearly a century's remove, without chills running down one's spine in much the same way that a first reading of "Future Prospects of the United States" in *Democracy in America* by Alexis de Tocqueville produced during the depths of the Cold War.³ Such prescience and perspicacity is almost inhuman. According to Rhodes:

In London . . . across from the British Museum in Bloomsbury, Leo Szilard waited irritably one gray Depression morning for the spotlight to change . . . Tuesday, September 12, 1933

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2. Richard Rhodes, *The Making of the Atomic Bomb* (New York, NY: Touchstone/Simon & Schuster, 1986), pp. 23-24.
 3. de Tocqueville, Comte Alexis, *Democracy in America* (1835), Chapter 21. "On the Future Prospects of the United States. There are at the present time two great nations in the world, which started from different points, but seem to tend towards the same end. I allude to the Russians and the Americans. Both of them have grown up unnoticed; and whilst the attention of mankind was directed elsewhere, they have suddenly placed themselves in the front rank among the nations, and the world learned their existence and their greatness at almost the same time." All other nations seem to have nearly reached their natural limits, and they have only to maintain their power; but these are still in the act of growth. All the others have stopped, or continue to advance with extreme difficulty; these alone are proceeding with ease and celerity along a path to which no limits can be perceived. The American struggles against the obstacles which nature opposes to him; the adversaries of the Russian are men. The former combats the wilderness and savage life; the latter, civilization with all its arms. The conquests of the American are therefore gained by the ploughshare; those of the Russian by the sword. The Anglo-American relies upon personal interest to accomplish his ends, and gives free scope to the unguided strength and common sense of the people; the Russian centres all the authority of society in a single arm. The principal instrument of the former is freedom; of the latter, servitude. Their starting-out point is different, and their courses are not the same; yet each of them seems marked out by the will of Heaven to sway the destinies of half the globe."

. . . Szilard stepped off the curb. As he crossed the street time cracked open before him and he saw a way to the future, death into the world and all our woe, the shape of things to come . . . Without question, Szilard read *The Times* of September 12, with its provocative sequence of headlines:

THE BRITISH ASSOCIATION

BREAKING DOWN THE ATOM

TRANSFORMATION OF ELEMENTS

Szilard was not the first to realize that the neutron might slip past the positive electrical barrier of the nucleus . . . but he was the first to imagine a mechanism whereby more energy might be released in the neutron's bombardment of the nucleus than the neutron itself supplied . . . As the light changed to green and I crossed the street," Szilard recalls, "it . . . suddenly occurred to me that if we could find an element which is split by neutrons and which would emit *two* neutrons when it absorbs *one* neutron, such an element, if assembled in sufficiently large mass, could sustain a nuclear chain reaction . . . In certain circumstances, it might be possible to . . . liberate energy on an industrial scale, and construct atomic bombs."⁴

The accidental discovery of x rays and radioactivity in 1895-96 upset everyone's notion of the immutable atom and the eternal clockwork universe, opening up grand new vistas of disturbing change. There at the turn of the century to interpret these mysterious new findings and extrapolate their potential meaning was one Herbert George Wells, a consumptive who in the fine tradition of impoverished tubercular writers before (Robert Louis Stephenson) and after (Robert A. Heinlein) was unable to do any heavier work than writing for a living. In 1899, he had already produced what Heinlein would call "the greatest speculative novel ever written," *When the Sleeper Wakes*.⁵ In this single novel, just one among many, Wells conceived:

- a) heavier-than-air engine-powered warplanes, including their major types (fighter, bomber, and large transport), as well as thought-out doctrine for

4. Rhodes (ref. 2), 13, 27-28.

5. A good subtitle might have been *The Miracle of Compound Interest*.

their application in air battles (note that this was four years before the Wright brothers flew 300 feet in their contraption at Kitty Hawk)

- b) a variety of so-called “Babble Boxes”—audio media machines to appeal to every demographic segment that anticipated narrowcasting, blogs, and the World Wide Web—and “televisors” that resembled the information-retrieval capabilities of the Internet
- c) mass-transit systems such as slidewalks, automatic high-speed surface freight, and airports

In addition to predicting the Bomb (as well as related concepts that we would recognize as decapitating first strike, strategic atomic exchange by air, and mutual assured destruction) in *The World Set Free* (1914), in other novels, Wells forecast suburbia and many other political and social developments that would accompany these innovations and, like de Tocqueville, the superpower status of America.⁶ All during his own life, Robert A. Heinlein described H. G. Wells as his single greatest literary and intellectual influence.⁷

HEINLEIN'S INFLUENCE

So what about Heinlein himself? He was more technically prolific than even the incredible Wells, but his influence was regrettably less direct than the example above. This may simply be a characteristic of how things go in a naïve versus mature ecosystem, in which 80 percent of the significance is determined within 20 percent of the timespan.

Direct Effects on Society and Spaceflight via Technological Innovation

The Web site <http://www.technovelgy.com> attributes 120 (so far) inventions, novel devices (e.g., the waterbed), and neologisms (e.g., “free fall” and “grok”) to Robert A. Heinlein. An incomplete list of just some of his space-related ideas includes: various electromagnetically-levitated transport systems also known as “mass-drivers,” a hands-free helmet, the “parking” orbit, a Space Shuttle, and the gravity slingshot maneuver. This polymath’s skill at innovating was not limited to science, technology, and engineering either, which handicapped most of the writing in what came to be known as “the pulp era.” Heinlein brought originality to his craft, pioneering the literary technique of “Future History” used by many top writers of the genre since (implicitly or explicitly),

6. Paul Crabtree, “The Remarkable Forecasts of H. G. Wells,” *The Futurist* 41, no. 5 (Sept./Oct. 2007): 40-46.

7. Michael Hunter, “First Look: the Influences of H. G. Wells on Robert A. Heinlein’s For Us, the Living,” *The Heinlein Journal*, no. 14 (January 2004): 15-18.

and refining Wells' trick of "domesticating the impossible" (canonical instance: "the door dilated").⁸ Heinlein eventually grew impatient with what he called his Procrustean bed. According to Elwood Teague, a contemporary of his, Heinlein, who read as widely as Wells, was obsessed with "the coming of the Bomb" even in the late 1930s. This surely must have been the Wellsian influence. Heinlein did, in fact, manage to meet Wells in Los Angeles about that time, and would have seen the groundbreaking epic motion picture, *Things to Come*, which was based on Wells' work, both dystopian and utopian. He was in frequent correspondence with scientists such as the physicist Robert Cornog, as well as engineers who would go on to the Manhattan Project, informing and being informed, and using the new discoveries to lend the essential Heinleinesque verisimilitude to his art. In keeping with his deep sense of discretion and military honor, this speculative phase ended instantly when his editor at *Astounding Science Fiction*, John W. Campbell, Jr., told him in December 1940 that discussion of uranium-235 had "gone black" in the technical literature. (His salient novella, *Solution Unsatisfactory* was already in press by then. The story is remarkable even today for the essential political truths it captured.) Being the Renaissance Man of the world he was, Heinlein knew exactly what this blackout portended.⁹ He maintained this self-imposed censorship throughout the war years, though it is obvious he never stopped thinking about it.¹⁰ Others were not so discreet. For example, Cleve Cartmill, his fellow habitue of the Manana Literary Society (MLS) that met in the Heinleins' living room in prewar Los Angeles, published a short story called "Deadfall" in the March 1944 issue of *Astounding* that was so technically accurate, it resulted in a visit to Campbell's editorial office by the naturally irate FBI. Heinlein's contact with the community of "rocket science" (meaning rocketry, nuclear weapons, and strategic matters) resumed after Hiroshima and continued for the rest of his life. One group of atomic scientists eventually became the Federation of American Scientists, principally interested in disarmament and arms control. Another later group became the Citizen's Action Committee for Space, the first proponent of what came to be called the Strategic Defense Initiative. Heinlein was apparently never troubled by the hobgoblin of consistency.

Though an engineer by training and inclination, Heinlein did not promote engineering per se. In his frequent lectures on the value of a liberal education, he would only say that the stool of knowledge has three legs: mathematics, (foreign) language, and history. Three legs are all that are necessary to stand:

8. Bill Patterson, "A Study of 'If This Goes On...,'" *The Heinlein Journal*, no. 7 (July 2000): 29-42.

9. Heinlein also predicted the time, mode, and method of the Japanese attack on Pearl Harbor a week before the event, based on his own experience as a Navy gunnery officer aboard an aircraft carrier participating in a simulated attack exercise nine years before.

10. Robert A. Heinlein to J. S. Kean, "Tentative Proposal for Projects to be carried on at NAMC," August 14, 1945, Heinlein Archives, <http://heinleinarchives.net/> (accessed August 19, 2007).

neither engineering, technology, nor science are mentioned. The first leg exists because mathematics is the universal language of science. The second leg exists because one will never really understand one's own language, so one cannot know the true shape of one's mind until one has seen it from the outside through a foreign language (there's probably a connection to Godel's Incompleteness Theorem). The third leg exists because one will never be prepared for the future until one has first learned to see the present in the light of the past.

Direct Effects on Spaceflight via People

After the Japanese attack on December 7, 1941, Robert Heinlein tried to rejoin the Navy. After being turned down, he used his Annapolis connections to get an engineering job as a civilian in an aeronautical factory at the Philadelphia Navy Yard, relocating there from Los Angeles with his second wife, Leslyn.¹¹ His Navy classmates, who were well aware of Heinlein's gifts, at first had him spotting engineering talent before giving him a materials research position at the Navy Air Materials Center (NAMC). (It was here he met the woman who would become his third wife—and so important to his later work—a Navy WAVE lieutenant (j.g.) named Virginia Gerstenfeld, forever known to history as “Ginny.”) Turning to the science-fiction community, Heinlein recruited his fellow writers L. Sprague deCamp and Isaac Asimov to work at the Navy Yard in aeronautical engineering as well. De Camp took a Navy commission and, under Heinlein's guidance, eventually turned to work on high-altitude pressure suits at NAMC. Towards the end of the war, combat aircraft—particularly long-range heavy bombers—were flying so high that mere warm clothing and oxygen masks could not protect the crews from the elements. Heinlein's troubles with tuberculosis, which had invalidated him into early retirement from the Navy in 1934, precluded his direct participation in the altitude chamber and other experiments. But it is certain that the science fiction background of all three men—namely in regard to what would be called “spacesuits”—informed the work. The 1940 short story “Misfit” contains an accurate description of what a space suit should be.

One of Heinlein's new (and less famous) hires was Edward L. “Ted” Hays, a mechanical engineer like Heinlein himself. Hays worked as a flight test engineer on problems associated with carrier operations. (Heinlein's first billet after graduating from Annapolis was on the most advanced warship of her day, the carrier USS *Lexington*.) Hays went on to safety and survival equipment, became deeply involved in the development of Navy pressure suits, moved to NASA in 1961 after Project Mercury was underway, and eventually ending

11. Robert James, “Regarding Leslyn,” *The Heinlein Journal*, no. 9 (July 2001): 17–36.

up on the Apollo program as chief engineer of life support systems where he specialized in, of course, space suits!¹²

Indirect Effects on Society and Spaceflight via Literature

Because his literary genius was recognized so early by his readers and fellow writers in the late 1930s, Heinlein left an indelible imprint on the entire genre of science fiction, which might not have happened in a later more fractured and competitive age.¹³ His prewar influence on the other writers (e.g., L. Sprague deCamp, Frederick Pohl, Isaac Asimov) of what came to be known as the postwar “Golden Age of science fiction” was simply profound. It is no exaggeration to say that writing in the field experienced a quantum leap in quality compared to its pulp roots. Postwar, Heinlein even managed to bring his chosen genre out of the ghetto into the respectable “slicks” (glossy, large-format color weeklies such as the *Saturday Evening Post* and *Collier's*, bygone media of a bygone age), where he would continue to be published. A full generation later, he was still mentoring and guiding major new writers (e.g., Larry Niven and Jerry Pournelle for their seminal “First Contact” novel, *The Mote in God's Eye* (1973)).¹⁴ Heinlein not only transmitted literary technique to his colleagues—his values of service and sacrifice, an individualistic outlook, and ethos of competence also came through and were propagated to millions of these authors' readers in turn.

Indirect Effects on Society and Spaceflight via Politics

Though his postwar writing was certainly more polished and sophisticated, Heinlein's prewar thinking was more original and imaginative in some ways. His earliest work contained themes that were politically revolutionary even by today's jaded standards. *Revolt in 2100* comprised the novella *If This Goes On . . .* (1939), and two short stories “Misfit” (1939), and “Coventry” (1940)—graced with the best science fiction cover art ever—are in this genre.¹⁵

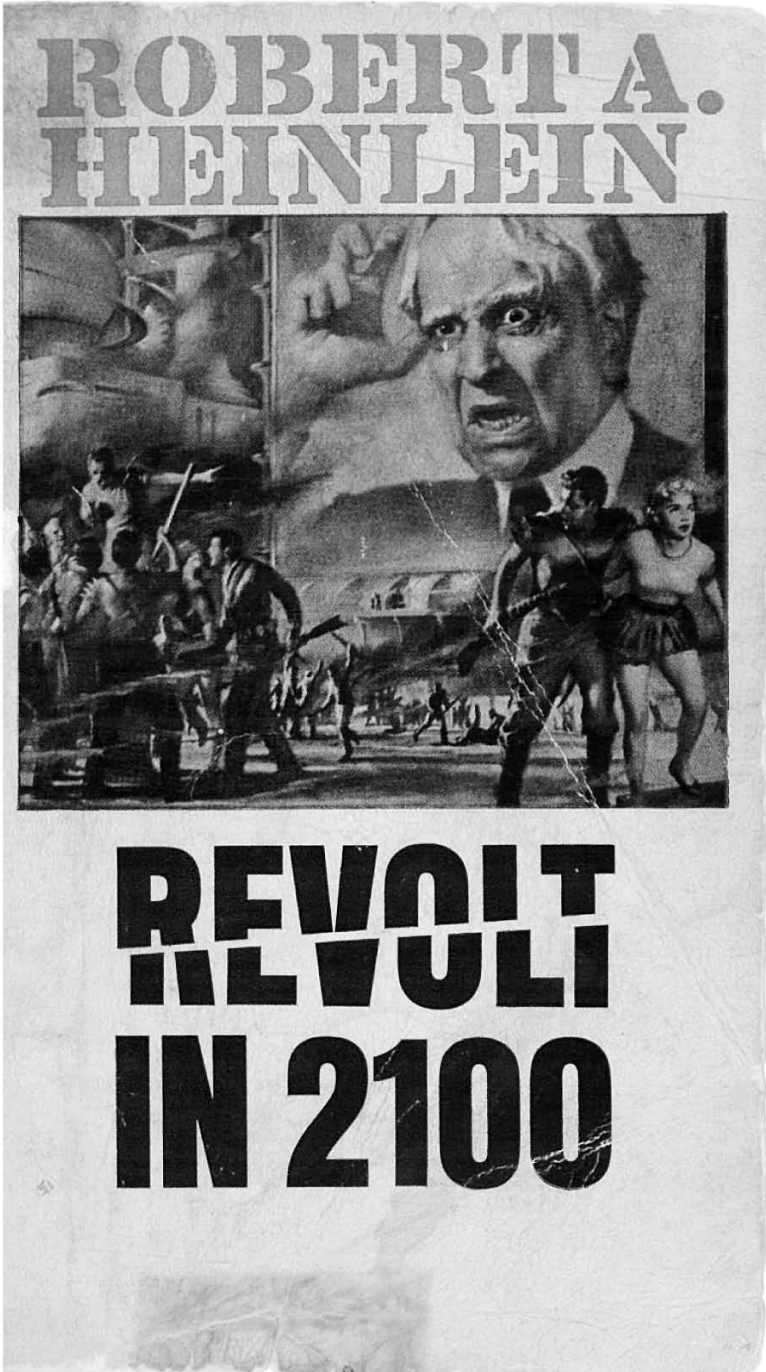
The first of these stories is perhaps the purest example of what MLS-member Henry Kuttner called “the innocent eye”—no surprise that it's among the earliest work before professionalism sets in. It is set in a world in which the United States has turned its back on interplanetary exploration and science after a period of “Crazy Years,” falling into a theocratic police state. One does

12. Bill Higgins interview, Kansas City, MO, July 7, 2007, unpublished article forthcoming.

13. Again, early players are generally more significant in a field than later ones, notwithstanding their absolute level of skill. This is a fundamental property of evolution.

14. Robert A. Heinlein to Larry Niven and Jerry Pournelle, “Motelight,” June 20, 1973, copy in U.C. Santa Cruz Heinlein Archives, UCSC Library, Santa Cruz, CA; Robert A. Heinlein to Larry Niven and Jerry Pournelle, “The Mote in God's Eye,” August 1973, copy in Heinlein Archives.

15. Robert A. Heinlein, *If This Goes On . . .*, “Coventry,” and “Misfit” in *Revolt in 2100* (New York: Signet Books, 1953).



Robert Heinlein's book, *Revolt in 2100*, was made up of the novella *If This Goes On . . .* (1939) and two short stories, "Misfit" (1939) and "Coventry" (1940).

not have to imagine how Depression-era readers received these words, either: we have their letters describing how awestruck they were and their immediate realization at what a talent they had in their mailboxes. (Regrettably, the background story of the novella *If This Goes On . . .* seems less outlandish now than it did 70 years ago.)

Heinlein wrote a remarkable (yet usual for him) valedictory memorandum to his superiors notifying them that the Bomb would put them out of business. Then he promptly resigned and returned to Los Angeles with his wife, Leslyn. He endured several lean years of hardship, during which his second marriage broke up, before returning to writing fiction. This was the period of 1945–47 when he engaged in what he disingenuously called “world saving”—articles for the general public about the significance of the new Atomic Age. Why distinguish his activity as disingenuous? Because, despite his protestations that he wrote just to keep the wolf from his door and his frequent declarations equating the value his writing with the reader’s beer money, Heinlein was in fact deeply interested in politics—he ran for the California State Assembly in 1938—and educating his fellow human beings. These pungent articles were mostly ignored by the mainstream and never saw print except for one major exception. An early postwar collaboration with his Annapolis classmate Captain Caleb Laning called “Flight into the Future” appeared in the August 30, 1947 issue of *Collier’s*, which described a nightmarish vision of an atomic arms race in space. (The concept eventually became the core of the second juvenile novel, *Space Cadet*.) The article (that was mostly Heinlein’s work) did attract a lot of attention but ultimately led nowhere.

Why didn’t “Flight” succeed? Why were its prescriptions and prognostications ignored by the military establishment and the policymakers? One must recall that the USAF was once called United States Army Air Force (USAAF) before being split off from the Army by President Truman in 1947 in the same Act that created the Department of Defense (DOD) and the Central Intelligence Agency (CIA). Aviation’s roots in this country are in the Army, not the Navy.¹⁶ Recall also that the Manhattan Project, and the related Operation Paper Clip and Project ALSOS (netted the German nuclear scientists as well as the rocket scientists including Wernher von Braun), were primarily Army operations. Likewise, Project RAND—an R&D department spun off from Douglas Aircraft that drafted the seminal “Design of an Experimental World-Circling Spaceship” (1946)—was supported by the USAAF. Rocket research was chronically underfunded by Navy [Hall 1970] until the submarine-launched ballistic missile (SLBM) program started in the mid-1950s. Caleb Laning was

16. Analogous to the situation in Russia, the Russian strategic missile forces and Russian rocketry in general have their roots in artillery (a classic army mission), not aerospace as is usually the case elsewhere, which has led to some interesting differences in design philosophy, doctrine, and operating procedures compared to the West.

as original a thinker as Heinlein, but despite starting earlier, strategic weapons and, by extension, their platforms, were always the Army's rice bowl. Perhaps the Navy's early expression of interest stimulated the nascent USAF to actively take over satellite portfolio.

Indirect Effects on Spaceflight via Pop Culture

After his breakup with Leslyn towards the end of his hard times in 1947, Robert hooked up with Ginny and hit the road. The first of his juvenile novels, *Rocket Ship Galileo*, appeared, which would become the basis for the movie *Destination Moon*. Robert and Ginny worked out the *modus vivendi* that would guide the rest of their lives together. She became his first reader and indispensable partner. A long string of juveniles alternating with adult novels followed during an amazingly prolific decade.

In 1949, some of Heinlein's connections from his prewar Hollywood days led to a collaboration with the producer George Pal as technical advisor on the Oscar-winning science-fiction motion picture *Destination Moon* (1950). Heinlein enjoyed an unusually close (by Hollywood standards) productive relationship with the film's director, Irving Pichel, who took most of Heinlein's advice. Thus this film still looks remarkably good by today's standards and raised the bar for science fiction on the silver screen.¹⁷ *Destination Moon* led to the trio of great science fiction films by George Pal: *When Worlds Collide* (1951), *War of the Worlds* (1953), and *The Time Machine* (1960). These classic films with their high production values certainly had at least indirect effects on pop culture. It is interesting that Pal, starting at Heinlein, came around to Wells.

Heinlein did not only transmit literary technique to his colleagues—his values of service and sacrifice, an individualistic outlook, and ethos of competence also came through, and were propagated to millions of these authors' readers in turn. It is surely no accident that, a decade after *Rocket Ship Galileo* (1947) and the whole series of juvenile novels that inspired millions of people who were teenaged in 1947-1959, legions of young professionals were ready to answer the challenge of Sputnik and to choose technical careers, entering the workforce just as the space race began.¹⁸ One (current) NASA Administrator is the apparent exception, declaring that an interest in spaceflight led him to science fiction, not the usual way around.¹⁹ The predominantly libertarian people who work in the free space movement almost universally cite

17. Like most of the crew, Heinlein did not enjoy the film's financial rewards; again standard for Hollywood. Also, and regrettably, it did not lower the bar on a lot of bad science fiction flicks yet to come, but one must remember that Sturgeon's Law is always in effect.

18. Bill Patterson, "A Study of 'Misfit'," *The Heinlein Journal*, no. 3 (July 1998): 24-32.

19. Michael Griffin, "The Future of NASA," speech delivered at the Robert A. Heinlein Centennial Conference 1907-2007, Kansas City, MO, July 6, 2007. This was apparently the first time in history that a serving NASA Administrator addressed a science-fiction audience.

Heinlein as their principal inspiration, including the most recent winner of the Ansari X-Prize.²⁰ Oddly enough, Heinlein's values lap over into pop culture by another unexpected route—namely the computing/cyberpunk community, which has a high degree of congruence with the sets of libertarians, space enthusiasts, and science fiction fans.

CONCLUSION

Heinlein's diluted meta-gift of values—independence and liberty, technical competence and self-sacrifice, a paradoxically well-informed innocent eye—passed down and paid forward, may well turn out to be his greatest contribution to spaceflight.

We'll see.

Acknowledgments

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